DEPARTMENT OF LAND UTILIZATION
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96-01763(DT)
95/SMA-25

April 23, 1996

The Honorable Gary Gill, Director
Office of Environmental Quality Control
220 South King Street, 4th Floor
State of Hawaii
Honolulu, Hawaii 96813

Published Notice in TEN File

Dear Mr. Gill:

Chapter 343, HRS Environmental Determination
Waialua-Kuilima 46kV Subtransmission Line Project
Supplemental Environmental Impact Statement (EIS) Not Required

This is to notify you of our determination that a Supplemental EIS for revisions to the above-described project is not required.

We request that notice of this determination be published in the Environmental Notice pursuant to Section 11-200-27, Chapter 200, Title 11, "Environmental Impact Statement Rules" of the Administrative Rules.

On October 6, 1993, the Department of Land Utilization accepted the Final EIS for the Waialua to Kuilima 46kV Subtransmission Line. Notice of this action was published in the October 23, 1993 issue of the OEQC Bulletin. At that time, the proposal was for the installation of a new 46kV (46,000 volt) subtransmission line from its existing Waialua Substation to its existing Kuilima Substation. The proposed line would have been approximately 13.6 miles long and generally cross the mid-elevation lands between the North Shore and the Koolau Mountains.

The current proposal will realign the 46kV line in the following four areas (see attached Maps 1 and 2):

Realignment 1 (in the Haleiwa area)

The old alignment would have affected the following Tax Map Keys (TMKs): 6-6-18: 25, 32; 6-2-7: 7, 12; 6-2-3: 3; and 6-4-1: 1. The new alignment will affect TMKs 6-6-18: 24, 39 and 6-4-1: 1, 6.

The new alignment follows a driveway to the road rights-of-way at Weed Circle. It is then within the Kamehameha Highway right-of-way for approximately 4,000 feet before crossing the highway and Helemano Stream and rejoining the EIS alignment along Twin Bridge Road. The proposed subtransmission line will be underground within the Haleiwa Special District.

The realignment removes the project from the Special Management Area (SMA) and flood prone areas. Realignment 1 also impacts fewer privately-owned parcels by following the right-of-way.

Realignment 2 (upper Waimea Valley)

The only change in the realignment is that the 46kV line will be located approximately 2,000 to 4,000 feet mauka of the Final EIS alignment and crosses through approximately 16,140 linear feet of Conservation-zoned land. In the area of Waimea Falls Park, the proposed line would be routed further mauka of the valley and beyond the last residences in Pupukea. The realignment will include 1,655 feet more Conservation District lands than did the Final EIS alignment. The realignment was suggested by the landowner to alleviate concerns about potential visual impacts from Waimea Falls Park.

Realignment 3 (Pupukea Forest Reserve)

The only change in the realignment is that the alignment will be moved to follow the property lines of TMKs 5-9-6: 5, 11, and 18. The owner requested that the lines not bisect his property as the Final EIS alignment did.

Realignment 4 (above Kawela Bay)

The Final EIS alignment was located at the top of the bluffs above Kawela Bay, which is within the Army's Kahuku training area. At the request of the U.S. Army, the 46kV Line will be moved to avoid conflicts with the Army's training activities, including helicopter operations.

The new alignment follows an existing subtransmission line easement at the base of the bluffs. Field surveys of the Campbell Estate lands will be conducted immediately upon receipt of right-of-entry or acquisition, and findings will be submitted to the Department of Land Utilization and the Department of Land and Natural Resources (DLNR).

In the Final EIS, the 46kV Line was to be situated on a single pole structure, in which the pole would be composed of Class H6 wood. The poles would be 65 feet in length (57 feet above the ground), with a 20.5-inch diameter at ground level.

Higher poles

With the proposed realignment, Hawaiian Electric Company proposes to utilize 40- to 100-foot high steel poles, rather than wood poles. A structure optimization study indicated that steel poles would be more cost effective. Pole heights above ground will vary between 34 and 88 feet depending on ground clearances, vegetation, and span-length requirements. Because of the longer spans of steel structures, fewer poles and less ground disturbance will be required.

The applicant has provided information showing that the proposed realignment will not affect environmental resources within the surrounding area of the 46kV line. The following documents and letters were submitted by the applicant:

1. Botanical Resources Assessment (July 1995) by Char & Associates: "Given the findings and limited nature of the proposed project, no significant negative impacts to the botanical resources are expected";

2. Archaeological Survey Report (August 1995) by Cultural Surveys Hawaii, Inc.: The field survey located no archaeological or significant historic sites within the Conservation District areas. Historic research shows little or no potential for sites within the specific pole locations. The survey concluded that the development of the powerline in the Conservation District areas will have no archaeological impact;

3. Michael G. Hadfield, Professor of Zoology at the University of Hawaii, remarked that a survey along the route of the proposed 46kV line through the Conservation District conducted by three biologists with extensive experience in Hawaiian terrestrial malacology yielded no evidence of living or dead specimens of the Federally endangered Achatinella (Hawaiian Tree Snail);

4. U.S. Fish and Wildlife Service said, "Because of the limited nature of the impacts and the ability to avoid any impacts to rare or endangered plants, the Service does not anticipate any significant negative impacts to the environment or fish and wildlife resources in the project area";

The Honorable Gary Gill, Director
Page 4
April 23, 1996

5. Letter from the DLNR commenting that the proposed transmission line through the Conservation District will have "no effect" on historic sites; and

6. Letter from the DLNR's Division of Forestry and Wildlife commenting that a portion of the transmission line comes fairly close to Nioi (Eugenia koolauensis) and recommends that a botanist be on site when the project commences.

Thus, the current proposal should have minimal impact on environmental resources within the project area. We have found that the environmental impacts of the current proposal do not exceed what was disclosed during the previous environmental review. After reviewing the proposal, and based on the criteria established by Chapter 343, HRS and Chapter 200, Title 11, Department of Health's Administrative Rules, we have determined that a supplemental statement is not required.

If you have any questions concerning this letter, please contact Dana Teramoto of our staff at 523-4648.

Very truly yours,

PATRICK T. ONISHI
Director of Land Utilization

PTO:am
attach.

cc: Dept. of Land and Natural Resources
Dames & Moore (Wendie McAllaster)

46kvsupp.djt

[illegible]

[illegible] Nature [under DLNR's jurisdiction]

1993 - Oahu - FEIS - Waialua -

FILE COPY

Kuilima

FINAL

ENVIRONMENTAL IMPACT STATEMENT

WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE PROJECT

North Shore, Oahu, Hawaii

AUGUST 1993

Prepared for:

Hawaiian Electric Company, Inc.

An HEI Company

RMTC

R.M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817

FINAL
ENVIRONMENTAL IMPACT STATEMENT

for the

WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE PROJECT

North Shore, Oahu, Hawaii

Prepared For:

HAWAIIAN ELECTRIC COMPANY, INC.
820 Ward Avenue
Honolulu, Hawaii 96814

AUGUST 1993

Prepared By:

R. M. TOWILL CORPORATION
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817-4941

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ACRONYMS AND ABBREVIATIONS

AAC	All Aluminum Conductors
ac	Alternating Current
ALISH	Agricultural Land of Importance to the State of Hawaii
AN	Audible Noise
CEC	California Energy Commission
CIRRPC	Committee on Interagency Radiation Research and Policy Coordination
CZM	Coastal Zone Management
dc	Direct Current
DLNR	Department of Land and Natural Resources, State
DLU	Department of Land Utilization, City and County of Honolulu
DOH	Department of Health, State
DOT	Department of Transportation, State
EIS	Environmental Impact Statement
ELF	Extremely Low Frequency
EMF	Electric and Magnetic Fields
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
G	Gauss
HECO	Hawaiian Electric Company, Inc.
HRS	Hawaii Revised Statues
Hz	Hertz
IITRI	Illinois Institute of Technology Research Institute
KCM-AAC	Kilo-Circular Mills - All Aluminum Conductor
kcmil	Kilo-Circular Mills
kV	Kilovolt
kV/m	Kilovolts Per Meter
LUO	Land Use Ordinance, City and County of Honolulu
mG	MilliGauss
mgd	Million Gallons Per Day

OTA	Office of Technology Assessment, U.S. Congress
PUC	Public Utilities Commission
PVC	Polyvinylchloride
RFI	Radio Frequency Interference
RN	Radio Noise
ROW	Right-of-Way
SBA	Science Advisory Board
SMA	Special Management Area
SMP	Special Management Area Use Permit
TVI	Television Interference
UBC	Uniform Building Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Service
V/m	Volts Per Meter
WPSC	Wisconsin Public Service Commission

SECTION 1

SUMMARY

SECTION 1
SUMMARY

1.1 OVERVIEW

Project:	Waialua-Kuilima 46 kV Subtransmission Line
Applicant:	Hawaiian Electric Company, Inc. (HECO)
Accepting Authority:	Department of Land Utilization, City and County of Honolulu
Project Area:	North-Central portion of Oahu from Wahiawa to Kahuku
Location:	Waialua and Koolauloa Districts of the Island of Oahu
Owner:	Various
Existing Land Uses:	Agricultural, Residential, Commercial, Open Space and Federal
State Land Use District:	Agricultural, Urban and Conservation
County Zoning Designations:	AG-1, AG-2, A-1, B-1, Country, F-1, I-3, I, P-1, P-2, Resort, R-10, R-5, and R-7.5 Designations

1.2 PURPOSE AND NEED FOR THE PROPOSED ACTION

The Hawaiian Electric Company (HECO) is planning a new 46 kV (46,000 volt) subtransmission line from its existing Waialua Substation to its existing Kuilima Substation. The purpose of the new 46 kV subtransmission line is twofold:

(1) to maintain reliable electrical service to the North Shore of Oahu by correcting low voltage conditions and to provide an alternative subtransmission line that can provide service in the event of a failure on the existing 46 kV line; and

(2) to provide additional transmission capacity to meet the growing demands of existing customers and to accommodate projected load growth along Oahu's North Shore.

Currently, the area between Waialua and Kuilima is being served by a single 46 kV subtransmission line. This area occasionally experiences low voltage conditions which need to be corrected. Low voltage conditions may cause damage to equipment. Additionally, should the existing 46 kV circuit require repair or maintenance, portions of the system would have to be taken out of service. This could result in leaving much of the North Shore without power while the line is being repaired. The new 46 kV line will improve the electrical service reliability to the North Shore, as well as provide added capacity to accommodate anticipated future load requirements.

1.3 DETERMINATION:

In accordance with the Hawaii Environmental Impact Statement (EIS) Law, Hawaii Revised Statutes (HRS), Chapter 343-5, there are eight triggers of the environmental review process. The proposed project will affect two of these: the use of State lands and the use of Conservation District Lands. The Hawaiian Electric Company determined that the proposed project could potentially have environmental impacts; therefore, this

Environmental Impact Statement (EIS) was prepared in accordance with Chapter 343 of the Hawaii Revised Statutes and Chapter 200 of Title 11, Administrative Rules for the Department of Health. This Draft EIS will provide detailed information on the proposed action, existing environmental conditions, and an assessment of probable impacts and mitigation measures.

1.4 PROJECT LOCATION

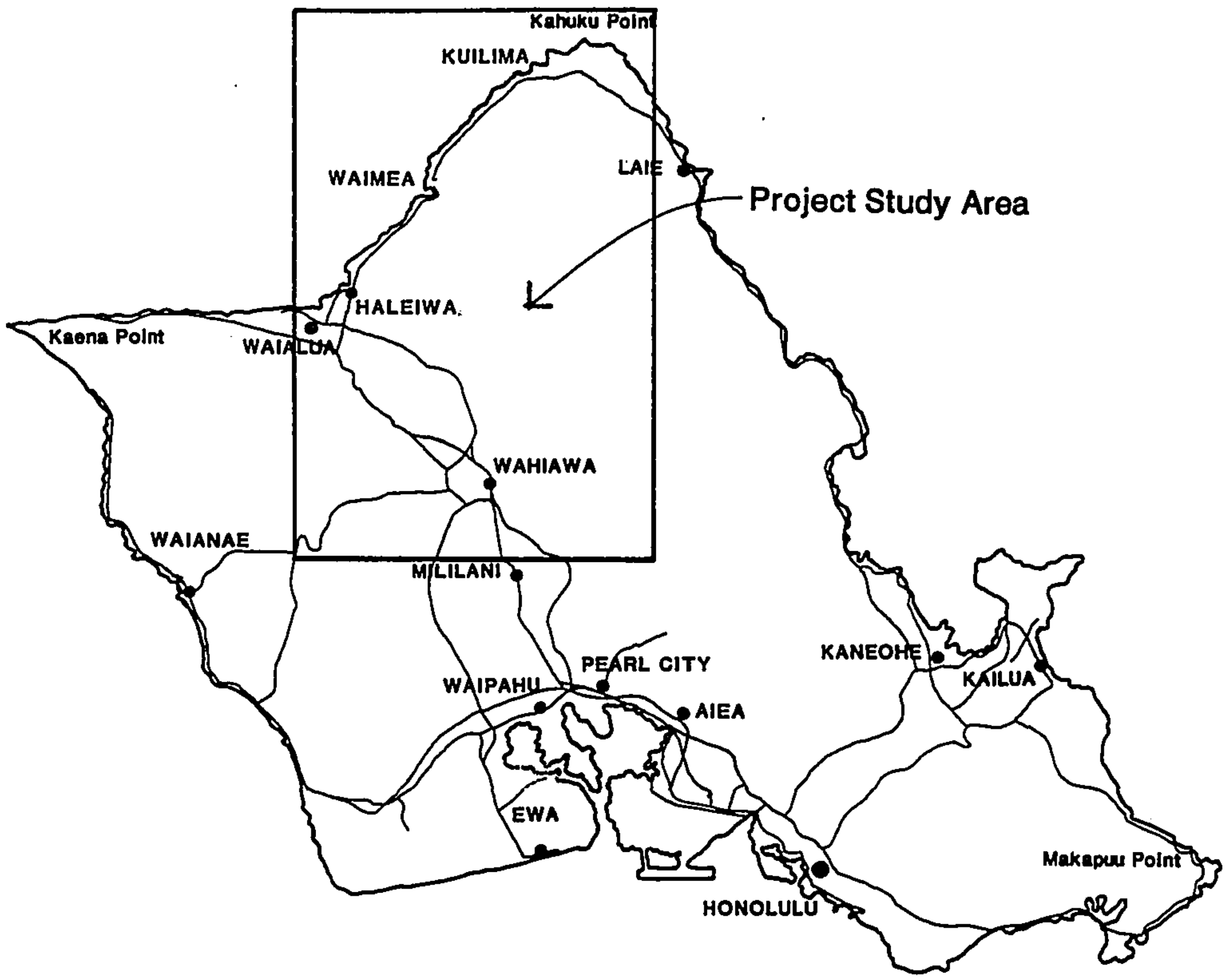
The proposed project study area is located in the north-central portion of the Island of Oahu. The Location Map, Figure 1-1, shows the study area location on Oahu. It encompasses approximately 78 square miles of land and the nearshore waters along Oahu's North Shore. The proposed line will extend from HECO's existing Waialua Substation to HECO's existing Kuilima Substation, crossing the mid-elevation lands between the North Shore and the Koolau Mountains, see Figure 1-2.

1.5 SUMMARY OF MAJOR IMPACTS AND MITIGATION MEASURES

1.5.1 Existing Uses and Proposed Development

The proposed project will require new right-of-way easements for much of the length of the proposed alignment. The easements will range in width from 25' to 50'. Additional easements may also be required for the installation of guy wires and anchors along the proposed alignment.

Impacts on existing and proposed uses will be limited to those activities that are adjacent to the alignment (generally within the 25-foot or 50-foot right-of-way). A majority of the alignment crosses agricultural land and will have some impact on sugar cane field operations. To mitigate this, the proposed line will be routed to follow existing cane roads or field edges to the maximum extent consistent with maintaining a reasonably direct route. Most of the remaining portions of the line will cross through undeveloped areas. These areas include the proposed Lihi Lani development, the Boy Scouts Camp, the Girl Scouts



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R. M. TOWILL CORPORATION

FIGURE 1-1
LOCATION MAP
WAIALUA-KUILIMA 46 KV
SUBTRANSMISSION LINE
HAWAIIAN ELECTRIC COMPANY

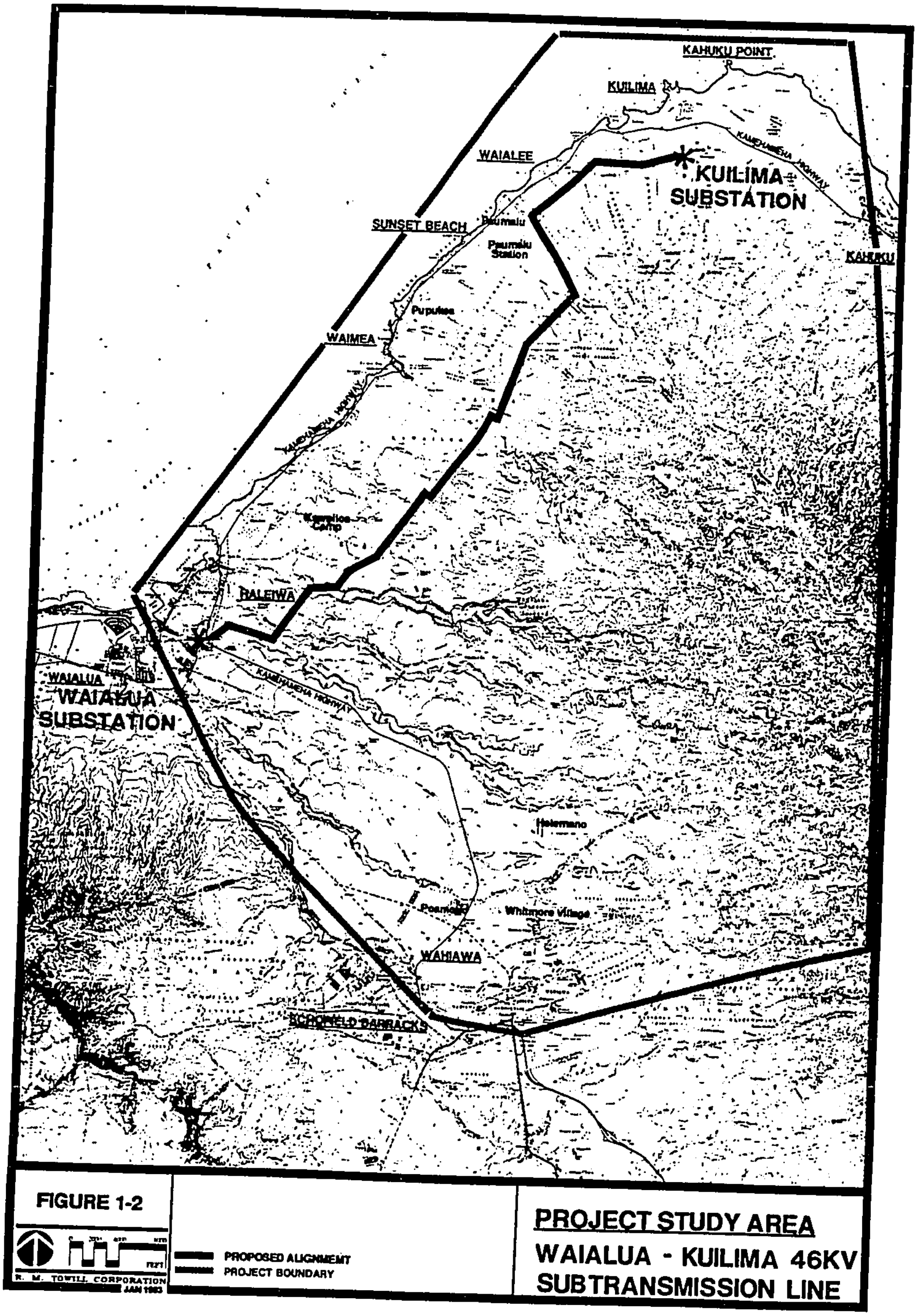


FIGURE 1-2

PROJECT STUDY AREA
WAIALUA - KUILIMA 46KV SUBTRANSMISSION LINE

Camp and the Army training area. To minimize impacts on these uses, the proposed line will be routed along boundaries and fringes of the affected properties. No houses or other existing buildings will be displaced by the proposed line.

1.5.2 Topography

Where new poles are required, the excavation for the foundations for the subtransmission line poles will entail some clearing and grubbing of the surface immediately surrounding the pole site. This also applies to portions of the line which will be excavated for underground segments. All the excavated areas will be returned to the same grade.

1.5.3 Air Quality

Temporary and very localized negative impacts on air quality will occur in areas adjacent to the construction sites from equipment and vehicle exhaust and dust generated by construction work. These impacts will be mitigated through such measures as proper equipment maintenance, avoiding construction during peak traffic periods and water sprinkling excavated areas.

1.5.4 Noise

An increase in noise levels due to construction activities is likely to occur adjacent to areas being worked on. The noise impacts will be temporary and will be eliminated as work is completed along the alignment. All activities associated with the construction phase of the project will comply with the provisions of the State Department of Health (DOH) Administrative Rules, Chapter 11-43, "Community Noise Control for Oahu." Mitigation measures such as the use of mufflers and limiting construction to daylight hours will be employed. As the majority of the alignment crosses uninhabited areas, noise impact should be minimal.

1.5.5 Historic and Archaeological Resources

The proposed project is not expected to have a negative impact on known historic or archaeological resources. Most of the proposed 46 kV subtransmission line alignment is located on land that has been previously disturbed for agricultural uses. Portions of the line which will cross areas of archaeological concern will be surveyed and the final alignment will be routed so as to avoid impacting possible sites. Should archaeological remains be uncovered during any excavation operations, work on the site will be temporarily suspended and the State Historic Preservation Division, Department of Land and Natural Resources, will be contacted for determination on the proper evaluation and disposition of the findings.

1.5.6 Views

The proposed project should have no significant adverse impacts on existing views. The majority of the line will be crossing cane fields and undeveloped areas nearly two miles inland, away from the view of the general public. The segment of the line which passes through the Haleiwa Special District will be placed underground. Portions of the line which span Waimea Valley mauka of Waimea Falls may have a small negative impact on the visual quality of the valley; however, because the proposed line will be located over 2,000 feet inland from accessible public areas and due to the varying topographic features within the valley, it is anticipated that the proposed line should not be readily visible to the general public. The area where the line could potentially be most visible to the public would be in the Waialee area, where the line follows the top of the coastal bluff. Separation from Kamehameha Highway ranges from 1,200 feet to over 3,000', and wherever possible the line will be routed inland (away from the bluff edge) so that it is not visible from the highway, beaches or residential areas.

1.5.7 Electric and Magnetic Fields (EMF)

Based on current knowledge and research there is no consistent or conclusive evidence relating adverse health effects with electrical subtransmission or transmission lines. The

State of Hawaii Department of Health has indicated in their policy statement that "the existing research data are inconclusive and not sufficient for adequate, accurate risk assessment." Therefore, as a matter of policy, they do not consider EMF standards to be appropriate at this time. Maximum magnetic and electric field exposures from the proposed subtransmission line are expected to be less than some typical home appliances such as electric can openers and coffee pots. Although adverse health effects have not been clearly demonstrated, HECO's policy is to design power lines to minimize EMF levels where feasible and reasonable in cost. This includes avoiding highly populated areas, configuring the conductors and phases to effect the greatest amount of field cancellation, avoiding highly populated areas, and locating conductors as high above ground as possible without being visually obtrusive. The proposed design will comply with the field standards of other states and would represent prudent steps to minimize exposure consistent with the approach suggested by the Department of Health.

The proposed alignment also will minimize exposure to electromagnetic fields, because most parts of the alignment are distant from residences and other areas where people congregate. The closest occupied residences are approximately 50 feet from the proposed alignment centerline. This condition occurs where the proposed line will cross Pupukea along a boundary adjacent to two dwellings. The proposed line does not cross any playgrounds, schools or other areas where people congregate.

1.5.8 Economic and Fiscal Impacts

The line will have a positive long-term impact on the economy of the area by providing additional transmission capacity and improving reliable electrical service to commercial and business activities, and residences in the region.

1.5.9 Traffic

Vehicular access to portions of the project alignment will be from cane haul roads which are part of Waialua Sugar Company's network of service roads. HECO will coordinate construction activity with the individual landowners and lessees. Construction of the proposed line crossing at Kamehameha Highway next to Weed Circle may temporarily disrupt traffic. To mitigate the negative impact, a traffic control plan approved by the State Department of Transportation, Highways Division will be developed and will include provisions for travel lanes of adequate width in both directions. It will also require that all lanes be open for traffic during peak traffic periods and non-working hours. Work on public roads must follow traffic control procedures prescribed by the Federal Highway Administration, the State Department of Transportation Highways Division, and City and County of Honolulu Department of Transportation Services. Work adjacent to a state road or highway requires a Permit to Perform Work on State Highways, which must incorporate a Traffic Control Plan approved by the Highways Division. The City and County of Honolulu requires observation of state and federal traffic control regulations for any work on county roads. The impact on traffic at the Pupukea Road crossing should be minor as traffic volume is minimal at this portion of the road.

1.5.10 Electrical System

The project will provide improved electrical service to North Shore communities, by providing additional transmission capacity and improving the reliability of electrical service.

1.6 SUMMARY OF ALTERNATIVES CONSIDERED

A lengthy process of evaluating various alternatives was conducted prior to selecting the proposed alignment. This included the options of taking no action; selecting possible corridors within the project study area that could accommodate the proposed line; analyzing different transmission system technologies; and evaluating alternative alignments. Section

5 provides detailed discussion of the alternatives considered for the proposed action. The following paragraphs summarize the various alternatives.

1.6.1 No Action

This alternative would result in the continuance of existing low voltage conditions in the North Shore area, which jeopardizes electrical system reliability. This, in turn, would result in failure to meet the existing and growing electrical demands of the customers. Also, without the installation of the 46 kV line, there will be no backup system to provide continuous electrical service should the existing 46 kV line require maintenance or repair.

1.6.2 Corridor Identification

Alternative corridors approximately 1,500' wide were identified for the subsequent siting of potential subtransmission line alignments. The parameters used in establishing the corridors are as follows:

- Maintain separation from existing 46 kV lines
- Minimize route length
- Minimize number of angles within the corridors
- Minimize number of spans greater than 350 feet
- Avoid military lands
- Minimize disturbance of agricultural lands
- Minimize fragmentation of property
- Avoid, to the extent possible, built-up areas
- Minimize conservation district impacts
- Minimize construction costs
- Minimize special management area impacts
- Minimize easement acquisition
- Minimize natural disaster risks (hurricanes, floods, tsunamis, etc.)

- Ease of access to Waimea Substation
- Ease of route access for construction, maintenance and repair

Using the above parameters, the nine corridors were selected for further analysis prior to identifying more specific alignments, see Figure 1-3. The following briefly describes each of the corridors:

<u>Corridor A - Coastal Route</u>. This corridor generally follows Kamehameha Highway between the Waialua and Kuilima substations.

<u>Corridor B - Direct Line</u>. This corridor assumes that the new subtransmission line will follow the most direct path between the Waialua substation and the Kuilima substation. It is located above the coastal bluff (crossing existing cane fields), spanning Waimea Valley below Waimea Falls and traversing Pupukea and above Sunset Beach.

<u>Corridor C - Modified Direct Line, Below Waimea Falls</u>. This corridor also crosses through the cane fields above the coastal bluff, following a direct line wherever possible. It crosses Waimea Valley below the Waimea Falls, through Pupukea and on to Kuilima substation.

<u>Corridor D - Modified Direct Line, Above Waimea Falls</u>. This corridor crosses the cane fields at mid-elevations, traverses Waimea Valley ridgelines mauka of the falls, crosses the upper portions of Pupukea and proceeds over primarily undeveloped lands to Kuilima.

<u>Corridor E - Mauka Special Management Area (SMA)</u>. This corridor follows existing road alignments through the Waialua sugar cane fields, crosses the mauka

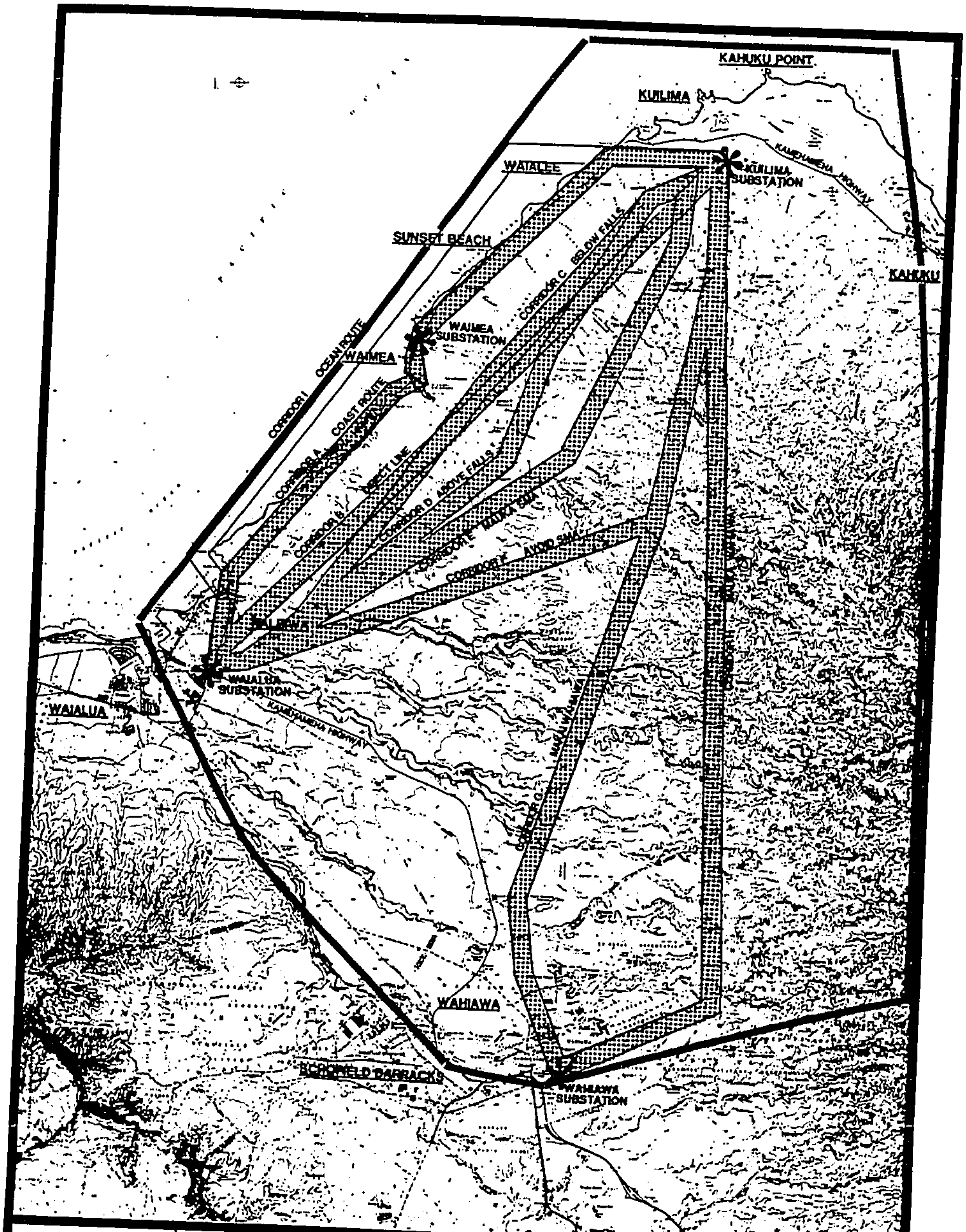


FIGURE 1-3

R. M. TOWILL CORPORATION

PROJECT BOUNDARY

CORRIDOR ALTERNATIVES

WAIALUA - KUILIMA 46KV SUBTRANSMISSION LINE

portions of Waimea Valley, bypasses Pupukea and then continues to the Kuilima substation following the route of the existing power line above Pupukea.

Corridor F - Avoid Waimea SMA. This corridor crosses the Waialua cane fields following alignments of existing cane roads. The corridor completely avoids the Waimea SMA area, bypassing it on the mauka side, and crosses heavily wooded uplands of the Koolau Mountains.

Corridor G - Makai Wahiawa. This corridor uses the Wahiawa substation as an alternative source for the proposed 46 kV subtransmission line. The corridor begins from the substation, follows the boundary between Wahiawa town and Schofield Barracks East Range and proceeds north across the pineapple and sugar cane fields towards Waimea Valley. Nearly mid-way, it enters the conservation district that encompass the Koolau Mountains and passes mauka of the Waimea Valley SMA.

Corridor H - Mauka Wahiawa. This corridor avoids all built-up areas, following an existing easement on the south side of Wahiawa. East of Wahiawa, the corridor enters the conservation district and crosses the Koolau Mountains in a direct path to the Kuilima substation.

Corridor I - Ocean Route. This corridor would enter the ocean at Haleiwa, follow the coastline at a depth of 100 to 300 feet and return to shore somewhere near Waialee before following a direct line to Kuilima substation.

Based on the analysis of the criteria listed above, preferred corridors were selected. These were: Corridor A (Coastal Route), Corridor C (Modified Direct Line, Below Waimea Falls) and Corridor D (Modified Direct Line, Above Waimea Falls). Figure 1-4 shows the preferred corridors.

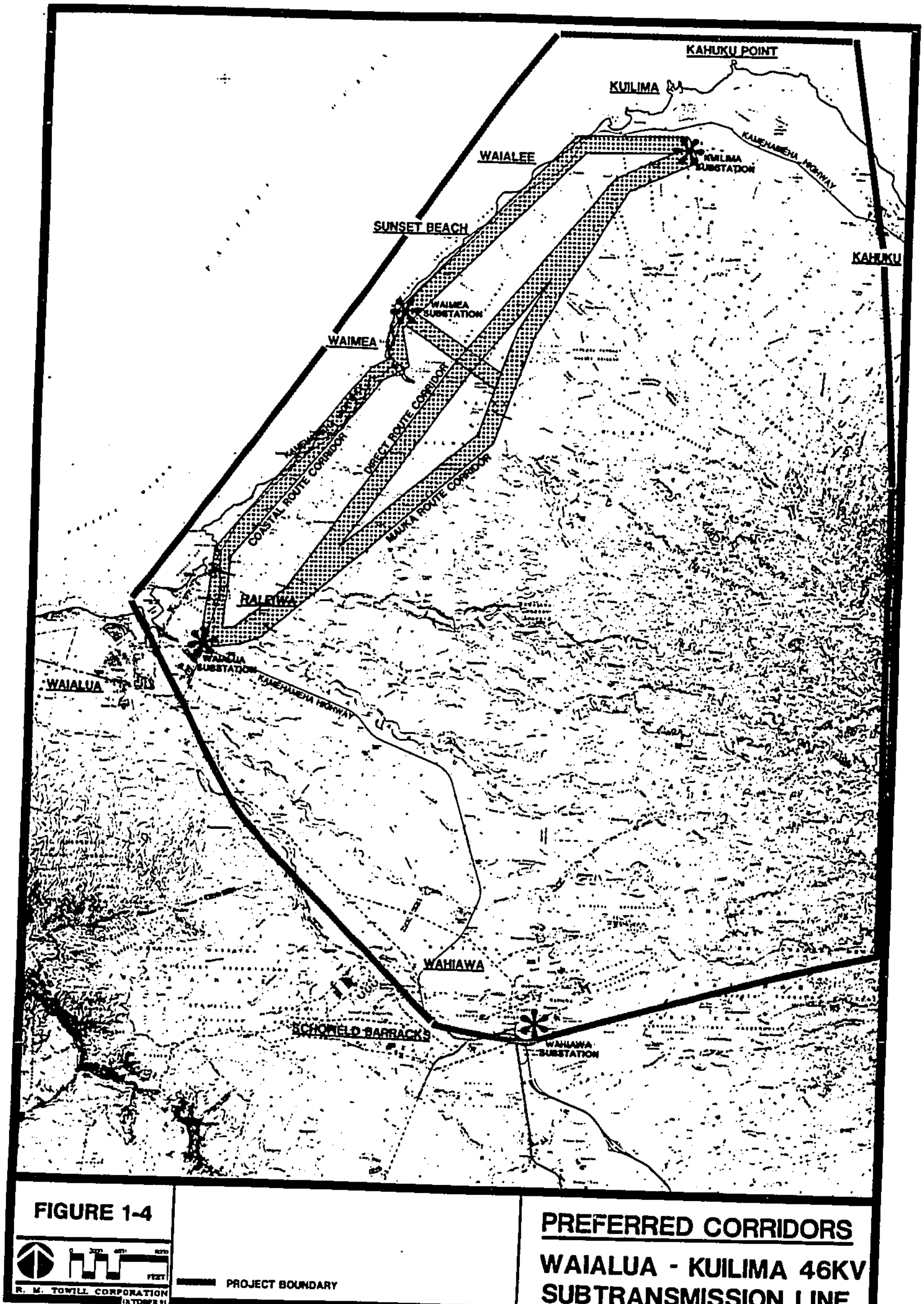
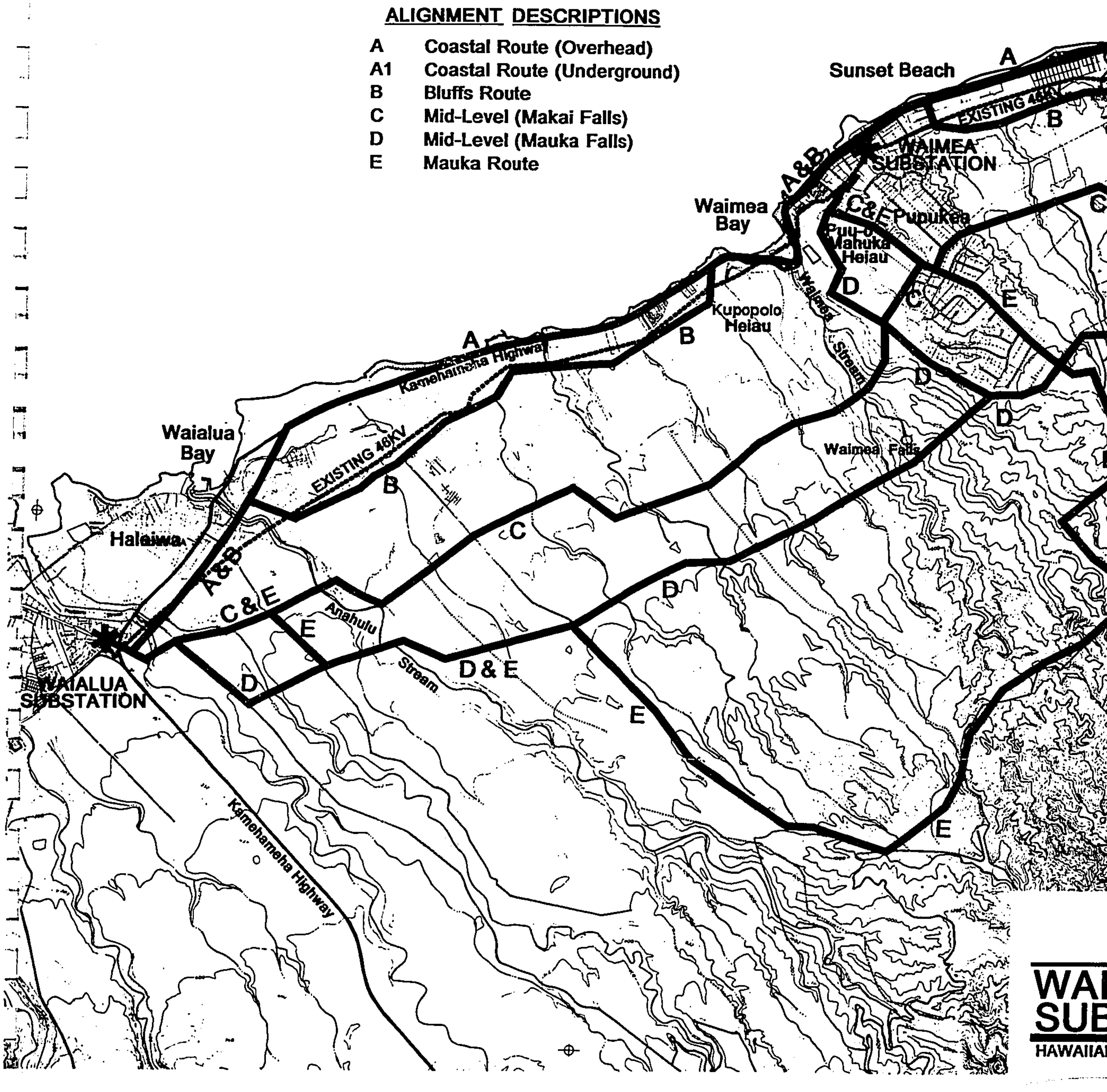
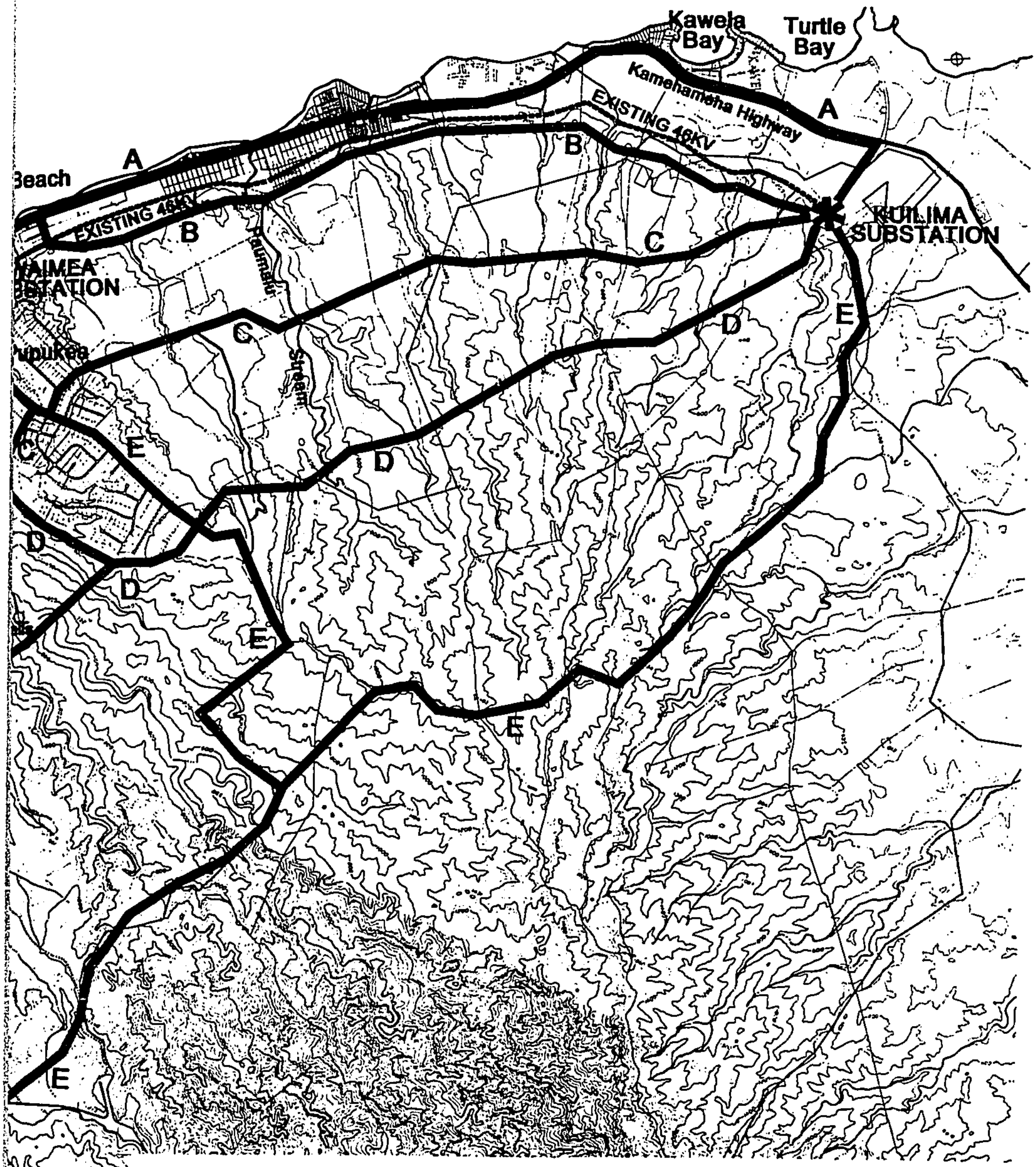


FIGURE 1-4

PREFERRED CORRIDORS

WAIALUA - KUILIMA 46KV SUBTRANSMISSION LINE


ALIGNMENT DESCRIPTIONS
A Coastal Route (Overhead)
A1 Coastal Route (Underground)
B Bluffs Route
C Mid-Level (Makai Falls)
D Mid-Level (Mauka Falls)
E Mauka Route
Sunset Beach
EXISTING 46KV
WAIMEA SUBSTATION
Waimea Bay
A&B
C&E
Pupukea
Puu-o Mahuka Heiau
Kupopolo Heiau
Waimea Stream
Waimea Falls
Kamehameha Highway
Waialua Bay
Haleiwa
WAIALUA SUBSTATION
Anahulu Stream
D & E
WAI
SUB
HAWAIIAI



ALTERNATIVE ALIGNMENTS

WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE

HAWAIIAN ELECTRIC CO., INC.

0 1000 2000 4000 FEET

R. M. TOWILL CORPORATION
JUNE 1982

FIGURE 1-5

1.6.3 Alternative Technologies Evaluation

Along with the identification of possible corridors, an analysis of several electrical system technologies was conducted. These system alternatives were: underground, submarine and overhead lines. Table 1-1 summarizes each of the basic system components, construction and operating effects, and maintenance considerations as they relate to the various alignment alternatives.

1.6.4 Alternate Alignments

Based on general environmental, land use, engineering and cost criteria, six alternative alignments were developed and evaluated for the proposed 46 kV subtransmission line. Each of the alternative alignments are shown on Figure 1-5. Table 1-2 summarizes the potential impacts relative to each of the alternative alignments. Detailed analyses of how these alternatives compared against each other are included in Section 5 of this EIS.

Alternate A, Coastal Overhead Alignment - This alignment accommodates much of the routing of the new subtransmission line along Kamehameha Highway by adding the new 46 kV line to the existing overhead distribution (12 kV and 4 kV) line system located within the highway right-of-way. Portions of the line may be placed underground due to regulatory requirements or technical design considerations.

Alternate A1, Coastal Underground Alignment - This alignment essentially is the same as Alternate A with the exception that the entire line is placed underground. Although the new 46 kV line will be underground, the existing 12 kV and 4 kV distribution lines will still be required and will remain overhead.

Alternate B, Bluff Alignment - Major portions of this alignment follow the coastal bluffs along the North Shore between Haleiwa and Waimea Bay, and Pupukea and Kuilima Substation.

TABLE 1-1

SYSTEM TECHNOLOGY ALTERNATIVES

WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE

TRANSMISSION ALTERNATIVES	BASIC SYSTEM COMPONENETS	CONSTRUCTION AND OPERATION EFFECTS			MAINTENANCE CONSIDERATIONS
		BIOLOGICAL AND CULTURAL RESOURCES	SOCIOECONOMIC, EMF, AND VISUAL RESOURCES	TRAFFIC CONSIDERATIONS	
Underground	1500 KCMIL polyethylene cable in 5" conduits Four conduits in concrete encasement Splicing vaults every 300-600 ft.	Trench excavation 2' wide by 4.5' deep Subsurface archaeological features may be disturbed Potential need to excavate cable for repair	Electric field negligible, magnetic field 10.6 mG maximum No visual impact after construction is completed	Construction: Continual traffic disruption and detours during laying of cable Operation: Pipe and line maintenance or repair have potential for traffic disruption	Minimal maintenance required for cable Probable traffic disruptions for repair Repair time: Hours to days
Submarine Cable (Underground from shore to substations)	2000 KCMIL polyethylene cable armour jacketed Laid in trench 0' to 4' deep	Temporary disrption of benthic region Permanent removal of coral in the path of trench Heat could affect benthos Effects of over land portion would be the same as those for underground option	EMF strengths low to negligible at surface, depending on depth of cable No visual impact under water Transition from ocean to underground may be visible Effects of over land portion would be the same as those for underground option	Effects of over land portion same as underground No traffic impacts for submarine portion	Inspections require periodic dives Locating faults possible hours to days Repair time: Days to weeks Effects of over land portion would be the same as those for underground option
Overhead, Above Existing Distribution Lines	Install new 46 kV, attempt to use existing structure by adding pole extensions 150'-180' spans Assume need to rebuild 25 structures per mile Delta configuration Conductor 556.5 AAC (Dahlia)	Existing ROW - no vegetation clearing required in most areas Additional ROW for guys may be required at angles Structures may be inadequate for added loadings; new structure would require excavation	Single circuit 46-kV line above distribution lines minimize aesthetic impact Electric field 0.065 kV/m maximum Magnetic field 27 mG maximum Poles and wires highly visible along roads	Construction: ROW typically near roadway one lane of traffic obstructed 4-6 weeks per mile during off-peak traffic periods Maintenance: Possible traffic disruption or delays depending on type of work	Repair time: Hours to days Bucket live line work is possible Subject to flood and tsunami hazard
Overhead Single Pole Line Built on New ROW Across Flat Terrain	New 46 kV wood pole Single pole delta configuration with line post insulators Conductor 556.5 AAC (Dahlia) Steel pole or H-frame structure for angles and deadends 300' spans average	Clearing of vegetation at structure sites Clearing of trees in the ROW Excavation for all foundations Subsurface archaeological features may be disturbed 25' ROW width	Single circuit 46 kV line has visual impact Electric field at center of ROW approx. 0.42 kV/m maximum Magnetic field at center of ROW approx. 12.6 mG maximum Poles and conductors highly visible in some areas	Construction: Access along ROW from existing roads Maintenance: Potential difficulty to access structures	Repair Time: Hours to days Bucket live line work may be difficult to impossible Possibly subject to flood, tsunami of high windhazard
Overhead H-Frame Line Built on New ROW Across Rough Terrain	New 46 kV Pole H-frame horizontal configuration Suspension insulators Conductor 556.5 AAC (Dahlia) Wood poles for angle and deadend structures 800' spans average	Clearing of vegetation at structure sites Clearing of trees in the ROW Excavation for all foundations Subsurface archaeological features may be disturbed 50' ROW width	Single circuit 46 kV line has visual impact Electric field 0.86 kV/m maximum Magnetic field 43.1 mG maximum. Poles and conductors not highly visible in most areas	Construction: Access roads may have to may have to be engineered Maintenance: Potential inaccessible locations - helicopter possible	Repair Time: Days Bucket live line work is impossible Subject to high winds

TABLE 1-2

SUMMARY OF IMPACTS
WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE

AFFECTED ENVIRONMENT	ALIGNMENT A COASTAL (OVERHEAD)	ALIGNMENT A1 COASTAL (UG)	ALIGNMENT B BLUFFS ROUTE	ALIGNMENT C MID-LEVEL (MAKAI)	ALIGNMENT D MID-LEVEL (MAUKA)	ALIGNMENT E MAUKA ROUTE
Extg Uses/Proposed Development	No Adverse Impact	No Adverse Impact	Minor Adverse Impact	Minor Adverse Impact	Minor Adverse Impact	Minor Adverse Impact
Topography	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Hydrology	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Wetlands	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Flora and Fauna	No Adverse Impact	No Adverse Impact	Minor Adverse Impact	Minor Adverse Impact	Minor Adverse Impact	Adverse Impact
Air Quality	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Noise	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Historic/Archaeological Resources	No Adverse Impact	Minor Adverse Impact	Minor Adverse Impact	Minor Adverse Impact	Minor Adverse Impact	Minor Adverse Impact
Views	Minor Adverse Impact	No Adverse Impact	Minor Adverse Impact	Minor Adverse Impact	Minor Adverse Impact	Minor Adverse Impact
Electric and Magnetic Fields	Minor Adverse Impact	Minor Adverse Impact	Minor Adverse Impact	Minor Adverse Impact	No Adverse Impact	No Adverse Impact
Recreation Resources	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Economic/Fiscal Impacts	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Traffic	Adverse Impact	Adverse Impact	Minor Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Other Utilities	Minor Adverse Impact	Minor Adverse Impact	Minor Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Public Services	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Electrical Service	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact

Legend

No Adverse Impact

Minor Adverse Impact (may not be significant)

Adverse Impact (may be significant)

Alternate C, Mid-Level Alignment (below Waimea Falls) - This alignment crosses the cane fields at elevations ranging from about 200' to 400', between Haleiwa and Waimea Valley. It traverses Waimea Valley ridgelines makai of Waimea Falls and crosses the lower portions of Pupukea. The alignment then proceeds over primarily undeveloped lands at elevations ranging from about 500' to 600', continuing on to the Kuilima Substation.

Alternate D, Mid-Level Alignment (above Waimea Falls) - This alignment crosses the cane fields at mid-elevations using cane roads and irrigation ditches, gradually moving up to the 400-600' elevations. The alignment then traverses Waimea Valley ridgelines mauka of Waimea Falls and crosses the upper portions of Pupukea. North of Pupukea, the alignment crosses primarily undeveloped lands at the 600-800' elevation to the Kuilima Substation.

Alternate E, Mauka Alignment (the Drum Road) - This alignment initially follows Alignments C and D, crossing cane fields at mid-elevations up to about the 1,100' elevation. The alignment follows major portions of Drum Road, traversing the lower reaches of the Koolau Summit through the mauka end of Waimea Valley and across undeveloped lands above Pupukea and Waialee.

1.6.5 Preferred Alignment Selection

Alignments A, C and D were selected as the top three alignments based on considerable environmental and engineering evaluation. Detailed analysis is presented in Section 5 of this document. The factors considered in further evaluating the top three alignment alternatives to select a preferred alignment were cost, environmental concerns, community concerns and permitting. Selection of the factors was based on issues that contributed to lower cost, community acceptance and reducing the permitting requirements. Based on this evaluation, the Mid-Level Mauka alignment (Alignment D) was selected as the preferred alignment. This alignment was selected over Alignment A (Coastal) primarily because of lower costs and general community acceptance. Selection over Alignment C (Mid-Level, Makai) was focused more on general public acceptance as Alignment C would span Waimea Valley makai of Waimea Falls, bisect the Pupukea Community and cross the middle of the proposed Obayashi development.

1.7 UNRESOLVED ISSUES

There are two major issues relating to the proposed project which presently remain unresolved: acquisition of easements and effects of electric and magnetic fields. An issue that requires resolution prior to the installation of the proposed subtransmission line is the acquisition of easements along the alignment to permit the construction, operation and maintenance of the subtransmission line on private property. Almost the entire length of the proposed alignment will traverse privately owned property. The landowners affected include Castle and Cooke, Bishop Estate, Campbell Estate, Waimea Falls Park, the State of Hawaii and a number of other smaller property owners. In addition to the landowners, lessees, such as the Department of the Army and Waialua Sugar Company, will also be contacted in order to gain access across property under lease. The actual number, location and cost for each easement required to construct the proposed line will not be resolved until the design phase of the project.

The predominant view of the scientific community is that the evidence gathered thus far does not demonstrate that electric and magnetic fields from power lines adversely affect human health. Because there is no conclusive evidence on the health effects associated with electric and magnetic fields, HECO has adopted a policy to minimize EMF effects on humans wherever feasible by: 1) avoidance, where alternatives are available, the lines will be directed away from residential areas, 2) engineering, by configuring the conductors in a manner that reduces the fields generated. HECO will continue its research and consult with governmental agencies like the State Department of Health, and the scientific community in order to gain a better understanding of this phenomena.

1.8 POTENTIAL PERMITS AND APPROVALS

The following lists the potential permits and approvals that may be required for the proposed project.

1.8.1 Federal

Corps of Engineers Permit

1.8.2 State of Hawaii

Department of Health

- Section 401 Water Quality Certification
- Noise Variance

Department of Land and Natural Resources

- Conservation District Use Application (CDUA)
- Perpetual Easement for Use of State Lands

Office of State Planning

- Hawaii Coastal Zone Management Program Federal Consistency Review

Department of Transportation

- Permit to Perform Work on a State Highway

Public Utilities Commission

- Approval for Construction in a Residential Area
- General Order No. 7 Approval

1.8.3 City and County of Honolulu

Department of Land Utilization

- Flood Determination in General Flood Plain
- Special Management Area Use Permit (SMP)
- Special Districts, Special Design Permits

Department of Public Works

- Construction Dewatering Permit (Temporary)
- Grubbing, Grading and Stockpiling Permit

Department of Transportation Services

- Street Usage Permit
- Permit for Construction Within a County Road Right-of-Way

Building Department

- Building Permit

1.8.4 Other Approvals

Landowners and Easements

- Perpetual Easements

SECTION 2

DESCRIPTION OF PROPOSED ACTION

SECTION 2
DESCRIPTION OF THE PROPOSED ACTION

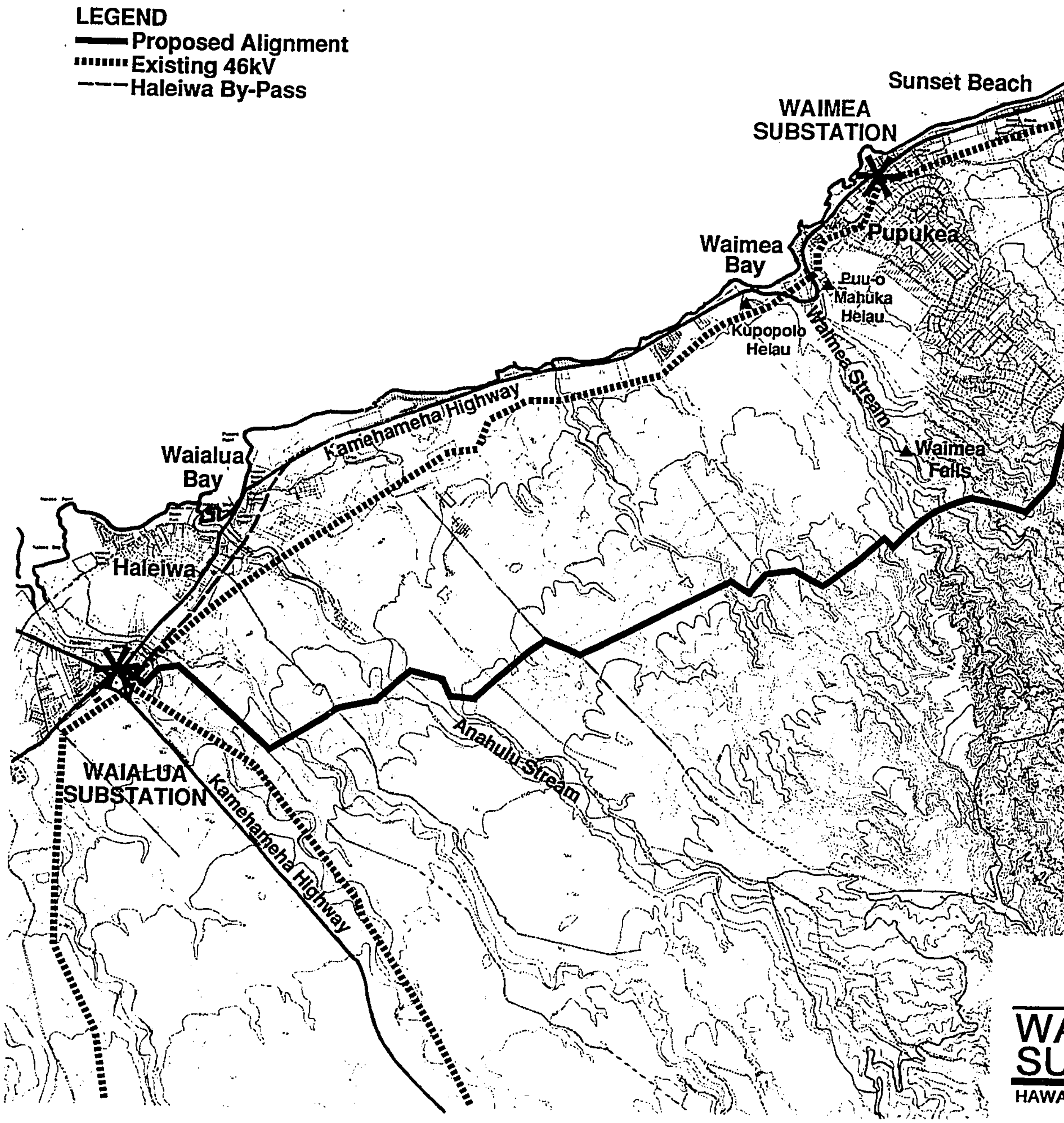
2.1 PROJECT OVERVIEW

The proposed project will entail the installation of a new single-circuit 46 kV subtransmission line between Hawaiian Electric Company's (HECO) existing Waialua and Kuilima substations. The purpose of the new 46 kV line is to provide needed system redundancy, improved service and additional capacity along the North Shore of Oahu.

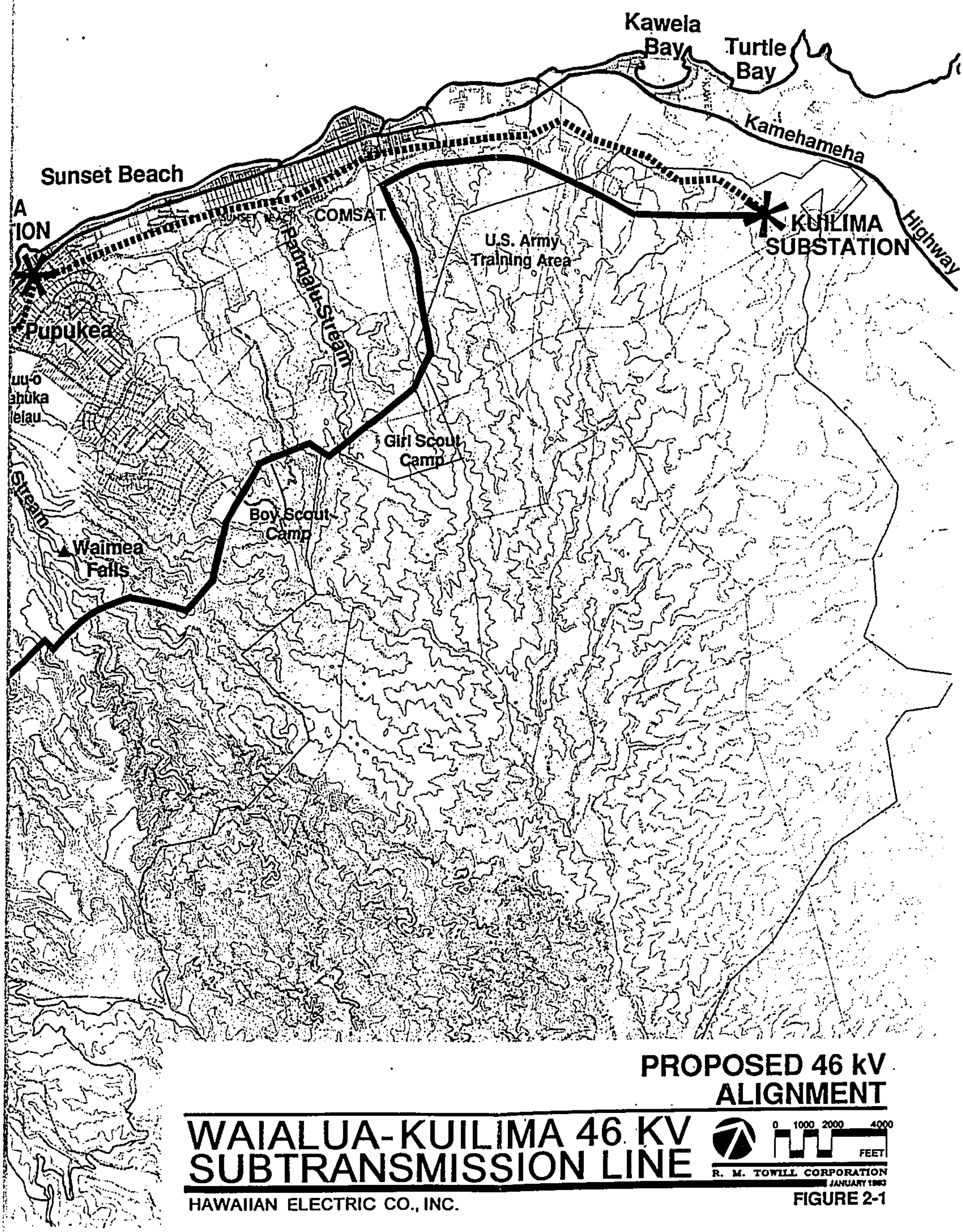
2.2 PROPOSED ALIGNMENT

The proposed alignment for the Waialua-Kuilima 46 kV subtransmission line is shown on Figure 2-1. The length of the proposed subtransmission line is approximately 13.6 miles. From the Waialua Substation, the proposed line will proceed underground (the section within the Haleiwa Special District) in the mauka direction crossing Kamehameha Highway near Weed Circle to the mauka side of the new Haleiwa Bypass Road. On the mauka side of the bypass road the line will remain underground until it approaches Helemano Stream where it will transition to an overhead configuration. From this point, it will head in a northeasterly direction to Twin Bridge Road. The line will then follow Twin Bridge Road in the mauka direction to about the 250 feet elevation.

At this point, the line will begin to traverse the Waialua Sugar fields following an alignment that is generally parallel to the coastline. Whenever possible, the line will follow existing cane roads and edges of fields to minimize impacts on field operations. The line will initially cut through a field, then span Opaeula Stream Gulch. It will then cross more fields and continue on a cane road to Opaeula Road, after which it will again cross some cane fields. The line will span Anahulu River Gulch in two segments; approximately 600 feet across a tributary gulch and approximately 1,100 feet across the main gulch. The line will then follow the edge of the valley and cane fields in the mauka direction, to about the 400 feet elevation. Generally following small cane roads for the next half mile, the line will pass



LEGEND
Proposed Alignment
Existing 46kV
Haleiwa By-Pass
Sunset Beach
WAIMEA SUBSTATION
Pupukea
Waimea Bay
Puu-o Mahuka Helau
Kupopolo Helau
Waimea Stream
Waimea Falls
Kamehameha Highway
Waialua Bay
Haleiwa
WAIALUA SUBSTATION
Anahulu Stream
Kamehameha Highway



PROPOSED 46 kV ALIGNMENT

WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE

0 1000 2000 4000 FEET

R. M. TOWILL CORPORATION
JANUARY 1993

HAWAIIAN ELECTRIC CO., INC.

FIGURE 2-1

mauka of a reservoir and follow field edges. After crossing a field, the line will span a small gulch, then follow a cane road for about 3,500 feet. The line will cross another small gulch and portions of a cane field. It will continue on a cane road where the line intersects with Ashley Road and follow it to a gulch. After spanning the gulch, the line will cross a narrow field, a gulch in two spans, and cross another narrow field on a short cane road as it approaches Waimea Valley.

Because of the size of Waimea Valley the proposed line will need to cross the valley by spanning several intermediate valley ridges. There will be four spans ranging in length from 1,500 feet to 1,000 feet. The line will then cross the upper portion of Pupukea following a row of trees along the makai boundary of a parcel leased by Oceanic Cablevision. The line will then cross Pupukea Road makai of the Board of Water Supply aboveground water tank, crossing the lower portion of a State parcel leased to the Boy Scouts of America. It will then follow the mauka boundary of the Obayashi Hawaii property, below the Pupukea Paumalu Forest Reserve, and proceed along the makai boundary of the Girl Scouts Camp to the Comsat Road. In crossing this area, the line will have to span a number of gulches. These are: Kalunawaikaala Stream, Pakulena Stream, Kaleleiki Stream, Paumalu Stream and Aimuu Gulch. The area between Pupukea Road and Kaleleiki Stream is heavily forested.

Once the line reaches the upper Comsat Road, it will be routed around and on the fringes of the lands being leased to the Army for training. From the Girl Scouts Camp boundary, the line will follow the Comsat Road approximately 2,000 feet in the makai direction. The line will then cross over to the edge of Kaunala Gulch and follow the edge of the gulch heading makai to about the 400 feet elevation. The line will then span Kaunala Gulch and proceed to follow the top of the bluff, spanning several gulches. These gulches include: Waialee Gulch, Pahipahialua Gulch and Kawela Gulch. The line will then tap onto the existing 46 kV line east of the Kuilima Substation at the base of Oio Gulch.

2.3 TECHNICAL CHARACTERISTICS

Design, construction, operation and maintenance of the proposed 46 kV subtransmission line will be in accordance with established HECO standards and Public Utilities Commission General Orders No. 6 and No. 10. The following paragraphs summarize the technical characteristics of the proposed action.

2.3.1 Poles

The majority of the proposed line will be installed as an overhead system. Two types of support structure methods will be employed for the overhead portion of the new 46 kV line: single pole structure and H-frame structure. Figure 2-2 shows the two types of overhead line support systems.

- Single Pole Structure - The single pole structure will entail the installation of new Class H6 wood poles 65 feet in length (57 feet above the ground). The poles will have an approximate diameter of 20.5 inches at ground level. These poles will be installed to withstand sustained wind loads of 80 mile per hour with a minimum safety factor of 2.

- H-Frame Pole Structure - The H-frame structure will be used for gulch crossings where extended spans between support structures dictate the need for additional structural support. These poles will be similar to the single pole structures; however, they will be made up of two support poles and a 25 feet crossbeam from which the insulators and conductors are suspended. The structure heights will vary between 45 and 60 feet, dependent upon the length of the span of the line and the depth of the crossing.

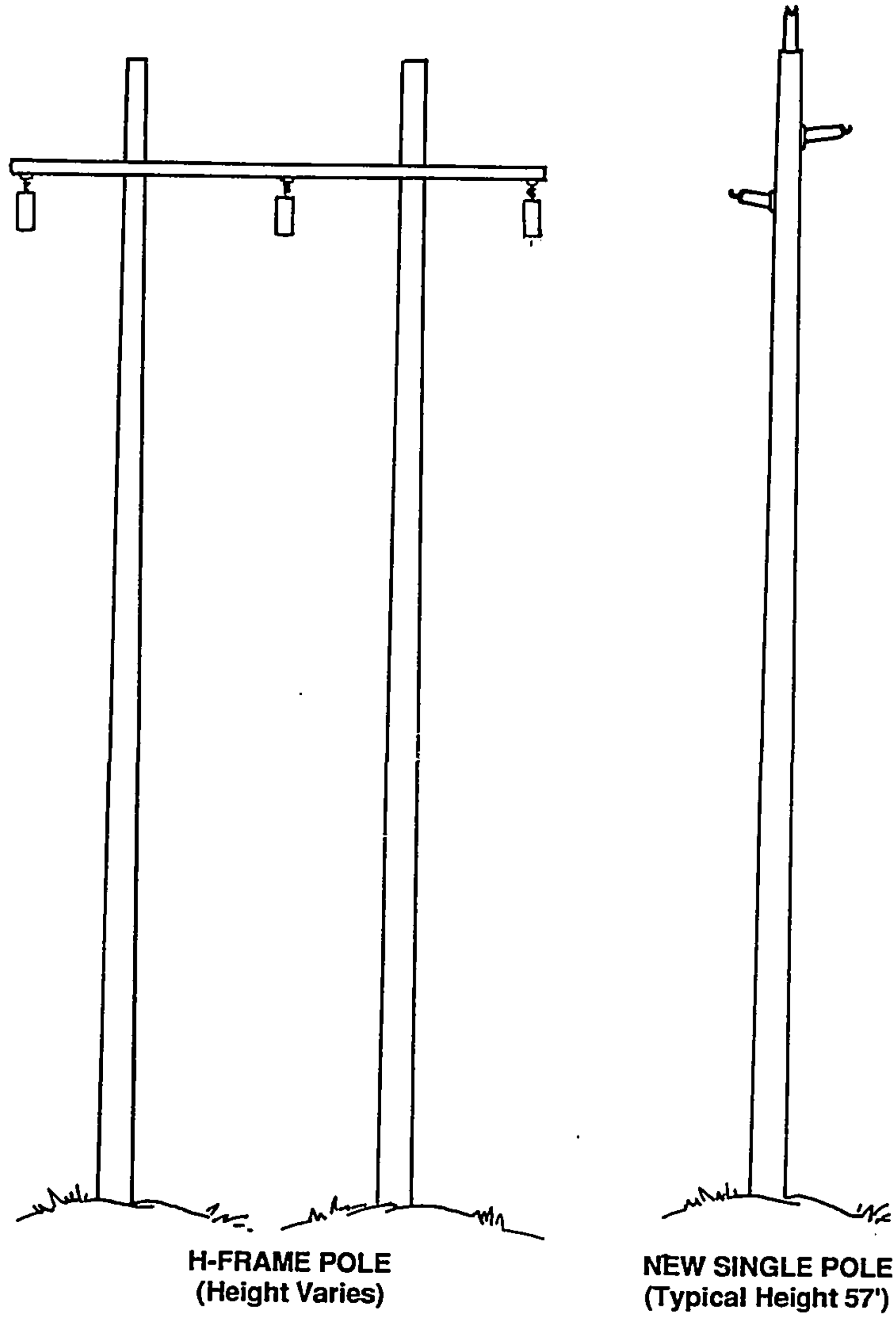


FIGURE 2-2
TYPICAL OVERHEAD LINE SUPPORT STRUCTURES
WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE
HAWAIIAN ELECTRIC COMPANY

Pole spans between single pole structures will average 300 feet, with a maximum extension to about 750 feet. The maximum spans between the H-frame support structures will be about 1,500 feet.

2.3.2 Conductors and Insulators

The project will entail the installation of conductors and cables: conductors for the overhead portion of the line and cables for the underground segment. Approximately 13.4 miles of single-circuit 46 kV conductors (one conductor per phase, three phases per circuit) will be used for the overhead portion. The conductor will be 556.6 kcmil (kilo-circularmils) AAC (all aluminum conductor), "Dahlia". The overhead conductors will be mounted on the poles with horizontal post or suspension porcelain insulators.

The underground cables will be 1500 kcmil aluminum single conductor polyethylene jacketed cables. There will be one cable per phase with three phases for the underground circuit. The cables will be installed in three of the four (one spare) 5-inch PVC conduits which will be encased in concrete. Figure 2-3 illustrates a typical cross section of the underground cable installation.

2.3.3 Substation Upgrades

To accommodate the new 46 kV subtransmission line equipment upgrades will be needed at the Waialua and Kuilima Substations. This will include installation of switching equipment and line support structures.

2.4 RIGHT-OF-WAY ACQUISITION

Right-of-way easements are the land rights acquired for the construction, operation, and maintenance of the subtransmission line within private property. Twenty-five (25) foot wide easements will be required for portions of the line where single pole structures will be used

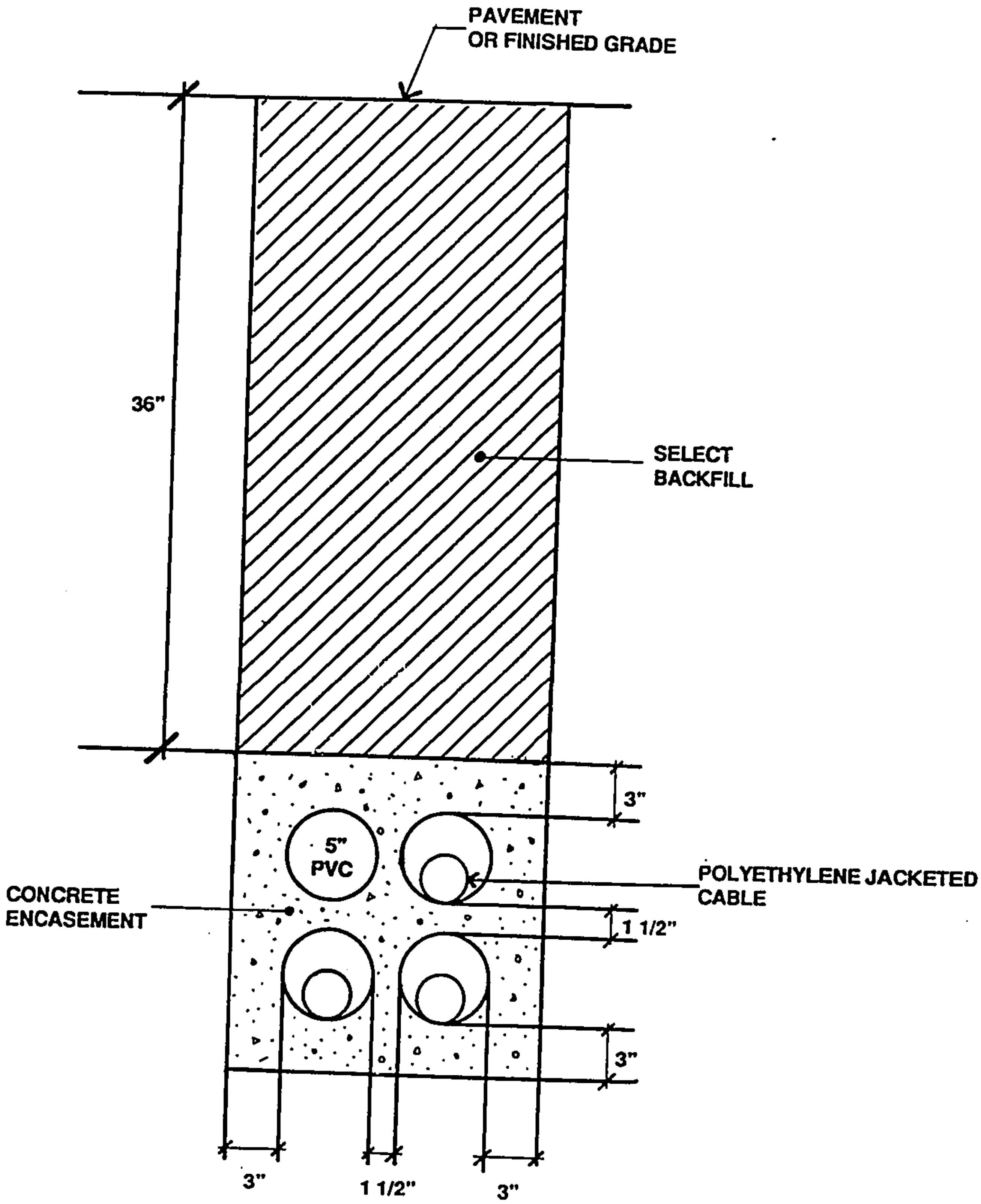


FIGURE 2-3
TYPICAL UNDERGROUND SECTION
WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE
HAWAIIAN ELECTRIC COMPANY

and fifty (50) foot wide easements will be needed where the H-frame structures are required. HECO will negotiate with the various landowners affected.

In areas where new easements are required, a right of access to the proposed right-of-way will be required during construction and maintenance of the subtransmission line. If the right-of-way is adjacent to a public road HECO's franchise rights provide access from the roadway to the lines for construction and maintenance.

Typically, several steps are involved in obtaining a right-of-way. Initially, a HECO land agent will contact each landowner (and other parties of interest) to negotiate a perpetual easement to accommodate the proposed subtransmission line. Following surveying and mapping of the land to be crossed, an appraisal is prepared to provide the basis of determing the fair market value of the land rights to be acquired. The appraisal is prepared by an independent real estate appraiser and the report is the basis for determining a value payable for the easement.

The owner of each affected parcel is then contacted by HECO's land agent and an offer for the easement is tendered. When a agreement is reached with the owners, the formal easement document is prepared and executed, the document is recorded and the landowner is paid.

A "right-of-entry" (i.e., a temporary right of access) is also negotiated for surveys, engineering studies, environmental assessment studies and construction before the perpetual easement has been recorded and takes effect.

The landowner grants HECO an easement for its facilities, but retains title to the land, and full use of the easement area, subject to safety limitations.

Where easements negotiations are unsuccessful, and adjustments to construction or routing requirements are impractical, HECO may invoke a legal options. The State constitution grants certain public bodies and utilities the right of eminent domain. This right gives utilities the power to acquire, through the courts, property rights for facilities to be built in the public interest. Eminent domain (sometimes call condemnation) is used as a last resort, if an agreement cannot be reached between a landowner and HECO, of if a landowner refuses to grant an acceptable easement. The court provides for fair compensation to be paid for the easements acquired in condemnations.

HECO attempts to minimize the impact of construction activity on the right-of-way. Claims for damages to land and crops are generally resolved through repair or compensation after construction is completed.

2.5 CONSTRUCTION METHODS

The construction methods to be employed in the installation of the proposed 46 kV subtransmission line are grouped into two categories: overhead line installation and underground cable installation.

2.5.1 Overhead Sections

Typical construction work includes: surveying, clearing, excavation of foundations, pole erection and installing of conductors. The initial activity for installation for the new line will be property, right-of-way, ground profile, access road and construction surveying. Next, both vertical and horizontal clearing of the right-of-way is done, as necessary to prepare for efficient installation of poles and conductors and to provide for electrical clearances.

There will be times when part of a public road (i.e. Kamehameha Highway next to Weed Junction) will be occupied by equipment performing construction activities associated with the installation of the line. Work on public roads must follow traffic control requirements prescribed by the Federal Highway Administration, the State Department of Transportation, Highways Division, and the City and County of Honolulu, Department of Transportation Services. This includes obtaining a Permit to Perform Work on State Highways, which must incorporate a Traffic Control Plan approved by the Highways Division. The State dictates that on a two-lane highway, lanes of adequate width in both directions must be provided wherever possible. Additionally, all lanes must be open to traffic during peak hours, 6:00 a.m. to 8:30 a.m. during the morning, and 3:30 p.m. to 6:00 p.m. in the afternoon. State guidelines for types of signs, lights, markers, positions of traffic cones, areas coned off, and the use of flagmen and/or police officers shall be followed. Coning off a lane of traffic may be required during construction activities such as foundation excavation, and pole and conductor installation.

Typical activities involved with the erection of new poles include the boring of holes 2-3 feet in diameter, and approximately eight feet deep. For portions of the route accessible by vehicle, the new wooden poles will be erected by a mobile crane. Other areas which are not accessible, will require pole erection to be accomplished with the use of a helicopter. For areas with termite problems, holes will be filled with termite barrier sand backfill and capped with concrete. Guy wires will be installed to provide necessary structural stability and safety.

Prior to installing the conductors, it may be necessary to install temporary clearance structures at the road crossings and at locations where the conductors might inadvertently contact existing electrical or communications lines or vehicular traffic during installation. The "tension-stringing" method of installing the conductors will be used to prevent the conductors from touching the ground or other objects by maintaining specified tension and sag during the stringing operation. Under this method, the conductors are pulled, using a pulling line, from pole to pole through pulleys attached to the insulators. They are tensioned to a specific ground clearance (sag) and clipped with insulator clamps. For poles next to roadways, adjacent traffic lane closure may be required during the pulling and tensioning operations. For inaccessible areas, helicopters will be used to install conductors.

2.5.2 Underground Section

Similar to the overhead portions of the proposed line, initial work will entail surveying of right-of-way, ground profile and access requirements. Following surveying activities the right-of-way will be cleared as necessary. Portions of the underground cable will cross Kamehameha Highway (within the Haleiwa Special District); therefore, traffic control requirements as described for the overhead section will also apply.

The underground segment of the proposed line will require excavating a 1.5 feet wide by 4.5 feet deep trench. Four five-inch PVC conduits will be encased in concrete at the bottom of the trench. Figure 2-3, shown earlier, illustrates a typical cross section of the trench. A 6 feet by 14 feet concrete manhole, will be placed every 300-400 feet. Once these facilities are in place, the underground cable will be pulled through the conduit and spliced at the manholes. At the Haleiwa Bypass, the underground line will transition to overhead conductors. The trench will be backfilled with select fill, and for sections crossing pavement, repaved to match existing conditions.

2.5.3 Quality Control

As sections of the line are completed, inspection of the work will be conducted to verify construction in accordance with specifications and standards. All excess material will be removed, and the work areas will be restored to conditions prior to construction to the extent reasonably possible.

2.6 PROJECT SCHEDULE

The construction of the proposed Waialua-Kuilima 46 kV Subtransmission Line will take approximately 12 months, from January 1994 through December 1994. The operational date for the line is scheduled for December 1994.

2.7 PROJECT COSTS

The estimated cost for the project is $8.2 million based on 1992 dollars. A cost breakdown including each general cost category is provided below. The cost of construction does not include any required improvements, easements costs, or addition of equipment at the substations.

Description	Cost (Millions)
Underground Line Installation	$0.7
Overhead Line Work	$1.1
Pole Installation	$2.8
H-Frame Structure Installation	$1.4
Construction Access	$0.9
Design Costs	$0.8
Maintenance Costs	$0.5
TOTAL	$8.2

SECTION 3

DESCRIPTION OF THE AFFECTED ENVIRONMENT, IMPACTS AND MITIGATION MEASURES

SECTION 3
DESCRIPTION OF THE AFFECTED ENVIRONMENT, IMPACTS AND MITIGATION MEASURES

3.1 OVERVIEW

This section provides a description of the existing physical and socio-economic environment within the overall project study area for the Waialua-Kuilima 46 kV subtransmission line, as well as specific descriptions of the environment along the proposed alignment. Many of the potential impacts of the subtransmission line were anticipated during the routing study and potential impacts were mitigated by avoidance (i.e., by selecting an alignment that minimized impact on the environment). Where impacts (either temporary or permanent) could not be entirely avoided during the siting process, mitigation measures have been identified.

3.2 PHYSICAL ENVIRONMENT

3.2.1 Site Description

The project study area falls within the Waialua, Wahiawa and Koolauloa Districts of the Island of Oahu, see Figure 3-1. It encompasses land bounded by Schofield Barracks to the south, the Koolau Mountains to the east, Kahuku to the northeast, and Waialua to the west. There are four distinct bands of land use within the study area. These are the coastal strip along the North Shore (the main residential area), the coastal bluff behind the shoreline (site of an existing 46 kV line), the inland slopes (mainly agricultural use), and the lower Koolau ranges (predominantly undeveloped forest land).

The proposed alignment for the Waialua-Kuilima 46 kV subtransmission line follows Twin Bridge Road up to about the 250' elevation then crosses the cane fields at mid-elevations using cane roads and irrigation ditches, gradually moving up to the 400-600' elevations. The alignment then traverses Waimea Valley ridgelines mauka of Waimea Falls and crosses the

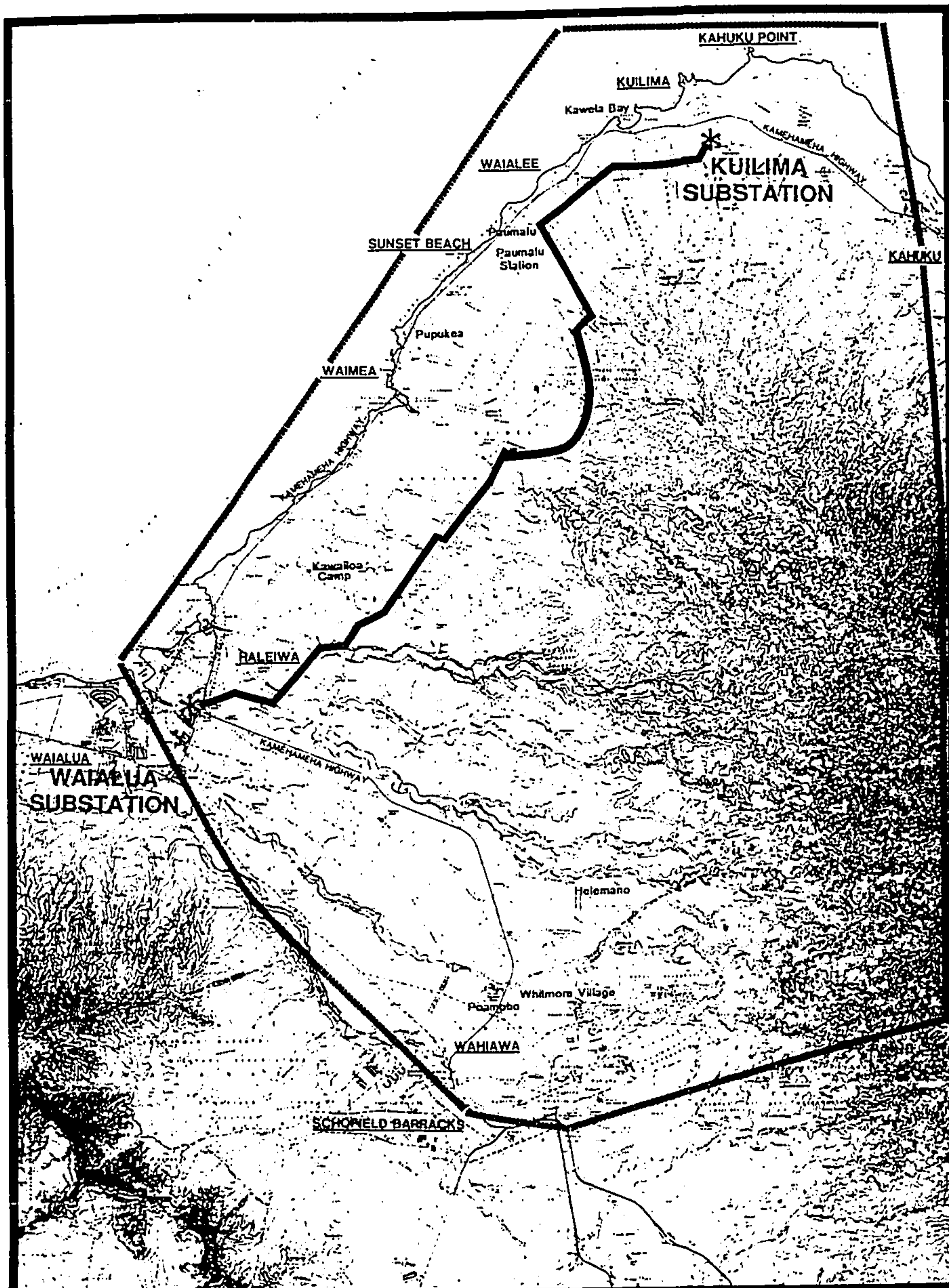


FIGURE 3-1

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PROPOSED ALIGNMENT
PROJECT BOUNDARY

PROJECT STUDY AREA
WAIALUA - KUILIMA 46KV
SUBTRANSMISSION LINE

upper portions of Pupukea on the mauka side of the Boy Scout Camp. North of Pupukea, the alignment crosses primarily undeveloped lands at the 600-800 feet elevation, following the mauka boundary of the Obayashi property, the makai boundary of the Girl Scout Camp. From the Girl Scouts Camp boundary, the line will follow the southern edge of Kaunala Gulch. The line will then cross over to the edge of Kaunala Gulch and follow the edge of the gulch heading makai for a little over a mile. At this point, about the 400' elevation, the line will cross close to the mouth of Kaunala Gulch (a span of about 1,000') and proceed to follow the top of the bluff, spanning several gulches. The line will then terminate near the Kuilima Substation at the base of Oio Gulch.

3.2.2 Existing Uses and Proposed Development

Figure 3-2 shows existing land uses within the project study area. Most of the study area is open space and undeveloped. The majority of open space area is within the State Conservation District, from the top of Koolau Mountain Range to the mauka portions of the agricultural zone and extending down numerous gulches and valleys to the coastal strip.

Agricultural land, primarily sugar, pineapple and cattle (in decreasing relative land area), comprise the next largest existing land use in the project study area. As reflected in Figure 3-3, agricultural lands extend from pockets within the mauka open space areas, and continue on the ridges between gulches and valleys down to the coast highway. At higher elevations around Wahiawa, pineapple is the predominant crop. Lower portions of the north-central plain between Haleiwa and Wahiawa, extending to Waimea, contain sugar cane. Within a portion of the coastal strip south of Waimea Bay, and inland above Sunset Beach and Waialee, cattle are raised. There are two agricultural experimentation stations within the study area. The first is along Route 803, midway between Waialua and Wahiawa. The second station is in Waialee operated by the University of Hawaii.

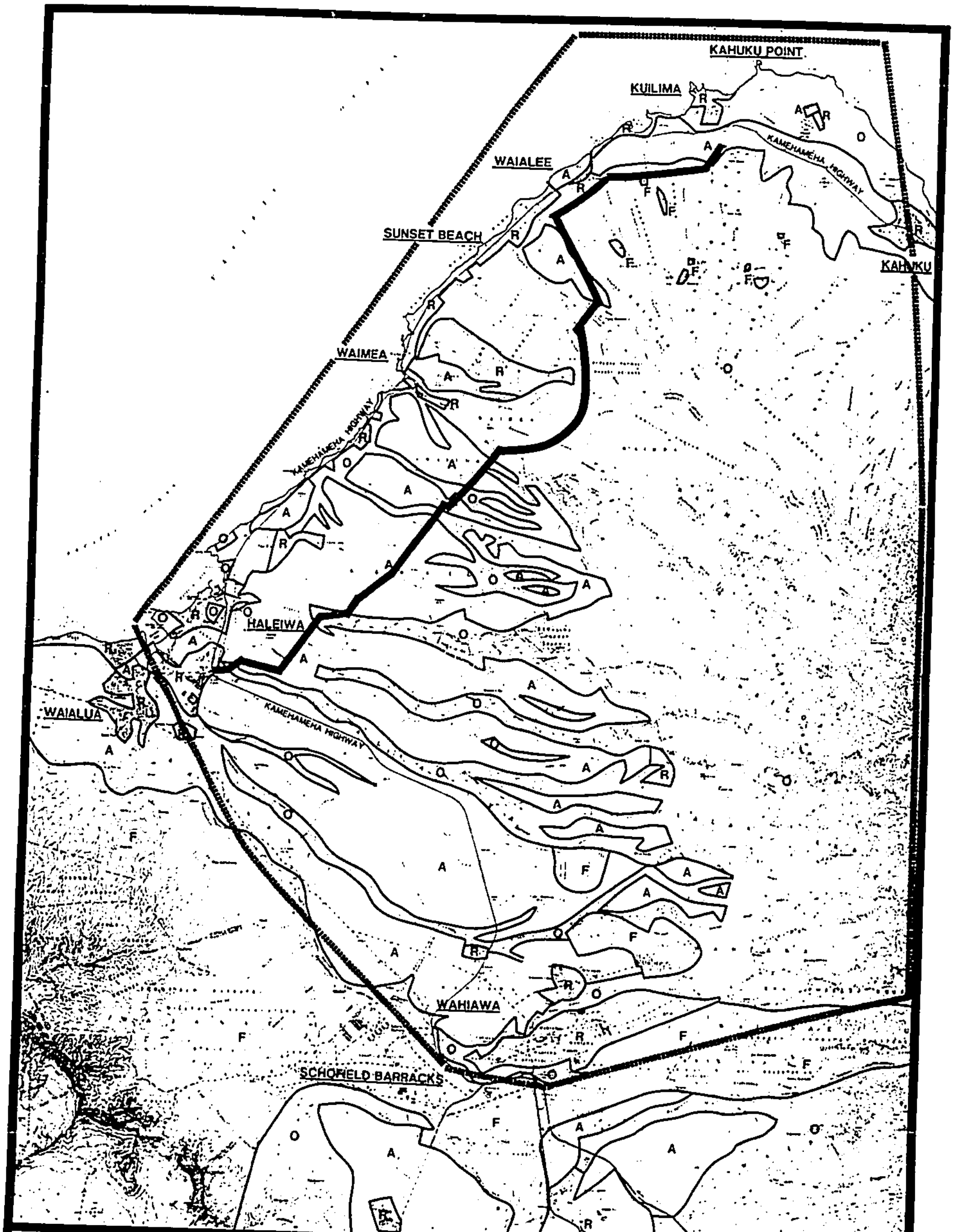


FIGURE 3-2

R. M. TOWILL CORPORATION
JAN

A Agriculture
O Open (undeveloped)
R Residential & Commercial
F Federal

PROPOSED ALIGNMENT
PROJECT BOUNDARY

EXISTING USES

WAIALUA - KUILIMA 46KV SUBTRANSMISSION LINE

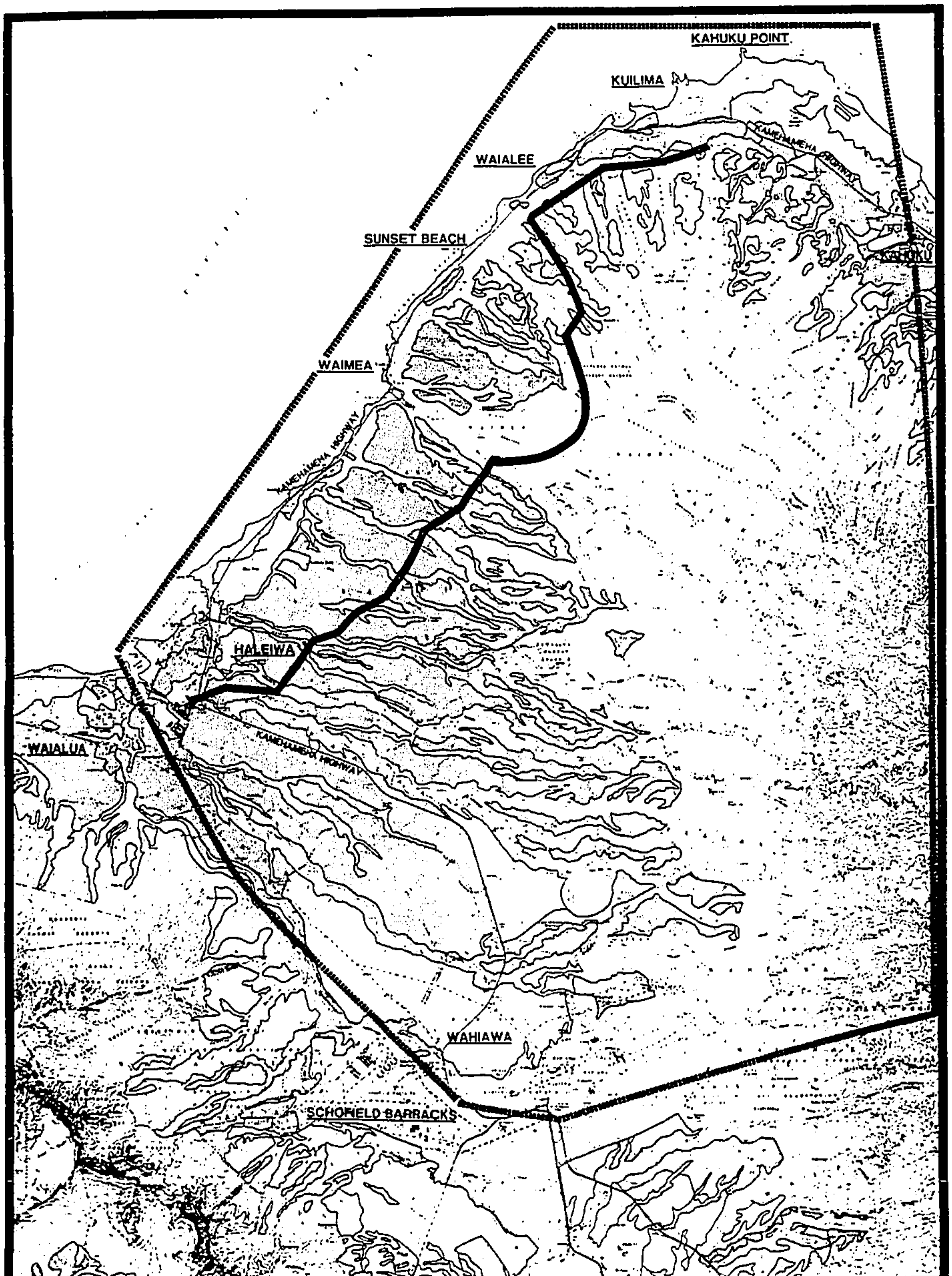


FIGURE 3-3

R. M. TOWILL CORPORATION
JAN 1983

- PRIME AGRICULTURAL LANDS
- UNIQUE & OTHER AGRICULTURAL LANDS
- PROPOSED ALIGNMENT
- PROJECT BOUNDARY

AGRICULTURAL LANDS

WAIALUA - KUILIMA 46KV SUBTRANSMISSION LINE

There are four general concentrations of residential/commercial development within the study area. The first includes Wahiawa and Whitmore Village, in the southern portion of the study area abutting Schofield Barracks. The second includes Waialua and Haleiwa, extending north to include the communities around Ukoa Pond and Kawailoa Camp. The third includes the coastal strips north and south of Waimea, the restaurant and park area within Waimea, residences along Pupukea and Paumalu Ridges and the communities at Sunset Beach and Waialee. This developed area also extends north to include Kawela Bay and the Turtle Bay resort development area. The fourth area comprises the township of Kahuku at the very northeast edge of the project area.

The final land use category that covers a significant portion of the study area is military that include Schofield Barracks, Helemano and Poamoho military installations at the southern edge of the study area, and the Kahuku training areas in the northern part of the study area. It also includes the communication stations scattered around Kuilima and the windfarm at the northern end of the project area, and the Paumalu station above Sunset Beach.

Lands along the proposed alignment are primarily in agricultural use or preserved as open space for conservation purposes. At Waimea Valley, the line will cross mauka of the falls and continue through State lands mauka of the Boy Scouts Camp. East of the Boy Scouts Camp, the line will enter lands owned by Obayashi Corporation and will then follow the makai boundary of the Girl Scouts Camp, which is located above Paumalu Gulch. Located at the northern edge of Kaunala Gulch and extending west are lands being leased to the Army for training. Recreational areas and facilities along the proposed alignment are described in section 3.3.4.

Proposed development in the vicinity of the project includes the Lihi Lani Recreational Community by Obayashi Hawaii Corporation. The proposed alignment traverses the mauka boundary of the Obayashi property. The proposed Lihi Lani development covers approximately 1,143 acres in Pupukea/Paumalu and includes an 18-hole golf course, equestrian ranch, tennis center, 120 one-acre country lots, 180 affordable housing units, riding and hiking trails, a campground and a community facilities center.

Impacts and Mitigation Measures

The proposed project will require new right-of-way easements for much of the length of the proposed alignment. Construction related impacts may include noise (addressed in Section 3.2.9) and the temporary disruption of traffic (addressed in Section 4.4.1). Impacts on existing and proposed land uses will be limited to those activities that are adjacent to the alignment. A majority of the alignment crosses agricultural land and will have some impact on sugar cane field operations. Specifically, portions of the line which bisect fields, clearing under lines and adjacent to poles will be required during harvesting operations. To mitigate this, the proposed line will be routed to follow cane roads or field edges to the maximum extent possible. Most of the remaining portions of the line will cross undeveloped areas. The line will cross the proposed Lihi Lani development in an area which will remain a buffer zone. The line also crosses State land mauka of the Boy Scouts Camp and continues below the makai boundary of the Girl Scouts Camp. Construction near these areas should not impact their activities.

The installation of the proposed 46 kV subtransmission line will impact a portion of the military training area in the North Shore area. The proposed alignment was routed along the outer fringes of the lands leased by the military to avoid these areas to the extent practicable because there is a potential incompatibility between military operations and the subtransmission line. Where impacts are likely, HECO will discuss options with the military prior to finalizing the subtransmission route.

3.2.3 Topography, Soils and Geology

Topography within the study area varies greatly because of the large area it covers. It ranges from uplands along the slopes of the Koolaus, deeply dissected by many intermittent streams, to moderately sloping agricultural lands at the low to mid elevations and to the generally flat coastal plain and sandy beach areas. Elevations range from sea level to over 2,000 feet in the Koolau Mountains. Slopes of 30 percent or more are found in the cliff and valley areas of the Koolau Range. At valley heads and within lands bordering the coastal plains, steep slopes of 21 to 30 percent as well as flatter slopes of 11 to 20 percent are found. Lands on the coastal plains and mouths of valleys have relatively flat slopes of 10 percent or less.

There are primarily four soil associations that are present within the study area, as identified by the U.S. Department of Agriculture Soil Conservation Service. The Kaena-Waialua association is located in drainageways, on coastal plains and talus slopes from Kaena Point to Kahuku. This association has the characteristic of having poorly to excessively drained soils with level and gentle slopes. These soils are formed in alluvium and have a fine to coarse textured subsoil or underlying material. The Helemano-Wahiawa association is located in the uplands from Waialua to Sunset Beach. These soils are formed in material weathered from basalt and are deep, well-drained, and nearly level to moderately sloping with a moderately fine to fine texture. The underlying subsoil is fine textured. The Lolekaa-Waikane association is found on uplands, alluvial fans, and terraces of the Koolau Range. The association is composed of deep, nearly level to very steep, well-drained soils. These fine to moderately fine textured soils have a dominantly fine-textured subsoil. They occur on older alluvium and colluvial material derived from basic igneous rock. The rough mountainous land-Kapaa association occurs on the Koolau Range between 1,000 foot and 3,000 foot elevations. Found in gullies and on narrow ridges, this association consists of very steep land broken by numerous drainageways. The soils are deep and well-drained with a fine or moderately fine textured subsoil.

The geological development of the island of Oahu began as lava flows from the Waianae volcanic shield on the west and the Koolau shield on the east coalesced to form a central plain known as the Schofield Plateau. The Waianae volcano subsequently became dormant and was deeply eroded before lava from the Koolau overlapped the eastern Waianae Range slopes. Features of both mountain ranges include amphitheater-headed valleys and spectacular cliffs. Eroded material from the Waianae and Koolau volcanoes form extensive alluvial and colluvial deposits in the lowlands.

According to the U. S. Department of Agriculture, Soil Conservation Service, Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii, August 1973, there are 16 soil types that are found along the proposed 46 kV subtransmission line alignment. Descriptions of each of the soil types are summarized below.

HLMG Helemano Silty Clay, 30 to 90 percent slopes
This soil is on the sides of V-shaped gulches. In a representative profile the surface layer is dark reddish-brown silty clay about 10 inches thick. The sub-soil, about 50 inches thick, is dark reddish-brown and dark-red silty clay that has subangular blocky structure. Permeability is moderately rapid. This soil is used for pasture, woodland, and wildlife habitat.

KIG Kapaa Silty Clay, 40 to 100 percent slopes
On this soil, runoff is very rapid and the erosion hazard is very severe. Most of the surface layer has been removed by erosion. This soil is used for water supply, wildlife habitat, and woodland.

KlaB Kawaihapai Stony Clay Loam, 2 to 6 percent slopes
This soil occupies smooth slopes. Runoff is slow, and the erosion hazard is moderate. Workability is impractical unless the stones are removed. This soil is used for pasture.

KpC Kemoo Silty Clay, 6 to 12 percent slopes
On this soil, runoff is medium and the erosion hazard is slight to moderate. Workability is slightly difficult because of the slope. This soil is used for sugarcane and pasture.

KpD Kemoo Silty Clay, 12 to 20 percent slopes
This soil occurs on uplands. The soils in these included areas have a concentration of heavy minerals in the surface layer. In a representative profile the surface layer is very dusky red to dark reddish-brown to dusky-red silty clay that has subangular blocky structure. The substratum is soft, weathered rock. Permeability is moderate to moderately rapid. Workability is slightly difficult because of the slope.

KPZ Kemoo-Badland Complex
The slope ranges from 10 to 70 percent. Runoff is medium to rapid, and the erosion hazard is moderate to severe. This complex is used for pasture.

LeB Leilehua Silty Clay, 2-6 percent slopes
This soil occurs as broad areas, as well as narrow areas bordered by gulches. In a representative profile the surface layer is dark reddish-brown silty clay about 12 inches thick. It contains concentrations of heavy minerals. The subsoil, about 36 inches thick, is dark reddish-brown and dusky-red silty clay and clay that has subangular blocky structure. The substratum is dark reddish-brown clay mixed with weathered gravel. The soil is extremely acid throughout the profile. Permeability is moderately rapid. This soil is used for sugarcane, pineapple, and home-sites.

LeC Leilehua Silty Clay, 6 to 12 percent slopes
On this soil, runoff is medium and the erosion hazard is moderate. Workability is slightly difficult because of the slope. This soil is used for sugarcane, pineapple, and pasture.

PaC Paaloa Silty Clay, 3 to 12 percent slopes
This soil occurs as narrow areas bounded by steep gulches. In a representative profile the surface layer, about 17 inches thick, is a mixture of dark-brown and dark reddish-brown silty clay and clay. The subsoil, about 43 inches thick, is dark reddish-brown silty clay and clay that has subangular blocky structure. The soil is strongly acid to very strongly acid. Permeability is moderately rapid. Workability is slightly difficult because of the slope. This soil is used for pasture and sugarcane.

Pec Paumalu Silty Clay, 8 to 15 percent slopes
On this soil, runoff is slow to medium and the erosion hazard is slight to moderate. Workability is slightly difficult. This soil is used for sugarcane and pasture.

PeD Paumalu Silty Clay, 15 to 25 percent slopes
The soil occurs as small, irregularly shaped areas. Permeability is moderately rapid. Runoff is medium and the erosion hazard is moderate. This soil is used for pasture and sugarcane.

PeE Paumalu Silty Clay, 25 to 40 percent slopes
On this soil, runoff is medium to rapid and the erosion hazard is moderate to severe. This soil is used for pasture and sugarcane.

PZ Paumalu-Badland Complex
In this complex Paumalu soils make up 40 to 80 percent of the acreage. Runoff is medium to rapid, and the erosion hazard is moderate to sever. Badland consists of nearly barren land that has remained after the Paumalu soils were removed by wind and water erosion. Runoff is rapid, and the erosion hazard is very severe. This complex is used for pasture and military purposes.

rRK Rock Land
The rock outcrops are mainly basalt and andesite. Rock land is used for pasture, wildlife habitat, and water supply.

WaB Wahiawa Silty Clay, 3 to 8 percent slopes
On this soil, runoff is slow and the erosion hazard is slight. This soil is used for sugarcane, pineapple, and pasture.

WaC Wahiawa Silty Clay, 8 to 15 percent slopes
On this soil, runoff is medium and the erosion hazard is moderate. This soil is used for sugarcane and pineapple.

Impacts and Mitigation Measures

Where new poles are located, the excavation for the pole foundations will entail some clearing and grubbing of the surface immediately surrounding the pole site. The foundation holes will be approximately 3' in diameter and 8-9' deep. Excavated soil will be replaced with the pole and termite barrier sand backfill and a concrete cap for areas with termite problems. Soil not required for backfill will be trucked to a fill site/or spread around the pole.

Due to the relatively shallow depth of the pole foundations, there will be no disturbance of geologic features. Clearing and grubbing activities during construction will temporarily disturb the soil retention values of the existing vegetation and expose the soils to erosional forces. The impact of construction activities on soils will be mitigated by several measures, as outlined in the following regulations:

a. City and County of Honolulu's Grading, Grubbing and Stockpiling Ordinance No. 3968, (1972);
b. DPW's Soil Erosion Standards and Guidelines, (1975);
c. The SCS's Erosion and Sediment Control Guide for Hawaii, (1968).

Prior to issuance of a grading permit, the project proponent will submit an erosion control plan for approval by the City and County of Honolulu, Department of Public Works, which will include applicable measures as specified in the regulations cited above. Such erosion control measures may include, but are not limited to, the use of cut-off ditches, temporary ground cover, and detention ponds.

3.2.4 Hydrology and Drainage

Due to the expansiveness of the study area, there are many types of surface water and drainage features. These include rivers, streams, ponds, marshes, reservoirs and irrigation ditches. Many of the reservoirs and ditches serve the cultivated agricultural lands and are located throughout the fields. Some of the major water features include Waimea Stream, Anahulu Stream, Paukauila Stream, Lake Wilson (Wahiawa Reservoir), Loko Ea Pond, Ukoa Pond and Kalou Marsh. The proposed alignment spans the following streams from north to south: Paumalu, Kalekeiki, Pakulena, Kalunawaikaala, Elehaha, Kamananui, Kaiwikoele, Anahulu, and Opaeula. It crosses the following gulches from north to south: Oio, Kawela, Pahipahialua, Waialee, Kaunala, and Aimuu.

Impacts and Mitigation Measures

No adverse impacts are anticipated on surface water or groundwater resources since the project will not alter existing stream channels or drainage patterns, and will not have any long term water requirement. Poles will be sited outside stream channels, thus, dredging or filling actions will not be required. There should be no discharges into surface waters nor any violations of any federal, state, or local water quality standards.

3.2.5 Wetlands

A wetland area may be described as a "land area subject to periodic or permanent inundation during the growing season which causes the selection of a group or an association of plants that can tolerate the wet conditions" (U.S. Army, Engineer District, Honolulu, December, 1977). Recognized wetland values include, among others, providing food chain production and habitat for a variety of aquatic and terrestrial species. In addition to their value for supporting wildlife, wetlands are important in flood control as evidenced at Kawainui Marsh on Oahu and in improving water quality by removing and filtering certain pollutants.

Wetlands in the study area include Ukoa Pond, Haleiwa Wetlands, Waimea Stream, and Kalou Marsh, see Figure 3-4. The Haleiwa lowlands between Anahulu Stream and Kaukonahua Stream were developed for wetland agriculture in the early 1900's. Used primarily for rice and taro cultivation, there were over 150 separate water impoundments in this area before World War II. Currently, much of the area consists of residential developments and sugar cane fields. A few wetland areas remain such as a freshwater marsh near Haleiwa town and areas along stream banks and near irrigation canals. Loko Ea Pond, located near the mouth of Anahulu Stream, was once connected to Ukoa Pond.

Ukoa Pond has been cited as a wetland area of significance for protecting endangered waterbirds such as the Hawaiian Stilt, Hawaiian Coot, Hawaiian Gallinule, and Hawaiian Duck. It is located approximately one mile northeast of Haleiwa, near Kawailoa Beach.

Water from this basal, spring-fed coastal marsh has been tapped and pumped for sugar cane irrigation. Additionally, part of the original marshland has been eliminated by the City and County of Honolulu's Kawailoa Sanitary Landfill. Portions of the marshland are used for cattle grazing.

The Waimea Stream Wetland consists of a small estuarine marsh located on the lower reach of the Waimea Stream, near Waimea Bay. A sand bar at the mouth of the river offers some protection against wave action, however, the wetland is somewhat influenced by tidal action.

Kalou Marsh is located approximately two miles northeast of Sunset Beach. Once known as Kalou Fishpond, this site is listed in the Hawaii Register of Historic Places. A University of Hawaii Agricultural Experiment Station is located in the area, a portion of which is also utilized as pasture.

In addition to Ukoa Pond, Haleiwa lotus fields and Waimea Falls Park are considered primary habitats for the recovery of endangered Hawaiian waterbirds in the Hawaiian Waterbirds Recovery Plan (U.S. Fish and Wildlife Service, September 1985).

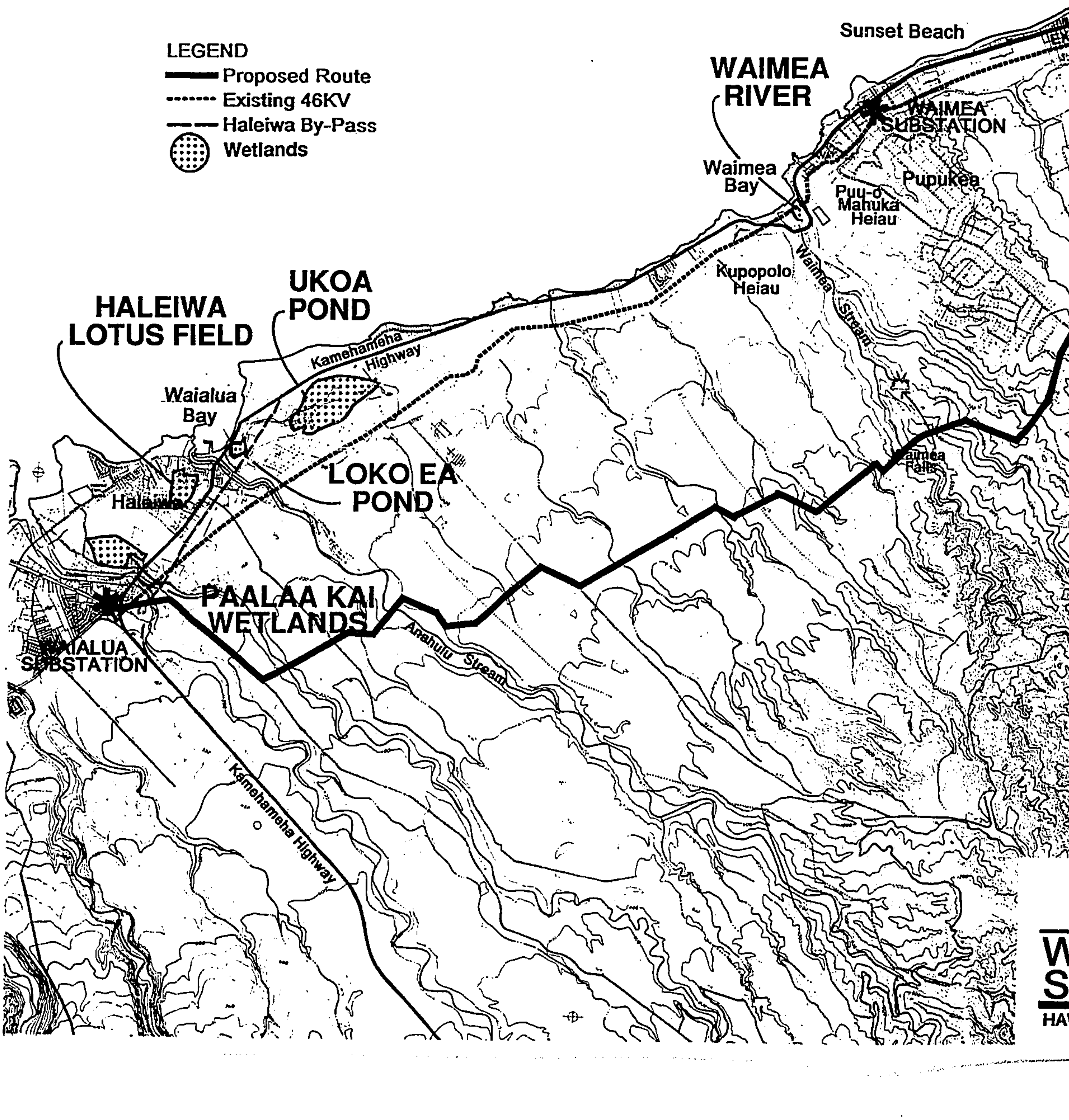
Impacts and Mitigation Measures

No short or long term impacts are expected on wetland areas from the development of the proposed project, as the proposed alignment avoids these sensitive areas.

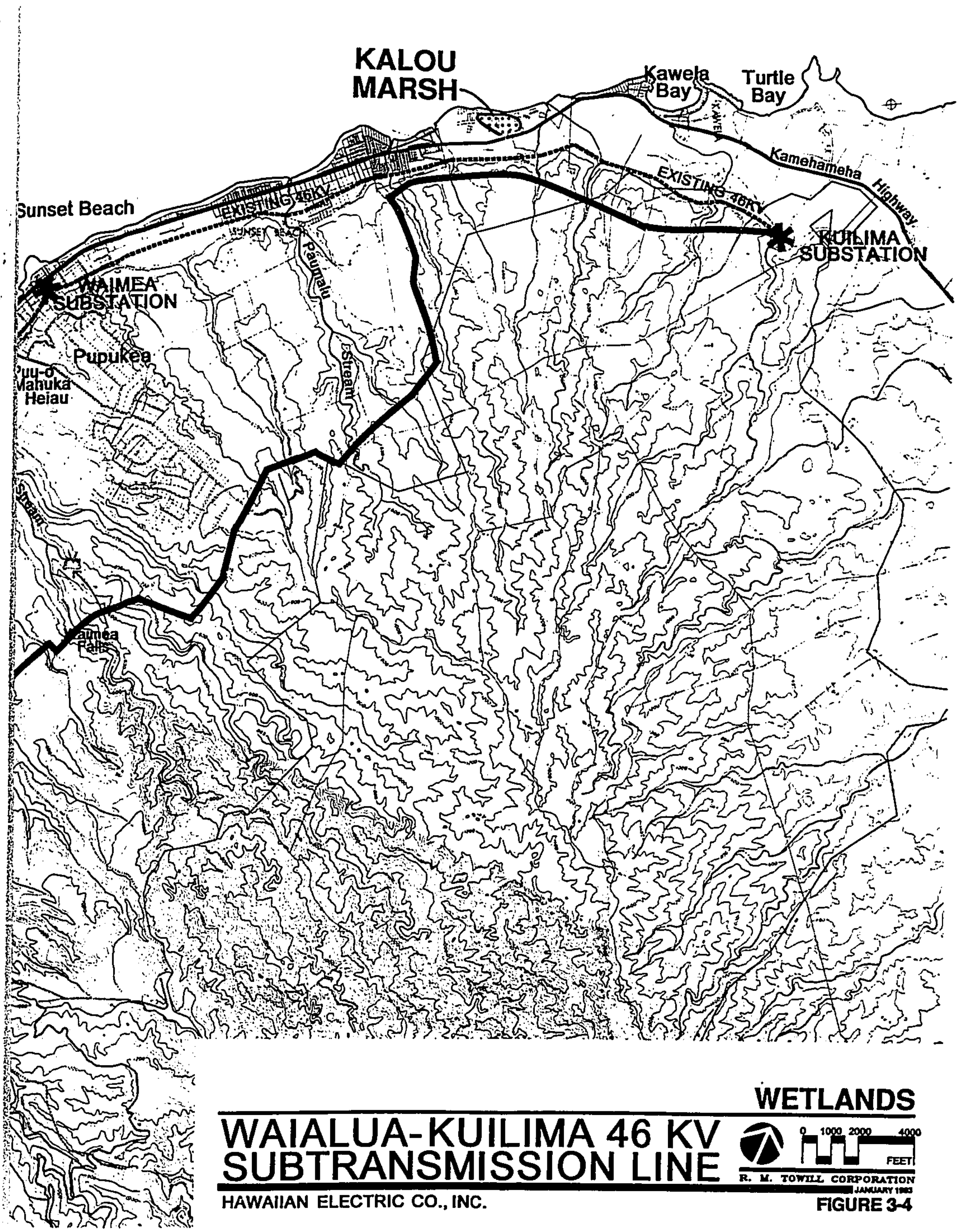
3.2.6 Flora and Fauna

Flora

There are a wide variety of plants that can be found within the study area. These range from cultivated crops of sugarcane and pineapple on agricultural lands to exotic and native wild plant life in the large undeveloped open areas. Similarly, there is a variety of wildlife of both introduced and native species.



LEGEND
Proposed Route
Existing 46KV
Haleiwa By-Pass
Wetlands
Sunset Beach
WAIMEA RIVER
WAIMEA SUBSTATION
Waimea Bay
Pupukea
Puu-o Mahuka Heiau
Kupopolo Heiau
Waimea Stream
UKOA POND
HALEIWA LOTUS FIELD
Kamehameha Highway
Waialua Bay
Haleiwa
LOKO EA POND
PAALAA KAI WETLANDS
WAIALUA SUBSTATION
Anahulu Stream
Waimea Falls
Kamehameha Highway



WETLANDS

WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE

0 1000 2000 4000 FEET

R. M. TOWILL CORPORATION
JANUARY 1993

HAWAIIAN ELECTRIC CO., INC.

FIGURE 3-4

The coastal lowlands between Kaena Point and Kahuku receive 20 to 40 inches of rain a year. An association of lantana (Lantana camara L.) and koa haole (Leucaena leucocephala) shrubs thrives under these conditions and generally characterizes the flora of the area. Other prevalent vegetation include the klu (Acacia farnesiana L.), panini (Opuntia megacantha), ilima (Sida fallax), and Natal redtop grass (Rhychelytrum repens).

The predominant vegetation of the northeastern slopes of the Waianae Range, the Leilehua Plateau, and the northern slopes of the Koolau Range, below an elevation of 2500 feet, is an association of open guava forest and shrubs. Flora characteristic of this area include guava (Psidium guajava), koa haole, lantana, Spanish clover (Desmodium spp.), and Bermuda grass (Cynodon dactylon).

The prevalent vegetation at altitudes below 1500 feet on the slopes of the Waianae and Koolau Ranges, where annual rainfall is 60 inches or more, consists of closed guava forests with shrubs. Characteristic plants include guava, Boston fern (Nephrolepis exaltata bostoniensis), Hilo grass (Paspalum conjugatum), basket grass (Oplismenus hirtellus), false staghorn fern (Dicranopteris linearis), kukui (Aleurites moluccana) and hala (Pandanus odoratissimus).

A closed ohia lehua rainforest occupies the upper slopes of the Waianae and Koolau Ranges. Native Hawaiian flora characteristic of these areas are the ohia lehua (Metrosideros collina sub sp. polymorpha), hapuu tree fern (Cibotium spp.), and olapa (Cheirodendron trigynum).

According to the Hawaii Heritage Program, Natural Diversity Database, compiled by the Nature Conservancy of Hawaii in June 1992, several endangered plant species are located in the study area. The endangered plant species 'Awiwi (Centaurium sebaeoides) and

Diellia falcata have been observed historically. The Makou (possibly extinct, Botrychium subbifoliatum) and Adenophorus periens are two plant species historically observed in the area on which the U.S. Fish and Wildlife Service (USFWS) has substantial information regarding their biological vulnerability. These plants are potential candidates for the Federal official endangered species list. Also historically observed in the area is the Anini (Wanini, Eurya sandwicensis), a plant species that may qualify as endangered or threatened, pending additional data.

Botanical Consultants conducted a botanical assessment of the five proposed subtransmission line alternative alignments, from Waialua to Kuilima on August 1992, see Appendix B, Waialua-Kuilima Transmission Alignment Botanical Reconnaissance Report. The purpose of the survey was to ascertain the type of vegetation found along these alignments, its identity, density, and approximate heights. Data was collected by surveying the undeveloped areas along the proposed alignments. Using aerial photographs, USGS topographic maps, and an altimeter the approximate corridors were located and information on the species composition, height, and density of the vegetation was collected. No time was spent in the cane fields, pastures, and suburban areas. According to the Botanical Consultants no State of Hawaii (DLNR Update 1991) or Federal (USPFWS 50 CFR 17 1991) proposed or listed threatened or endangered species were found during this study.

The predominant vegetation near the proposed 46 kV subtransmission line alignment before reaching Opaeula Stream is sugarcane. At Opaeula, the walls of the gulch are covered with koa haole. The bottom of the stream is heavily forested with Java plum and a few scattered silk oak trees which are about 30 feet in height. Between the stream and the cane fields is a dense band of guinea grass. The proposed alignment again crosses sugarcane fields until it comes to Anahulu Stream. The vegetation is thick and varied, but made up of mostly introduced species. The ironwood trees are 50 to 60 feet in height. There are also African tulips, monkey pod, silk oak, date palm, and banyan trees. Sisal, Apple of Sodom, Indian fleasbane, 'A'ali'i, and sour grass are also common."

The proposed alignment then continues across more sugarcane fields until it crosses Kawailoa Plus 1 Gulch. The vegetation is Albizia, silk oak, Chinaberry, paperbark and java plum trees which are 50 to 75 feet in height. The vegetation of the gorge bottom is composed of these trees as well as Formosan koa. All of these species are known to have been planted by the Territorial Forestry Department between 1910 and 1980.

The next vegetated area along the alignment is at Kawailoa Plus 2 Gulch. The cliff faces are ironwood trees 35 to 45 feet in height. There are also silk oak, Java plum, Albizia, and Chinaberry trees with and understory of Christmasberry shrubs. Many landscape plants such as Bougainvillea, Poinciana, Hibiscus sp. and white shrimp plant are found along the edges of Kawailoa Plus 2 Gulch. Guinea grass fills all the space between the trees and shrubs.

The proposed alignment crosses Kawailoa Plus 3 Gulch, and the species composition of the vegetation is similar to the previous two sites except here the ironwoods are 50 to 60 feet in height. There are also Kukui and mango trees and some native vegetation, notably koa trees 25 to 35 feet in height, mountain naupaka, 'Akia, ti, and palapalai fern.

The proposed alignment crosses more cane fields and one more unnamed gulch before entering the Waimea Forest Reserve. In crossing the Waimea Stream drainage, the proposed alignment crosses several small streams and ridges. Kaiwikoele Stream gorge, and Kamananui Stream gorge, later join to form Waimea Stream. The alignment crosses the northeastern tributary of the Waimea Stream, the intermittent Elehaha Stream. The vegetation of the area is very diverse and includes large ironwood trees near the rim with silk oak, koa, ohia, strawberry guava and 'A'alii trees among others on the gorge walls. In the valley floor there are large mango, kukui and java plum trees. Christmasberry, strawberry guava, Formosan koa, pili grass and many roadside ferns are common.

Upon reaching the Kuilima side of Waimea Gorge, the proposed alignment hugs the edge of Kauwalu Gulch, a small side gorge into the Waimea watershed. The rim of Kauwalu Gulch and the edges of Pupukea Road are lined with ironwood and swamp mahogany trees. At the rim of Kauwalu Gulch, the proposed alignment splits seaward in a northwesterly direction toward Pu'u O Mahuka Heiau. This route is along the ridge top through an almost pure ironwood forest. Near the heiau, swamp mahogany, Formosan koa, Java plum, and strawberry guava, and sisal.

The cross country proposed alignment from Pupukea road to Kaunala Gulch crosses Kalunawaikaala, Pakulena, and Kaleleiku. The territory between the major streams is cut by small ridges and waterways. Along this entire alignment the major vegetation is ironwood and swamp mahogany trees, with Christmasberry, silk oak, and both strawberry and yellow guava becoming more common along the northeastern end of the corridor.

The proposed alignment encounters another 1500 foot rim to rim gorge at Paumalu Stream. This gorge is 250 to 300 feet deep and the vegetation is varied. The upper edge of the gorge on the Waialua side is covered with ironwoods and only scattered swamp mahogany trees. On the steep drop down into the stream bed, the cliff walls are covered with strawberry guava and some young silk oak trees. On the Kahuku side, the vegetation is scrub silk oak trees, some Christmasberry, yellow guava, lots of pili grass, sword fern, and Philippine ground orchid. From Paumalu Gorge, the proposed alignment looses elevation as it traverses the Girl Scout Camp and some well kept pastures as it approaches Kaunala Stream. In this area the vegetation is more open and varied. The gorge is 1000 to 1500 feet across and approximately 300 feet deep. The scattered ironwoods are 40 to 60 feet high and there are also silk oak, koa, 'ohia, Java plum and pandanus trees. Native shrubs such as mountain naupaka and pukeawe are common as are many species of ferns.

From Kaunala Gulch to the Kuilima Substation road, much of the land is in agriculture, either vegetable fields or pasture lands. There are scattered ironwood, kiawe, be-still trees, coconut, banyan, and Chinaberry trees as well as koa haole, Christmasberry, and large stands of guinea grass. Norfolk island pines and ironwood, mango, monkey pod, and kiawe trees are common.

Fauna

A variety of mammals are known to occur in the study area. These include feral pigs, feral cats, feral dogs, mongooses, rats, and mice, as well domesticated cattle. The northern part of the Koolau Range is a wet area and provides a favorable environment for wild pigs, many of which are hybrids of the wild Hawaiian pig and introduced breeds.

Insect life is abundant in the study area, and the control of the insect population is especially important in agricultural areas, such as Waialua. Trees and shrubs are inhabited by land snails of the genus Achatinella which are classified as endangered by Federal and State authorities.

Birds found in agricultural areas in the region include the cardinal, barred and spotted doves, mockingbird, golden plover, Hawaiian Owl (pueo, Asio flammeus sandwichensis), ricebird, house sparrow, ring neck pheasant, egret, seabirds and white eye. Endangered bird species found in the study area include: Hawaiian Coot, Hawaiian Duck, Hawaiian Gallinule, and Hawaiian Stilt.

The proposed subtransmission line alignment is not located near the habitats of any known species whose status are identified as rare, endangered or threatened by the Federal and/or State government.

Impacts and Mitigation Measures

Possible impacts on flora will be limited to flora along the immediate alignment because clearing and tree trimming will be required. An inventory survey will be conducted on the final selected alignment. Generally, tree trimming will be done manually and herbicides will not be used. Shrubs and other low growing vegetation will be left undisturbed as much as possible.

Because the installation of the proposed 46 kV subtransmission line will not change the physiography of the area it is hypothesized that potential resident birds that may use the area are not expected to be significantly impacted by the subtransmission line. Similarly, once the final alignment is determined and a botanical inventory accomplished, it can be determined if any tree snails will be impacted. If there is an occurence, the site can be avoided. Potential feral mammals which may be found in the area such as wild cats, rats or mongoose are also not expected to be significantly impacted by the installation of the subtransmission line.

3.2.7 Climate

The climate of the area is typical of Hawaii; mild with equable temperatures year round, moderate humidities, persistence of northeasterly trade winds, widely variant rainfalls within a short distance and infrequency of severe storms. Average high temperatures range from the mid-70's during the "winter" months (December-March) to the upper-80's from July to October. Low temperature averages range from the low-60's December-May, to the upper-

60's and low-70's July-October. Average annual rainfall ranges from less than 30-40 inches in the low lying, coastal areas to over 100 inches in the uplands of the Koolaus.

Impacts and Mitigation Measures

The proposed project is not expected to impact the local climate of the project area.

3.2.8 Natural Disasters

Flooding - Flood prone areas within the project study area are all contained within the coastal strip. Figure 3-5 shows the 100-year flood zone. The boundary includes the Haleiwa Harbor area, but does not cover the Waialua substation. It generally follows Kamehameha Highway between Haleiwa and Waialee, with further half-mile encroachments up into the Waimea and Paumalu valleys. From Waialee to Kuilima, the flood hazard boundary stays more makai of the highway within a few hundred feet of the coast. The boundary then sweeps back and forth across the highway towards Kahuku, except around the National Wildlife Refuge at Kahuku where it shifts towards the coast, paralleling it with a 200 foot separation. As can be seen in Figure 3-5, the proposed alignment does not fall within the 100-year flood zone. It is also important to note that all the substations within the project study area are outside of any Federal Emergency Management Agency (FEMA) determined flood prone area.

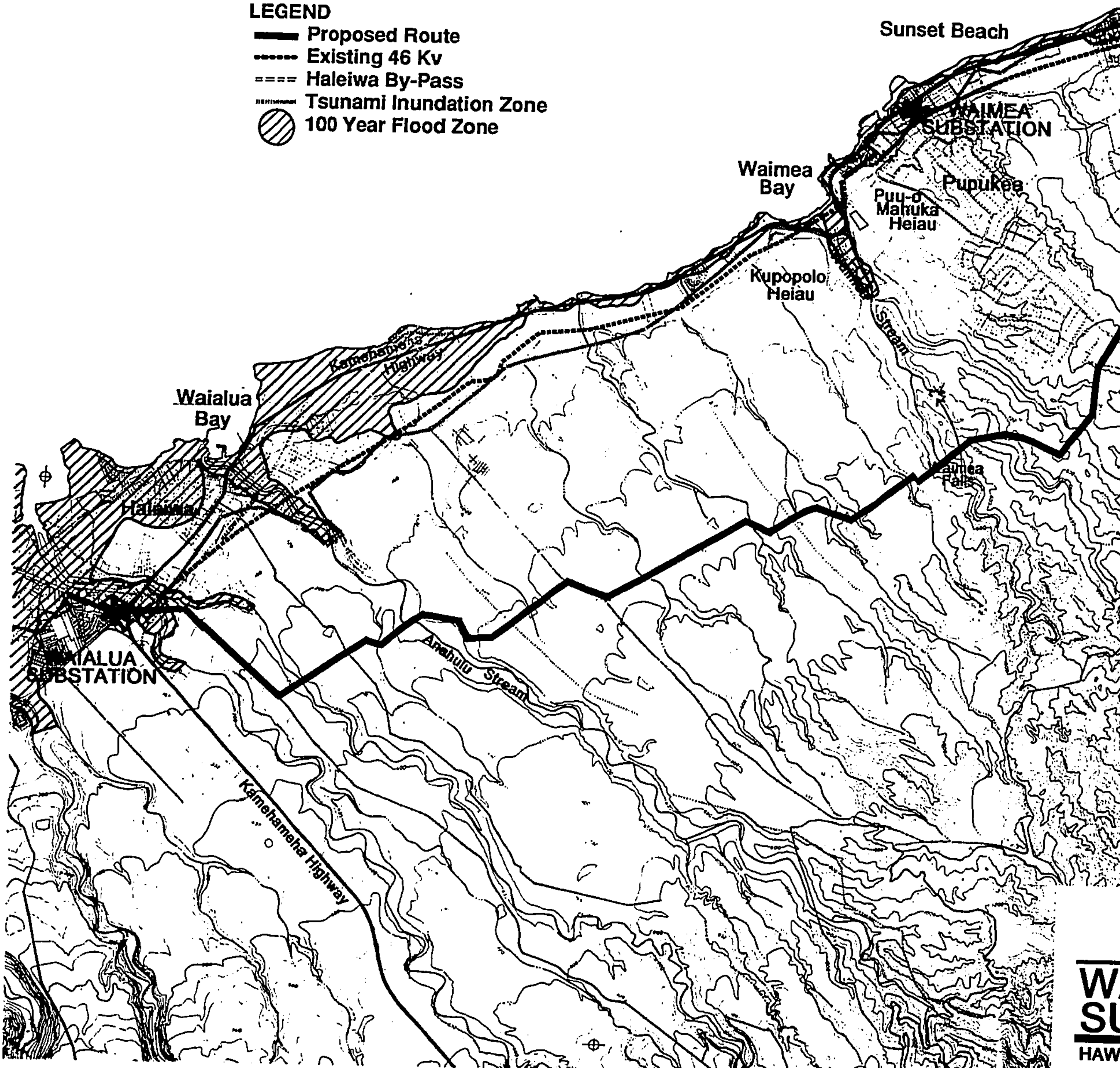
Tsunamis - The most recent tsunamis with run-ups of two meters or more are: 1946 (from Aleutian Islands), 1952 (from Kamchatka, U.S.S.R.), 1957 (from Aleutian Islands), 1960 (from Chile), 1964 (from Alaska), and 1975 (from earthquake on southeast coast of the island of Hawaii). The tsunami inundation zone is shown in Figure 3-5. It extends mauka of both the highway and 100-year flood boundary between Waialua and Kuilima. Consequently, it includes the substations at Waimea and Waialua, and major portions of the existing 46 kV subtransmission line along the North Shore. For the most part, the proposed alignment will be routed outside of the tsunami boundary.

Hurricanes - Hurricanes and tropical storms that affect Hawaii usually originate off the coast of Central America. The most recent hurricanes that passed the Hawaiian Islands resulting in significant property damage were Hurricane Dot (1959), Hurricane Iwa (November 1982) and Hurricane Iniki (September 1992). Hurricane Iniki was the most powerful hurricane to hit the islands this century, devastating the Island of Kauai and causing significant damage to the western coast of Oahu.

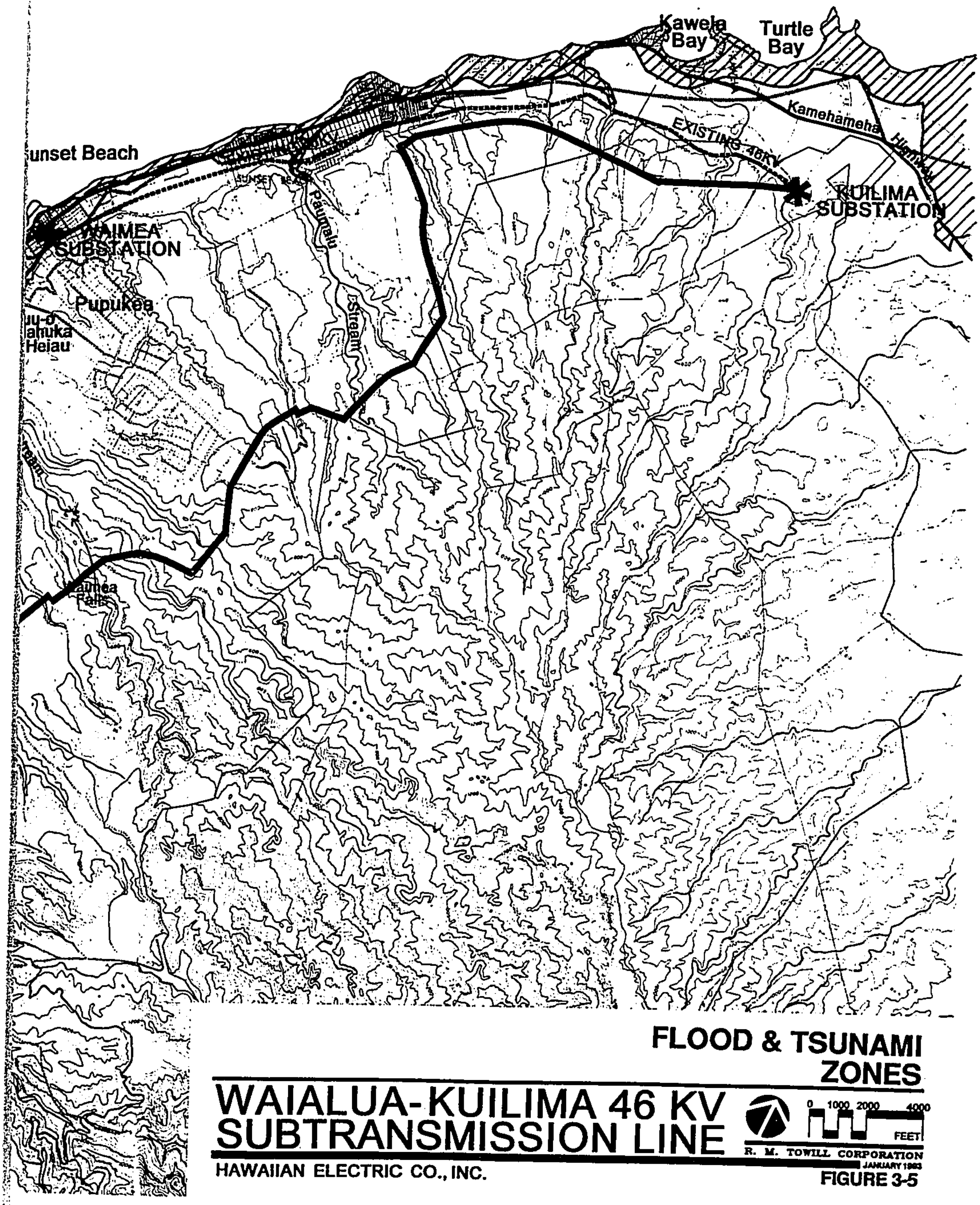
Earthquakes - All of the island of Oahu is rated as seismic Zone 2A, according to standards established in the 1988 Uniform Building Code (UBC). There are four zones (through 4) in this range, with Zone 1 as the rating given to areas least prone and Zone 4 as the most prone to earthquake hazards.

Impacts and Mitigation Measures

The mauka location of the proposed subtransmission line will eliminate the risks to tsunami disasters and flood damage. Historically, there have been few hurricanes that have caused great damage to the North Shore area. However, they do pose a high wind damage threat to the system. To mitigate this possible impact on the system, the new poles will be designed and installed to withstand sustained 80 mph winds.



LEGEND
Proposed Route
Existing 46 Kv
Haleiwa By-Pass
Tsunami Inundation Zone
100 Year Flood Zone
Sunset Beach
WAIMEA SUBSTATION
Waimea Bay
Pupukea
Puu-o Mahuka Heiau
Kupopolo Heiau
Stream
Kamehameha Highway
Waialua Bay
Haleiwa
WAIALUA SUBSTATION
Anahulu Stream
Kamehameha Highway
HAW



FLOOD & TSUNAMI ZONES

WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE

HAWAIIAN ELECTRIC CO., INC.

0 1000 2000 4000 FEET

R. M. TOWILL CORPORATION

JANUARY 1993

FIGURE 3-5

3.2.9 Air Quality

Air quality of the proposed project area is good due to low emission levels and the almost continual presence of tradewinds or on-shore breezes. There is no industrial activity in the vicinity of the project. The only significant sources of man-made pollution are pollutants in vehicle exhausts produced along Kamehameha Highway. Therefore, any amount of emissions generated from construction activities is anticipated not to exceed the governing air quality standards of the State Department of Health or the Federal Environmental Protection Agency.

Impacts and Mitigation Measures

Temporary and very localized negative impacts on air quality will occur in areas adjacent to the construction sites. Equipment that will be used during the construction phase will emit exhaust and airborne particulates, and the construction work will also produce dust. These impacts will be reduced through the use of mitigative measures such as dust control by watering, proper vehicle maintenance and work scheduling to avoid peak traffic periods when crossing roadways.

Adequate dust control measures will be utilized during construction to minimize airborne particles. Strict adherence to approved erosion control plans and the use of mitigative measures such as water sprinkling will reduce the potential for adverse impact on air quality. Vehicular emissions will be minimized through proper equipment maintenance and the avoidance of construction during peak traffic periods. Prevailing tradewinds will also help in dispersing the airborne pollutants.

3.2.10 Noise and Vibration

Noise from wind, ocean surf, traffic along roadways, and military activity (helicopters) contribute to the sound level in the study area and along the proposed 46 kV subtransmission line alignment.

Impacts and Mitigation Measures

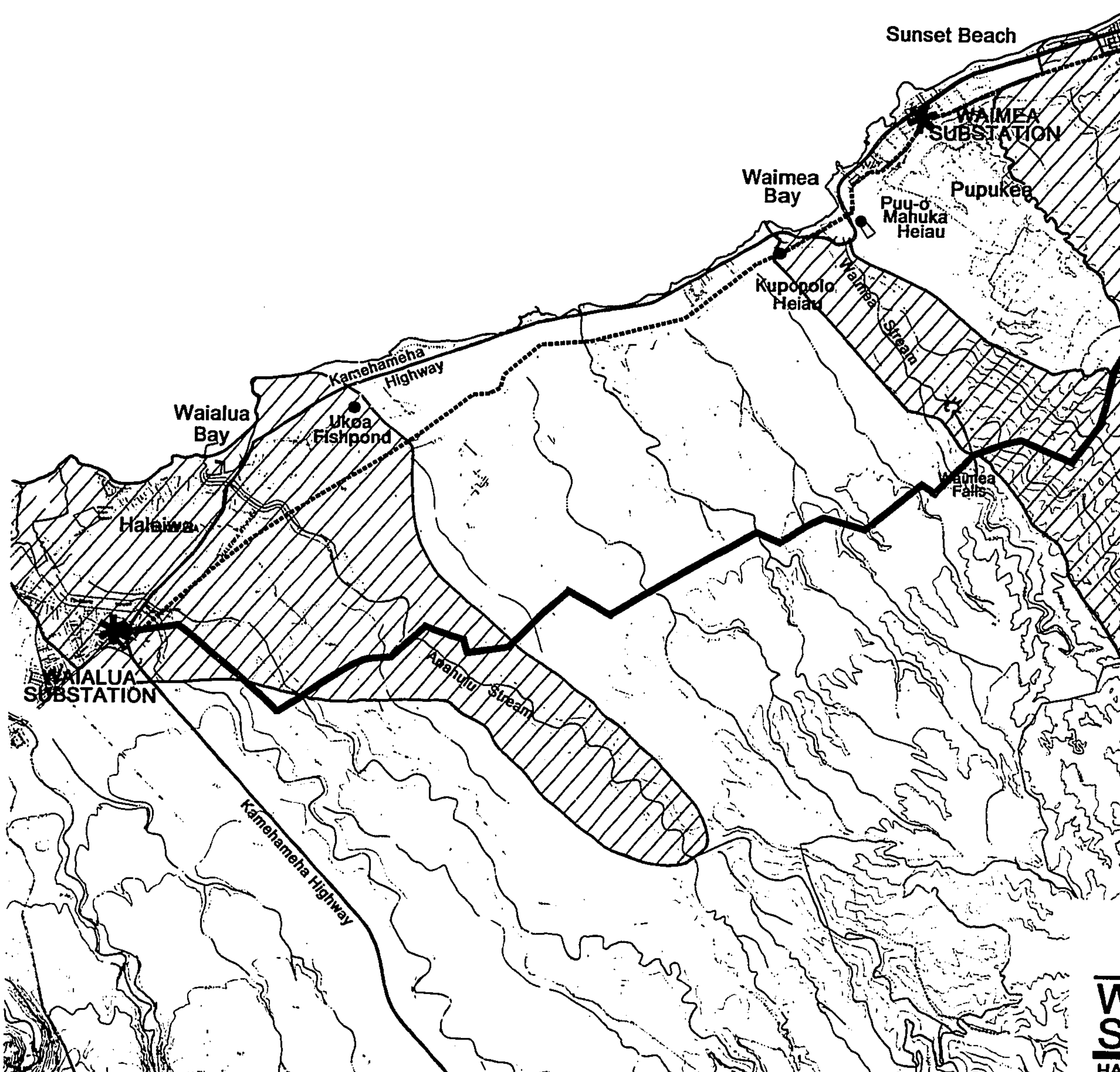
A temporary increase in noise levels due to construction activities is likely to occur adjacent to areas being worked on. Any increase in noise due to construction will be eliminated as work is completed along the alignment. All activities associated with the construction phase of the project will comply with the provisions of the State Department of Health (DOH) Administrative Rules, Chapter 11-43, "Community Noise Control for Oahu." Noise levels from construction activities are not expected to exceed the allowable levels of the regulations. Mitigation measures such as the use of mufflers and limiting construction to daylight hours will be employed.

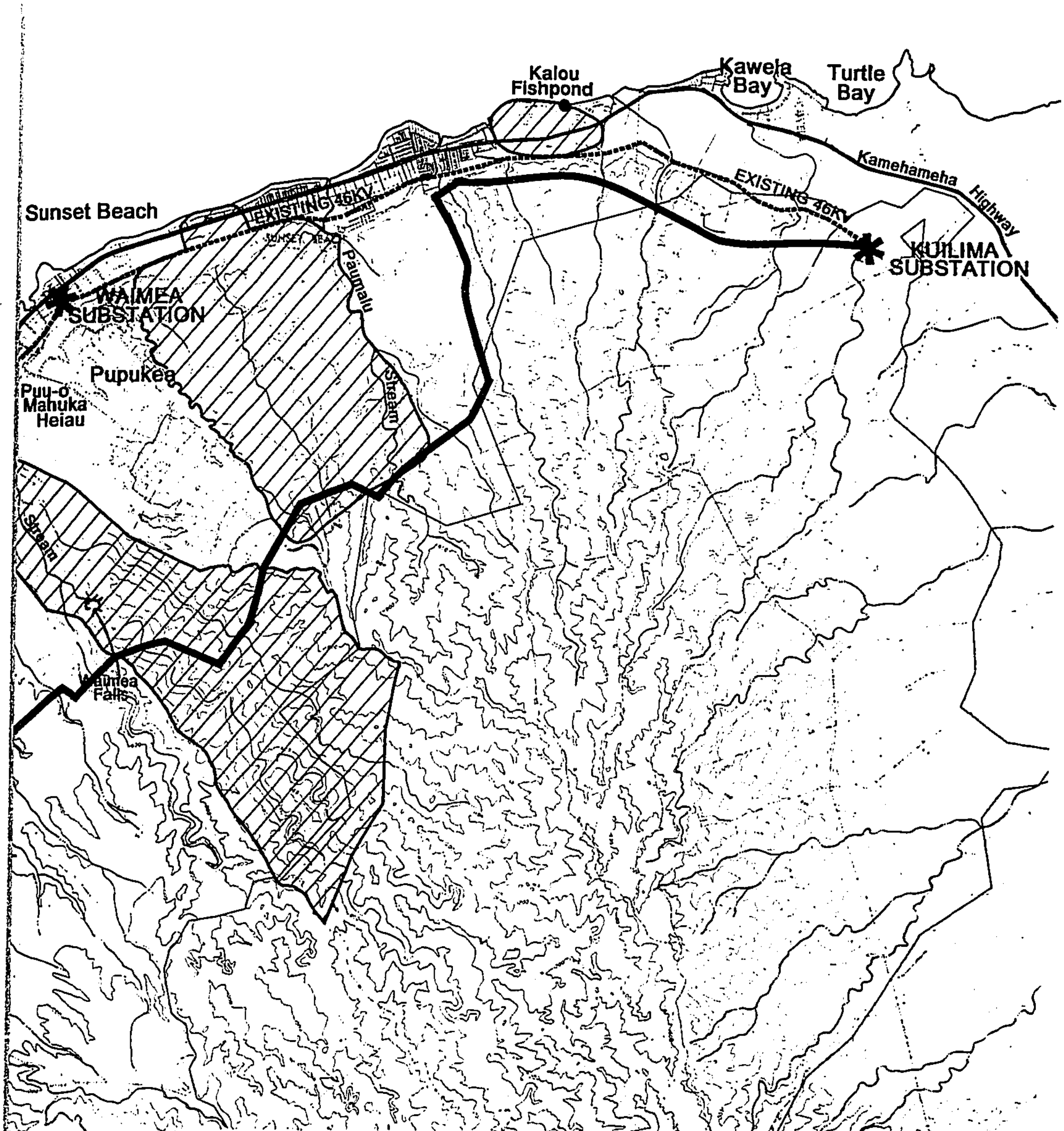
3.3 SOCIO-ECONOMIC ENVIRONMENT

3.3.1 Historic and Archaeological Resources

The historical research conducted by Cultural Surveys Hawaii in February 1992 indicates that there are archaeological resources in the study area. In areas that have been protected from large scale agriculture activity or urban development, there is a high probability of finding historic sites. The coastal area contains the highest density of sites, while the upper reaches of the forest reserve contain fewer known sites.

From the investigations conducted by Cultural Surveys Hawaii, it is apparent that there are five major areas of archaeological concern with respect to the project study area that should be considered. Figure 3-6 highlights these areas which were the major areas of settlement during the early historic period, and possibly in prehistoric times as well:


Sunset Beach
WAIMEA SUBSTATION
Waimea Bay
Pupukea
Puu-o Mahuka Heiau
Kupopolo Heiau
Waimea Stream
Kamehameha Highway
Waialua Bay
Ukoa Fishpond
Haleiwa
Waimea Falls
WAIALUA SUBSTATION
Anahulu Stream
Kamehameha Highway



ARCHAEOLOGICAL AREAS OF CONCERN

WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE

HAWAIIAN ELECTRIC CO., INC.

FIGURE 3-6

1) The area in and around the towns of Waialua and Haleiwa. This includes the lower Anahulu Valley, Ukoa Pond, and the coastal areas in and around Waialua Bay.
2) The Anahulu Stream valley running through Kawailoa ahupua'a from the mountains to Waialua Bay.
3) The valley of Waimea, which is both a private park and a Special Management Area.
4) he area of the Pupukea/Paumalu development in the hills above Pupukea Beach Park.
5) An area of dense Land Commission Awards in the coastal region of Waialee ahupua'a.

All of these archaeological areas of concern are located near the proposed subtransmission line except for the coastal region of Waialee ahupua'a.

The first major area of concern is the area in and around the towns of Waialua and Haleiwa, of interest not only for its many prehistoric and early historic Hawaiian sites, but also for early plantation sites common in the area. A number of archaeological studies have been conducted in the area. In 1979, a CHINIAGO Inc. study identified a historic deposit, a wall remnant, an old church, an historic building, Kawaipuolo Spring, and Ukoa Pond as significant sites in the area.

The second major area of concern is the Anahulu Stream Valley, first heavily researched in the early 1970's. The research, conducted as part of a project of Marshall Sahlins, discovered that in both prehistoric and historic times there were several zones of production from the coast up to the hinter lands in the upper reaches of the valley. Two major areas were surveyed and excavated in the valley, Kapuahilua 'ili and Keae 'ili. The Kapuahilua 'ili is a fairly extensive terraced area located in the upper reaches of the valley on one side of the river, including a series of house platforms, taro pondfields, and various walls, enclosures, and other artifices of human manufacture. The Keae 'ili excavations located a number of sites, including a rock shelter.

The third major area of concern is Waimea ahupua'a, much of which is now part of the privately owned Waimea Falls Park in Waimea Valley. Waimea was a very rich valley, holding cultural significance, that was intensively utilized in both historic and pre-historic times. Present in the valley are agricultural terraces, koa (fishing shrines), burial caves and plots, house sites, and heiau. Pu'u o Mahuka heiau, considered to be the largest heiau on Oahu, is located on the north side of the valley. Religious activities at this heiau, registered as a National Historic Landmark, were almost certainly connected with the kahuna at Waimea Bay. Directly across the valley, located on the ridge top to the south of the river mouth of the bay, is the Kupopolo heiau. Both heiau were probably important religious centers for Waimea Valley, itself a sacred place of great importance, in ancient times.
The fourth major area of concern is north of Waimea Bay, in an area known as the Pupukea/Paumalu homestead lands. A survey conducted by local archaeology company PHRI in conjunction with a proposed development in the area identified 60 known sites, containing 112 separate features, 28 of which are clearly prehistoric or historic Hawaiian sites. These sites, seven of which are recommended for preservation, include rock shelters, caves, cave burials, petroglyphs, and various agricultural and habitation features.

The last major area of concern, Waiale'e ahupua'a, had a densely populated coastal region at the time of the Great Mahele in the mid-1800's. There is a very dense section of Land Commission Awards along the coast of this region, the majority probably used as agricultural fields. Only one site in the Waiale'e ahupua'a is recorded in an archaeological survey by McAllister in 1933. This is the Kalou fishpond, an enclosed, spring-fed fishpond near the coast. In the past the fishpond was held by the chief of the area and was part of King Kamehameha III's royal lands during his reign.

Impacts and Mitigation Measures

No short or long-term impacts are expected from the development of the proposed project on any known historic or archaeological resource. Most of the proposed 46 kV subtransmission line alignment is located on land that has been previously disturbed for agricultural uses. After a staked alignment is identified archaeological surface surveys will be undertaken to accurately assess surface conditions, in areas with known sites. Where the alignment must cross known areas of concern, care will be taken that the placement of the infrastructure avoids impact on any sites in the project area. Should archaeological remains be uncovered during any excavation operations, work on the site will be temporarily suspended and the State Historic Preservation Division, Department of Land and Natural Resources, will be contacted for determination on the proper evaluation and disposition of the findings.

3.3.2 Visual Resources

There are many visual amenities throughout the project study area. These include views of the ocean and shoreline areas from the coastal highway, the Koolau and Waianae Mountains, large expanses of cultivated agriculture land, and undeveloped open areas along the North Shore.

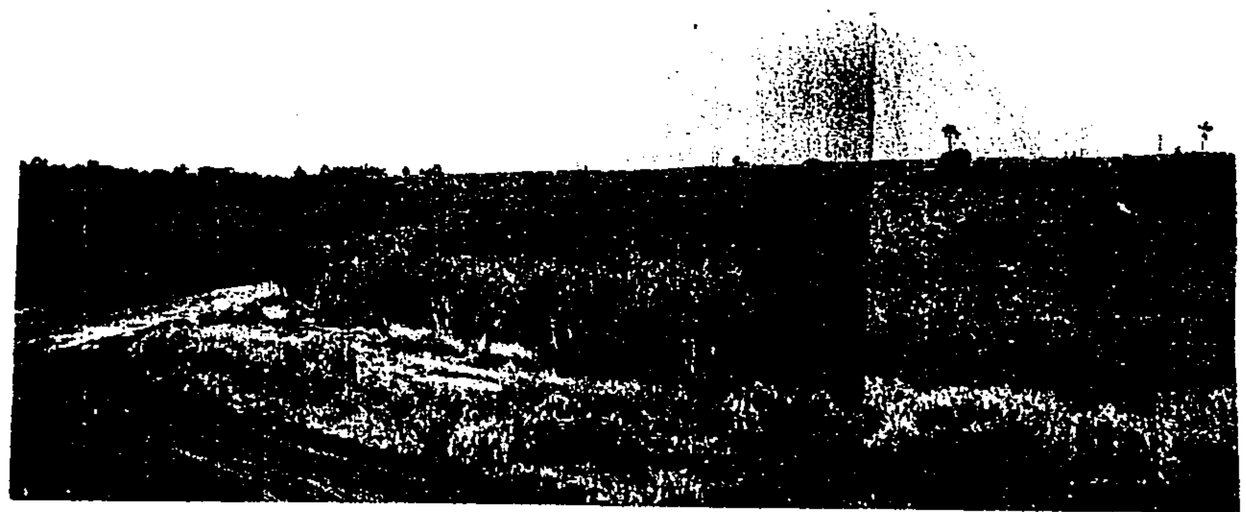
The drive along the North Shore affords views of many fine beaches including: Waialua Bay, Waimea Bay, and Sunset Beach. Waimea Valley may be seen when passing by Waimea Bay. Occasionally visible are the higher elevation sugarcane fields and Koolau and Waianae Mountain Ranges.

Many of the existing visual resources are presently affected to some degree by the development which has occurred along the North Shore over the years. This includes residential and commercial development, military and commercial communication facilities, and windfarm facilities. Additionally, the visual resources are affected by the existing 46 kV line, and electrical and communications overhead systems along Kamehameha Highway.

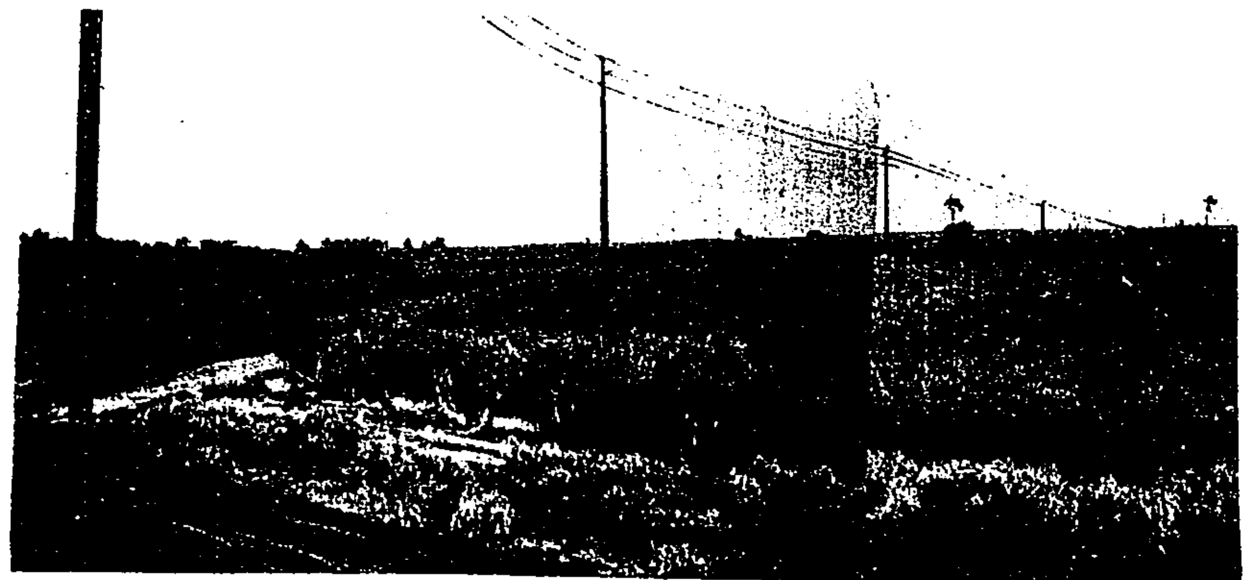
To assess the visual impact of the proposed 46 kV subtransmission line two methods were employed. The first method was used during the alignment selection and evaluation phase and entailed the analysis of sight lines from Kamehameha Highway. The second form of analysis was the visual simulation.

Once the preferred alignment had been determined, the task of identifying where the line would be visible was straight forward. As the subtransmission line leaves Haleiwa and the Waialua Sub, the line will be overhead (mauka of the Haleiwa by-pass road) and will continue mauka (east) along Twin Bridge Road for approximately 4,500 feet before it turns north toward Waimea Valley. The initial sections of the alignment will be clearly visible from the new Haleiwa by-pass road. Figure 3-7 illustrates a before and after view of the pole line along Twin Bridge Road as seen from the by-pass road. As the line heads toward Pupukea, the line will not be visible from Kamehameha Highway. As the line approaches Waialee, the subtransmission line will be placed along the bluff that parallels Kamehameha Highway. From Waialee to Kuilima, analyses of sight lines were performed. These were accomplished by establishing viewing points along the highway. The view points and sight lines are shown in Figure 3-8. Once the sight lines were determined, a section along the sight line was plotted to ascertain if the new subtransmission line could be seen. The results of the sight line analyses are shown in Figure 3-9 and 3-10. Based on the analysis, only the sight lines from Kawela Bay and the entry to the Turtle Bay Hotel would cause the line to be visible at a distance of approximately 3,800 feet.

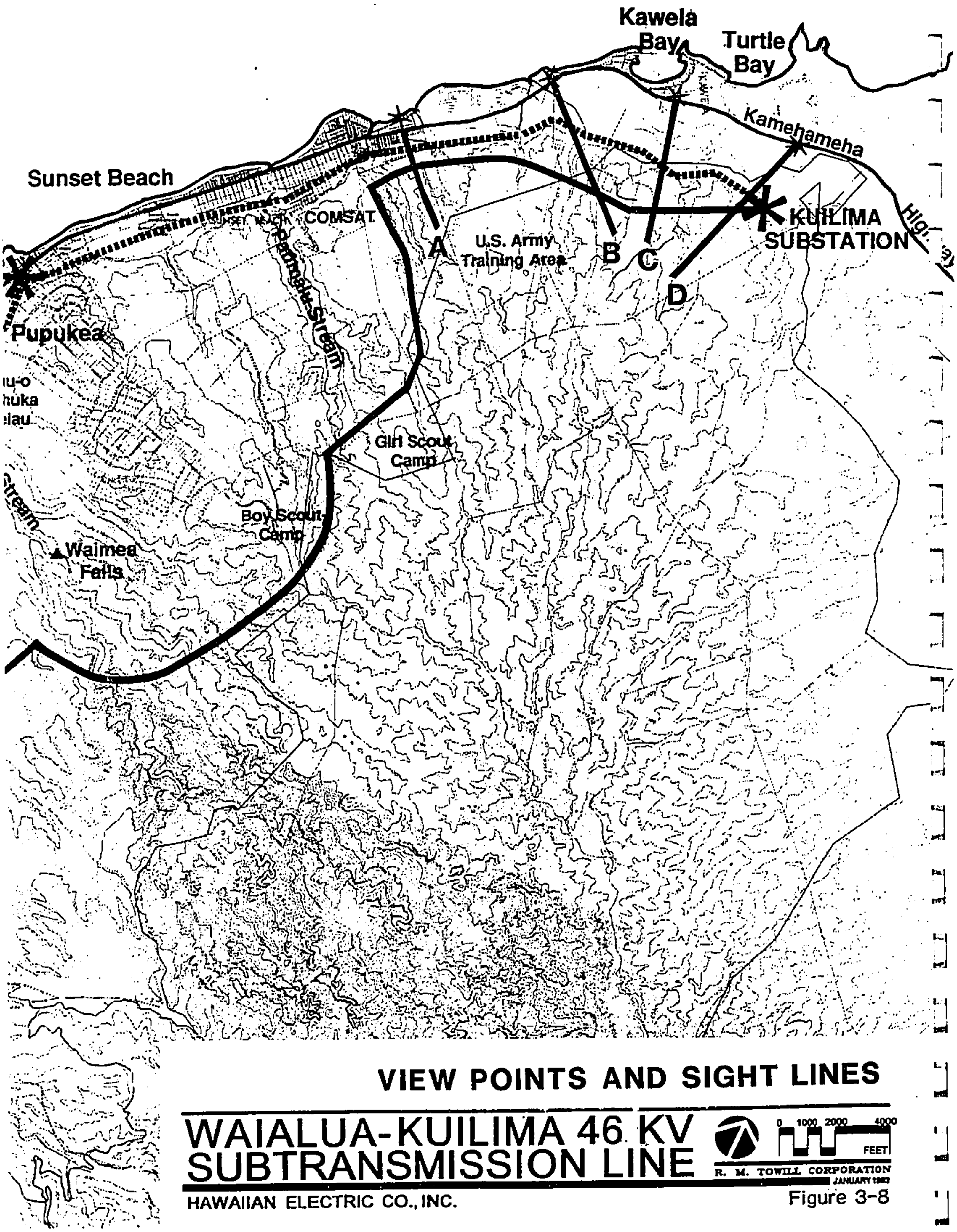
FIGURE 3-7
PHOTOGRAPH OF SUBTRANSMISSION LINE IN HALEIWA



Existing Condition: View mauka (east) along Twin Bridge Road. View from Haleiwa By-Pass Road



Future Condition: View mauka (east) along Twin Bridge Road with new subtransmission line installed.



VIEW POINTS AND SIGHT LINES

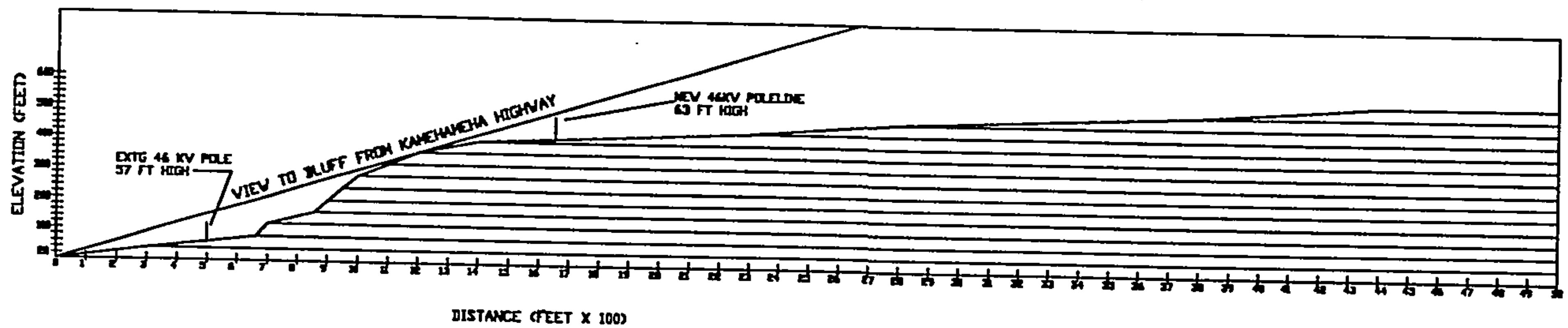
WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE

0 1000 2000 4000 FEET

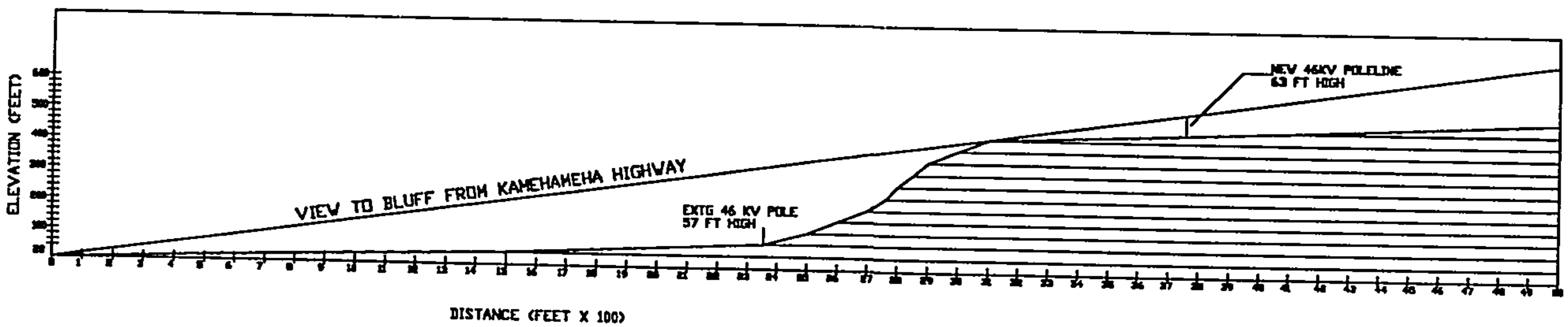
R. M. TOWILL CORPORATION
JANUARY 1983

HAWAIIAN ELECTRIC CO., INC.

Figure 3-8

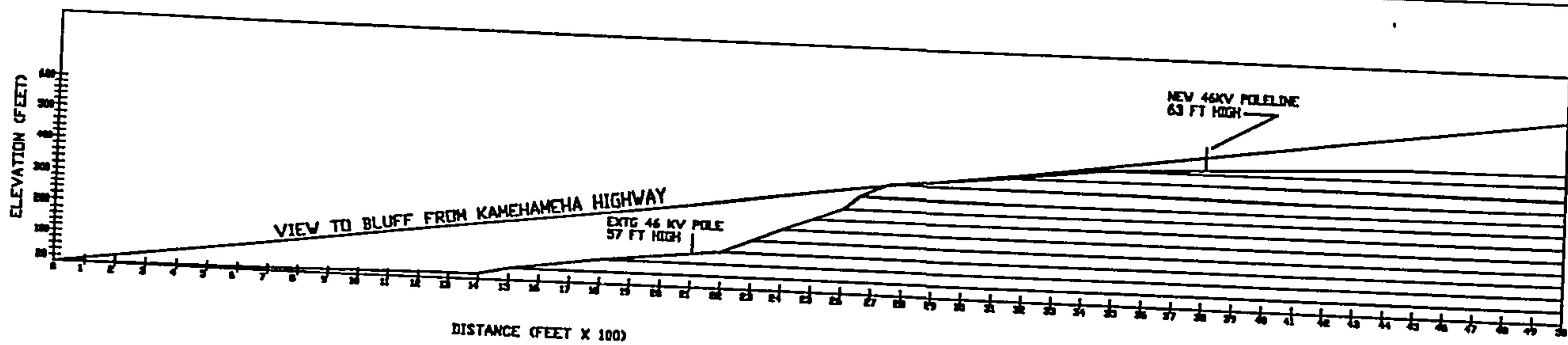


VIEW SIGHT LINE 'A' : KAUNALA

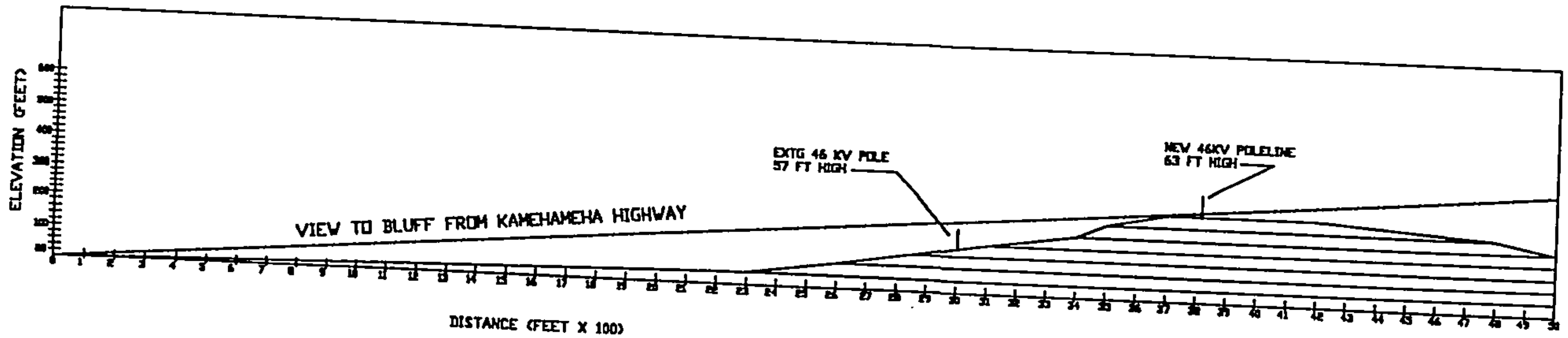


VIEW SIGHT LINE 'B' : PAHIPAHIALUA

FIGURE 3–9
VIEW SIGHT LINES : KAUNALA AND PAHIPAHIALUA
Waialua–Kuilima 46kV Subtransmission Line
Hawaiian Electric Company, Inc.



VIEW SIGHT LINE 'C' : KAWELA



VIEW SIGHT LINE 'D' : KUILIMA

FIGURE 3–10
VIEW SIGHT LINES: KAWELA AND KUILIMA
Waialua–Kuilima 46kV Subtransmission Line
Hawaiian Electric Company, Inc.

Impacts and Mitigation Measures

Based on the location of the poleline, the project will have little or no significant adverse impacts on existing views throughout most of its course. However, that segment of the line commencing mauka of Kawela Bay and continuing on to Kuilima Substation will have a minor impact on existing views based on the View Sight Line analyses displayed in Figure 3-10. The segment of the line which passes through the Haleiwa Special District will be placed underground. The proposed alignment lies within the North Shore Viewshed as defined by the Coastal View Study (Department of Land Utilization, 1987). The higher elevation lands are considered as an "important coastal land form," most likely relating to the views from the lowlands of the steep bluffs and ravines with their extensive natural vegetation cover. The varying topography and elevations will allow the poles to be sited in areas along the alignment to minimize significant alterations to the existing views and view planes. Most of the line will be too far inland to be visible to the public. In crossing Waimea Valley, the proposed line will be over 2,000 feet mauka of Waimea Falls. This is the closest distance the line will be to areas of general public access within the valley. Other portions of the line spanning ridges in the valley will be close to a mile further inland from Waimea Falls. Due to these significant separations and the varying topographic features within the valley, it is anticipated that the proposed line should not be readily visible to the general public. However, where Park activities are planned in the back of the valley, it is anticipated that the line and structures will be visible. For portions of the proposed alignment which will follow close to the coastal bluff (north of Waimea), the alignment has been placed back from the edge of the bluff as much as possible without interfering with the Army's training activities so as to minimize the visibility of the line from Kamehameha Highway and the populated areas along the North Shore. The subtransmission line and poles will be visible near the Kuilima Substation as it descends from the bluff.

3.3.3 Electric and Magnetic Fields

Overhead power lines are a vital part of the system that provides electric service to homes and businesses in Hawaii. In recent years there has been increasing interest about the possible health effects of electric and magnetic fields (EMFs) associated with these lines. There are concerns that exposure to EMFs may produce changes in living cells that could lead to cancer or other health effects.

The predominant view of the scientific community is that the evidence gathered thus far does not demonstrate that power lines adversely affect human health. No conclusive, convincing and consistent relationship between exposure to EMF and adverse health effects has been demonstrated. This is reflected in a policy statement by the State of Hawaii Department of Health noting that "the existing research data are inconclusive and not sufficient for adequate, accurate risk assessment" ("Electric and Magnetic Fields: The EMF Story", 1991). Also according to Your Guide To Understanding EMF, 1992, "The use of electricity has increased greatly in the last 40 years, but there has been no corresponding huge increase in childhood leukemia or any other cancers suggested by EMF studies. Based on this statistic, and on the research to date, many researchers believe that if EMFs are shown to cause health effects, the risk of these effects will probably be comparatively small."

Because there are no conclusive results from current EMF studies about health hazards, most authorities (including the New York Scientific Advisory Panel, California Energy Commission, and U.S. Environmental Protection Agency) recommend carrying out additional research. This research is underway with financial support from HECO through its membership in the Electric Power Research Institute. "HECO will continue to support and monitor these studies as they progress and will design and construct its facilities in a manner that will minimize EMF where technically feasible and economically reasonable" (HECO EMF Policy Statement, 1992). HECO will follow the State of Hawaii Department of Health's policy of prudent avoidance and will utilize an optimum configuration to minimize the electric and magnetic fields.

A technical report on electric and magnetic fields prepared by Sargent & Lundy Engineers entitled "Summary of Technical Information on Electromagnetic Effects for Waialua-Kuilima 46 kV Subtransmission Line Project," is included as Appendix C to this Environmental Impact Statement.

Impacts and Mitigation Measures

Based on current knowledge and research there is no conclusive evidence that confirms adverse health effects associated with subtransmission or transmission lines. The State Department of Health has indicated as a matter of policy that they do not consider EMF standards to be appropriate at this time. Maximum magnetic field levels from the proposed subtransmission line (43 mG directly under the conductors) would be less than maximum levels from a household can opener (35-250 mG at 12 inches away), and maximum electric field levels (0.86 kV/m) would be less than maximum levels from many household appliances (up to 1 kV/m).

Although adverse health effects have not been clearly demonstrated, HECO's policy is to design power lines to minimize electric and magnetic fields where feasible and reasonable in cost. This includes avoiding highly populated areas, optimizing conductor configurations, and locating conductors as high above ground as possible without being visually obtrusive. The proposed design will comply with the field standards of other states and would represent prudent steps to minimize exposure consistent with the approach suggested by the Department of Health. The proposed alignment also will minimize exposure to electric and magnetic fields, because most parts of the alignment are distant from residences and other areas where people congregate.

3.3.4 Television and Radio Interference

In addition to health effects caused by electrical transmission lines, concerns regarding interference to radio and television has been expressed. As a general rule, overhead transmission lines do not interfere with normal radio or TV reception (Waiau-Campbell Industrial Park, Final EIS, August 1992). Further, in power line installation below 230 kV radio and TV interference is not a concern. As part of the study conducted by Sargent and Lundy cited above, measurements were attempted but were below the normal calculation range and therefore concluded to be insignificant. However, without proper maintenance radio and TV reception can be impacted through corona or gap discharges. As with electric and magnetic fields, the effect of such interference diminish rapidly with distance. These occurrences are more of a nuisance and can be corrected through proper design and through periodic inspection and maintenance of the installed line fixtures.

Impacts and Mitigation Measures

Based on the proposed location of the 46 kV subtransmission line, it is believed that the subtransmission line will not cause radio or television interference. Further, because the lines will be regularly inspected as part of HECO's maintenance program, the probability of interference from poor maintenance is low. Should problems be detected, HECO will work with affected parties to reach a mutually beneficial solution.

3.3.5 Recreational Facilities

A variety of State, City and County, and private recreational facilities are located within the study area. Significant State facilities are the Haleiwa Small Boat Harbor, Kaiaka Point

State Recreation Area, and Puu O Mahuka State Park. City and County facilities of note are Ehukai Beach Park, Haleiwa Alii Beach Park, Haleiwa Beach Park, Haleiwa Regional Park, Pupukea-Sunset Beach Park, Sunset Beach Neighborhood Park, and Waimea Bay Beach Park. Private facilities in the area include Waimea Falls Park and Turtle Bay Country Club.

Waimea Bay and Sunset Beach are renowned for their winter waves, which are reputed to be the largest surfing waves in the world. When a big swell appears, surfers and spectators from all over Oahu gather on the beaches to watch some of the world's best surfers challenge the waves. These North Shore beaches have been featured in many surfing films, and surfers from all over the world have been attracted to the area.

The proposed alignment will cross the upper reaches of Waimea Valley mauka of Waimea Falls.

Impacts and Mitigation Measures

The construction of the 46 kV subtransmission line should have no impacts on almost all recreational facilities in the region except for that portion of Waimea Valley where activities are planned in the back of the valley. In this location, hikers may encounter the poles and pole structures, but they should not interfere with their activity. The portion of Waimea Valley that the line crosses will be closed during construction for public safety reasons. This action should not interfere with the operations of the Park's visitor center and restaurant and the Waimea Falls.

3.3.6 Population Characteristics

The study area falls within the Waialua and Koolauloa districts of the City and County of Honolulu, which together comprised a population of 29,992 in the 1990 census (State of

Hawaii Data Book, 1991). Communities within the study area are Waialua (3,943), Haleiwa (2,442), Pupukea (4,111), and Kawela Bay (366). The island of Oahu had a population of 836,231 in 1990.

Impacts and Mitigation Measures

The construction of the subtransmission line will have no impact on the population of the region.

3.3.7 Economic and Fiscal Impacts

The economy of the study area is based primarily on agriculture and tourism. Large employers are the Turtle Bay Resort and the Waialua Sugar Company. The Kawela, Waialee, Sunset Beach, and Waimea areas are primarily residential, with the Waimea Falls Park being a major employer. Haleiwa is the commercial center for the North Shore. Local employment is found primarily in commerce, small shops, restaurants, banking, real estate, and insurance. The community shopping area at Haleiwa attracts and employs persons from many communities along the North Shore. The economy of Waialua is primarily dependent on sugar cultivation, with the Waialua Sugar Company, Inc. employing numerous North Shore residents.

Impacts and Mitigation Measures

The line will have a positive long-term impact on the economy of the area by providing additional transmission capacity and maintaining reliable electrical service (line redundancy -- two 46 kV lines instead of one) to commercial and business activities in the region.

3.4 INFRASTRUCTURE SYSTEMS

3.4.1 Transportation Systems and Traffic

Kamehameha Highway is the only major transportation route within the project study area. Throughout most of the area it is a two-lane undivided highway. The segment of the highway that parallels the coastline between the Waialua and Kuilima Substations contains within its right-of-way electrical distribution line poles. As the Island of Oahu's only transportation route along the North Shore, it is a heavily used roadway, particularly on weekends and holidays.

Impacts and Mitigation Measures

Vehicular access to portions of the project alignment will be from cane haul roads which are part of Waialua Sugar Company's network of service roads. Coning off a lane of traffic is usually required during pole and conductor installation phases of line construction. HECO will coordinate construction activity with Waialua Sugar Company.

The line will cross Pupukea Road makai of the Board of Water Supply above ground water tank. Traffic impacts should be minor because traffic is minimal at this portion of the road. The proposed line will also cross Kamehameha Highway near Weed Circle, thus construction activities may temporarily disrupt traffic. Work on public roads must follow traffic control procedures prescribed by the Federal Highway Administration, the State Department of Transportation Highways Division, and City and County of Honolulu Department of Transportation Services. Work adjacent to a state road or highway requires a Permit to Perform Work on State Highways, which must incorporate a Traffic Control Plan approved by the Highways Division. The City and County of Honolulu requires observation of state and federal traffic control regulations for any work on county roads.

According to state highway regulations, only one lane at a time may be closed on a multi-lane highway and, on a two-lane highway, wherever possible, lanes of adequate width in both directions must be provided. All lanes must be open to traffic during morning peak hours (generally 6:00 a.m. to 8:30 a.m.) and afternoon peak hours (generally 3:30 p.m. to 6:00 p.m.). HECO and its construction contractors follow state guidelines for the types of signs, lights, markers, position of traffic cones, areas coned off, and the use of flaggers and/or police officers (State of Hawaii Department of Transportation; U.S. Federal Highway Administration, 1978).

Coning off a lane of traffic is usually required during pole and conductor installation phases of line construction. Traffic delays and congestion created by construction activity can be mitigated if construction is confined to non-peak hours.

3.4.2 Support Infrastructure

The Board of Water Supply is the primary supplier of potable water for most urbanized uses in the City and County of Honolulu. The existing system in the study area includes a single, integrated system extending from the Kuilima Resort in Kawela to Crozier Drive in Waialua. Within this system, existing 16-inch, 12-inch, and 8-inch transmission mains serve the area between Kuilima and Weed Junction. Major service to the Waialua area is by 16-inch and 12-inch mains.

Water storage for this system is comprised of a series of seven reservoirs. The total storage capacity of these reservoirs is 6.3 million gallons. Water for the Kawela-Waialua system is supplied by five pumping stations having a well capacity of 7.6 mgd. The mean daily pumpage for these sources is 2.83 mgd.

These wells distribute water through two subsystems of the Kawela-Waialua system. The Pupukea-Waialua subsystem encompasses the area from Pupukea to Waialua, and is served by the Haleiwa and Waialua Wells. The Kawela-Sunset Beach subsystem encompasses the Sunset Beach to Kuilima region and is served by the Waialee and Sunset Beach Wells. The three Pupukea reservoirs as well as the Haleiwa and Waialua reservoirs provide storage for the Pupukea-Waialua subsystem while the Kawela and Sunset Beach reservoirs serve the Kawela-Sunset Beach system.

The study area is served primarily by individual household cesspools and small private treatment plants located within high density areas. The Paalaa Kai Sewage Treatment Plant, located along Oliana Street near Waialua Beach Road, serves the Paalaa Kai Housing subdivision in Waialua.

Impact and Mitigation Measures

No long or short term impacts are expected from the proposed project. The proposed subtransmission line will not disturb any areas of water storage, sewage treatment, or potable water supplies. To insure that there will be no conflicts with existing water lines, the project design will be coordinated with the Board of Water Supply.

3.4.3 Communications Systems

Telephone services in the study area are provided by the Hawaiian Telephone Company, headquartered in Honolulu. The Navy Opana Communications Site is located above the coastal bluff, mauka of Kawela Bay, in the northern most portion of the project study area. The propose line will pass on the mauka side of the site as it approaches the Kuilima Substation. Also of note is the COMSAT receiving station which is located approximately 1,000' south of the proposed line. Cable television is provided by three companies on Oahu.

Impacts and Mitigation Measures

The proposed project is not expected to have any long or short-term impacts to communication systems. To insure that there will be no conflicts with existing lines and other communications facilities, the project design will be coordinated with the Hawaiian Telephone Company, Opana Communications Site, COMSAT and cable television companies.

3.4.4 Fire, Police, School and Medical Services

Fire protection is provided to the area by the Waialua/Haleiwa, Sunset Beach, and Kahuku Fire Stations.

The Wahiawa Police Station services the extreme southwestern portion of the study area up to the Haleiwa Bridge. The Kahuku Substation services the North Shore and the remainder of the study area. It provides walk-in "across the counter" services.

There are four public schools within the study area. These are Waialua Elementary School (K-6), Waialua Intermediate and High School (7-12), Haleiwa Elementary School (K-6), and Sunset Beach Elementary School (K-6).

Medical services are provided to the area by the Waialua Clinic and the Kahuku Community Hospital. The Kahuku Community Hospital is a 26-bed facility with 24-hour emergency medical services.

Impacts and Mitigation Measures

The proposed subtransmission line will have a positive long-term impact on fire, police, school, and medical services in the region by providing additional transmission capacity and maintaining reliable electrical service (line redundancy -- two 46 kV lines instead of one).

3.4.5 Solid Waste Disposal

Solid waste collection and disposal in the study area is provided by the City and County of Honolulu coordinated through baseyards in the Waialua-Haleiwa (servicing Waialua to Sunset Beach) and Laie areas (servicing the remainder of the study area). The City and County also provides a refuse transfer station in Kawailoa.

Impacts and Mitigation Measures

The proposed project will have no long or short term affects on solid waste disposal.

3.4.6 Electricity

Figure 3-11 depicts the existing HECO substations, transmission line and subtransmission line facilities located within the project study area. The study area encompasses the main HECO transmission station at Wahiawa, subtransmission substations at Waialua, Waimea and Kuilima, and the Mod-5B and "Windfarm" substations. The Wahiawa substation is located between Neal Avenue and the southeast portion of the Wahiawa Reservoir in Wahiawa. Two 138 kV transmission lines bring power into the study area from the Waiau and Kahe power plants on Oahu's south shore. The transmission lines enter the Wahiawa substation from the south after crossing the Wahiawa Reservoir. Within Wahiawa substation, transformers step down the voltage from the transmission voltage of 138 kV to the subtransmission voltage of 46 kV. Five 46 kV subtransmission lines then leave Wahiawa substation as follows:

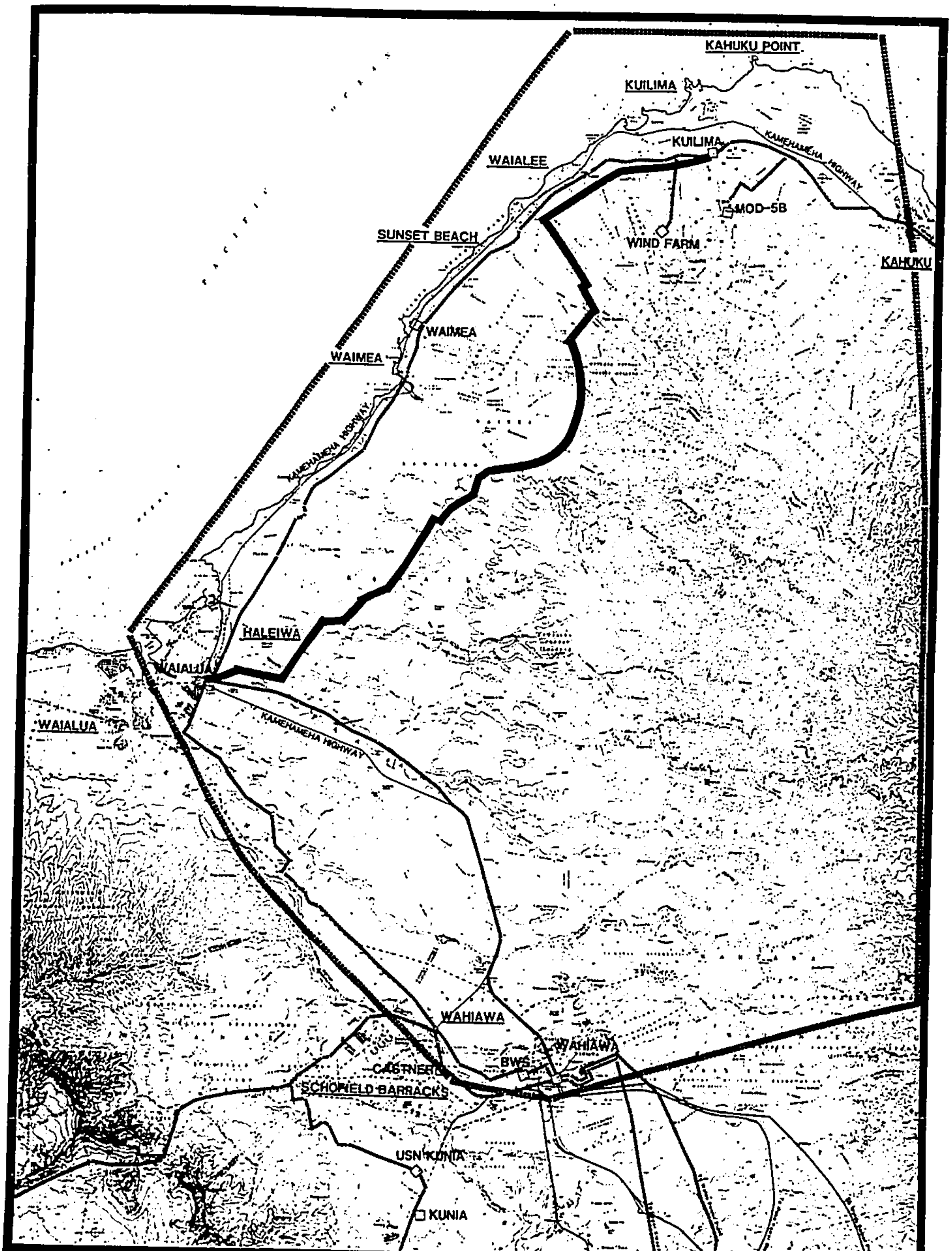


FIGURE 3-11

PROPOSED ALIGNMENT
46 KV Line
138 KV Line
Sub-Station
PROJECT BOUNDARY

R. M. TOWILL CORPORATION
JAN 1993

EXISTING HECO LINES

WAIALUA - KUILIMA 46KV SUBTRANSMISSION LINE

- Two 46 kV subtransmission lines head north to serve Waialua substation, with only one line continuing on to serve Waimea, Kuilima and Kahuku substations.
- Two 46 kV subtransmission lines leave the study area proceeding east along the Schofield East Range Military Reservation Boundary then crossing the Wahiawa Reservoir to head south to service the Mililani and Waipio-Gentry areas.
- One 46 kV subtransmission line heads west towards Schofield Barracks to serve Castner (Schofield Barracks) substation, then splits into two lines with one line heading south to serve the Kunia and Village Park areas, and the other line heading west over the Waianae Range to serve the Makaha and Waianae areas.

Within the southern portion of the study area, two 46 KV lines link Wahiawa and Waialua substations as follows:

- The first line goes west from Wahiawa, via the Board of Water Supply substation and residential streets. It then crosses the lower portion of the Wahiawa reservoir and continues along Route 803 to Thompson Corner. The line then turns along Route 930 towards Waialua entering the Waialua substation from the Waialua side. The total distance of this line from Wahiawa to Waialua is 9.1 miles.

- The second 46 KV line heads north from Wahiawa substation through residential areas and across the Wahiawa reservoir to Route 89. It turns onto Kamehameha Highway, and stays parallel and mauka of the highway until Weed Circle. It enters the Waialua substation from the mauka direction across Weed Circle. The length of this line from Wahiawa to Waialua substations is 8.7 miles.

There is only one subtransmission line that links the Waialua, Waimea and Kuilima substations along the North Shore of Oahu. This line exits Waialua substation and crosses to the mauka side of Weed Circle. The line then parallels Kamehameha Highway, with a 200 foot average span between poles, and follows the coast towards Waimea. The line stays within the coastal bluff area, ranging from close to sea level to a 200 foot elevation. It is suspended above Waimea Valley, just makai of the Waimea River mouth. The line connects with Waimea substation, which is situated directly mauka of Waimea town, and then continues to parallel the coastal road until Waialee where it changes course to take a direct route to the Kuilima substation. The Kuilima substation is situated 300' mauka of the Highway, nearly opposite the Turtle Bay Hilton property. The total line distance between Waialua and Kuilima is about 12 miles.

Impacts and Mitigation Measures

The project will provide improved electrical service to North Shore communities, by providing additional transmission capacity, relieving low voltage conditions, and maintaining reliable electrical service (line redundancy -- two 46 kV lines instead of one).

SECTION 4

RELATIONSHIP TO STATE AND COUNTY LAND USE PLANS, POLICES AND CONTROLS

SECTION 4
RELATIONSHIP TO STATE AND COUNTY LAND USE PLANS, POLICIES AND CONTROLS

4.1 OVERVIEW

This section discusses the relationship of the proposed project with the goals, objectives and policies of the various State and County Land Use Plans. These include the Hawaii State Plan, State Functional Plans, State Land Use Law, General Plan for the City and County of Honolulu, the City and County of Honolulu Land Use Ordinance, the City and County of Honolulu Development Plan, Special Management Area for the City and County of Honolulu, and the Central Oahu/North Shore Regional Plan.

4.2 HAWAII STATE PLAN

The Hawaii State Plan was developed to serve as a guide for future development of the State of Hawaii. Chapter 226 of the Hawaii Revised Statutes states the following purpose of the State Plan:

> "(it) shall serve as a guide for the future long-range development of the State; identify the goals, objectives, policies, and priorities for the State of Hawaii; provide the basis for determining priorities and allocating limited resources, such as public funds, services, manpower, land energy, water, and other resources; improve coordination of state and county plans, policies, programs, projects, and regulatory activities; and to establish a system for a plan formulation and program coordination to provide for an integration of all major state and county activities." (Chapter 226-1: Findings and Purpose, HRS)

The proposed project is generally consistent with the objectives and policies of the Hawaii State Plan. The following paragraphs describe the relevant goals, objectives, policies and guidelines of the State Plan and how the proposed project is compatible with them.

4.2.1 Section 226-18 Objectives and Policies for Facilities Systems - Energy/Telecommunications.

The proposed project is most directly related to this section of the Hawaii State Plan. Relevant portions of Section 226-18 are as follows:

(a) Planning for the State's facility systems with regard to energy/telecommunications shall be directed towards the achievement of the following objectives:

   (1) Dependable, efficient, and economical statewide energy and telecommunication systems capable of supporting the needs of the people.

(b) To achieve the energy/telecommunication objectives, it shall be the policy of this State to ensure the provision of adequate, reasonably priced, and dependable power and telecommunication services to accommodate demand.

(c) To further achieve the energy objectives, it shall be the policy of this State to:

   (2) Ensure a sufficient supply of energy to enable power systems to support the demands of growth.

   (4) Ensure that the development or expansion of power systems and sources adequately consider environmental, public health, and safety concerns, and resource limitations.

The proposed subtransmission line project supports the above objectives and policies as it will help to ensure reliable, efficient and economic provision of electrical service to the North Shore area of Oahu. In the planning of the project, HECO evaluated numerous alternative alignments against environmental, public health and safety considerations prior to selecting a preferred alignment. This evaluation is discussed in other sections of this Environmental Impact Statement.

4.2.2 Section 226-11 Objectives and Policies for the Physical Environment - Land-Based, Shoreline, and Marine Resources.

The proposed project is relevant to the following portions of Section 226-11:

(a) Planning for the State's physical environment with regard to land-based, shoreline, and marine resources shall be directed towards achievement of the following objectives:
   (2) Effective protection of Hawaii's unique and fragile environmental resources.

(b) To achieve the land-based, shoreline, and marine resource objectives, it shall be the policy of the State to:
   (3) Take into account the physical attributes of areas when planning and designing activities and facilities.
   (8) Pursue compatible relationships among activities, facilities, and natural resources.

The proposed subtransmission line avoids coastal and wetland areas. The submarine cable alternative was not selected primarily to its high cost.

4.2.3 Section 226-12 Objectives and Policies for the Physical Environment - Scenic, Natural Beauty, and Historic Resources

The proposed project is relevant to the following portions of Section 226-11:

(a) Planning for the State's physical environment shall be directed towards achievement of the objective of enhancement of Hawaii's scenic assets, natural beauty, and multi-cultural/historic resources.

(b) To achieve the scenic, natural beauty, and historic resources objective, it shall be the policy of this State to:

(1) Promote the preservation and restoration of significant natural and historic resources.

(3) Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.

The project will have no significant adverse impacts on existing views. The segment of the line which passes through the Haleiwa Special District will be placed underground. This will help to preserve the aesthetic enjoyment of the surrounding area. The proposed alignment lies within the North Shore Viewshed as defined by the Coastal View Study (Department of Land Utilization, 1987). The higher elevation lands are considered as an "important coastal land form," most likely relating to the views from the lowlands of the steep bluffs and ravines with their extensive natural vegetation cover. The varying topography and elevations will allow the poles to be sited in areas within the site to minimize significant alterations to the existing views and view planes. Most of the line will be too far inland to be visible to the public. For portions of the proposed alignment which will follow close to the coastal bluff, the alignment has been placed back from the edge of the bluff as much as possible so as to minimize the visibility of the line from Kamehameha Highway and the populated areas along the North Shore.In crossing Waimea Valley, the proposed line will be over 2,000 feet mauka of Waimea Falls. This is the closest distance the line will be to areas of general public access within the valley. Other portions of the line spanning ridges in the valley will be close to a mile further inland from Waimea Falls. Due to these significant separations and the varying topographic features within the valley, it is anticipated that the proposed line should not be readily visible to the general public.

4.2.4 Section 226-13 Objectives and Policies for the Physical Environment - Land, Air, and Water Quality

The proposed project is relevant to the following portions of Section 226-13:

(a) *Reduce the threat to life and property from erosion, flooding, tsunamis,* hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.

The line will be located away from existing residential areas thereby reducing potential damages to property and injury to residents in the event of natural disasters.

4.3 STATE FUNCTIONAL PLANS

The State has seven Functional Plans which set forth major objectives, policies and actions to be implemented in managing the State's physical resources. These Plans are: Agriculture, Conservation Lands, Energy, Historic Preservation, Recreation, Tourism and Transportation. The proposed project does not conflict with the objectives, policies and implementing actions of these various Plans. The Energy Functional Plan focuses on energy conservation, alternate and renewable energy, education, legislation, integrated energy management, and emergency preparedness.

4.4 STATE LAND USE LAW

The State Land Use Commission has classified all land in the state into one of four classifications: Urban, Rural, Agricultural, and Conservation. The proposed subtransmission line alignment traverses Urban, Agricultural, and Conservation Land Use Districts, see Figure 4-1. The proposed alignment will cross a Conservation District at the Waimea Bay area. A Conservation District Use Permit will be applied for as part of this project. A State Land Use District Boundary Amendment will not be required.

4.5 CITY AND COUNTY OF HONOLULU GENERAL PLAN

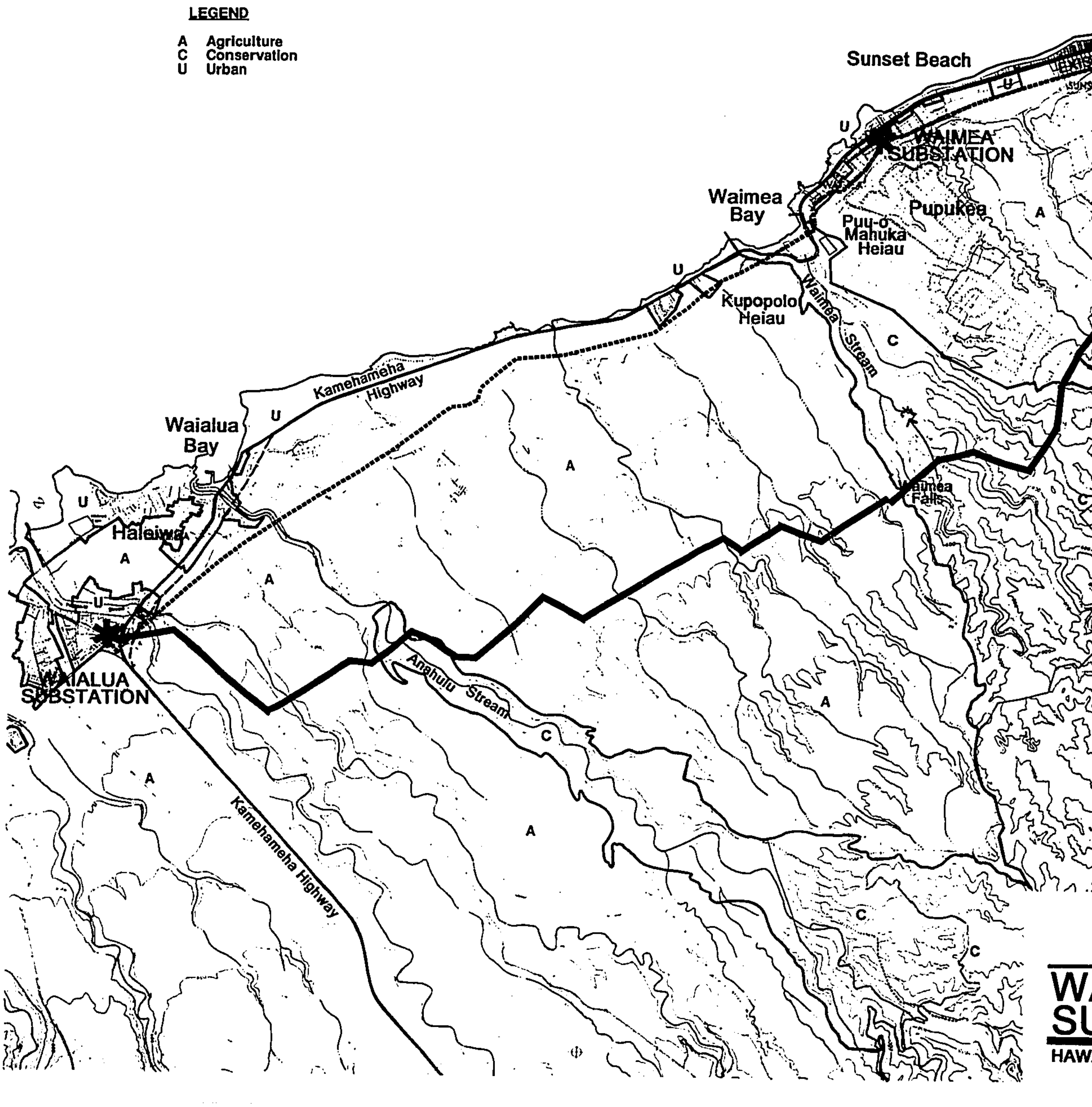
The General Plan for the City and County of Honolulu contains long-range social, economic, environmental and design objectives and policies. The objectives and policies which are relevant to the proposed project are presented below along with discussion of their compatibility with the project.

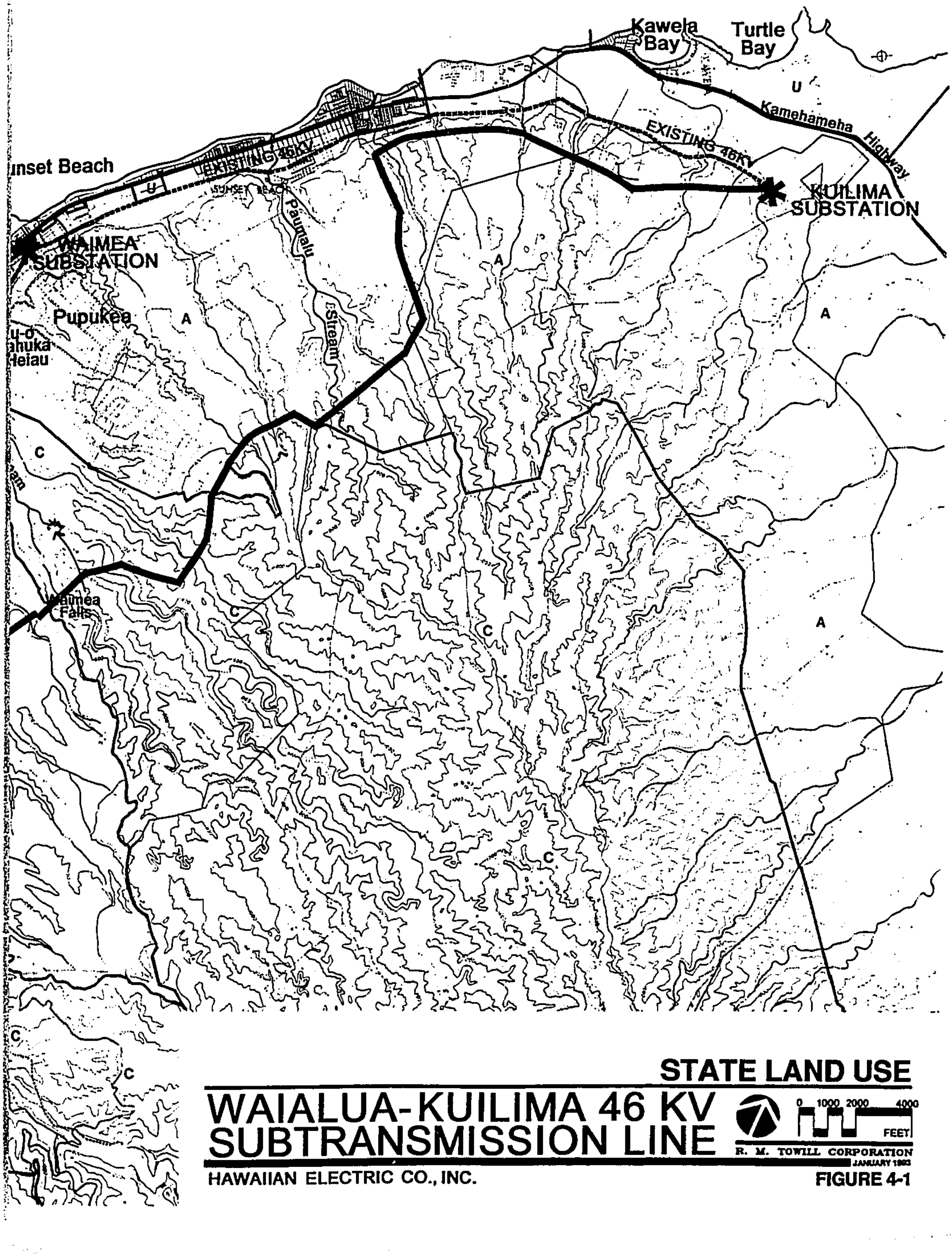
4.5.1 Transportation and Utilities Objectives

The transportation and utilities objectives and policies most relevant to the proposed project are as follows:

> Objective C: To maintain a high level of service for all utilities.
>
> Policy 1: Maintain existing utility systems in order to avoid major breakdowns.
>
> Policy 2: Plan for the timely and orderly expansion of utility systems.

The proposed Waialua-Kuilima 46 kV Subtransmission Line is designed to improve the reliability of electric service to existing and future customers on the North Shore of Oahu. It will provide an additional 46 kV line to service the area.


LEGEND
A Agriculture
C Conservation
U Urban
Sunset Beach
WAIMEA SUBSTATION
Waimea Bay
Pupukea
Puu-o-Mahuka Heiau
Kupopolo Heiau
Waimea Stream
Waimea Falls
Kamehameha Highway
Waialua Bay
Haleiwa
WAIALUA SUBSTATION
Anahulu Stream
Kamehameha Highway



STATE LAND USE

WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE

0 1000 2000 4000 FEET

R. M. TOWILL CORPORATION
JANUARY 1993

HAWAIIAN ELECTRIC CO., INC.

FIGURE 4-1

Objective D: To maintain transportation and utility systems that will help Oahu continue to be a desirable place to live and visit.

> Policy 4: Evaluate the social, economic, and environmental impact of additions to the transportation and utility systems before they are constructed.
>
> Policy 5: Require the installation of underground utility lines wherever feasible.

The impacts of the proposed project are included in the Environmental Impact Statement. A portion of the subtransmission line is being proposed for underground installation in the Haleiwa Special District. It should be noted that the installation of 46 kV subtransmission lines are generally overhead. This is primarily due to the substantially higher costs of construction for underground lines. Along with this, underground lines requires extensive excavation, posing a greater risk of impacting biological and cultural resources. Underground construction will also disrupt traffic for a longer period than the installation of overhead lines. Additionally, location and repair of faults in the line are more time-consuming, costly and disrupt traffic longer. With higher construction costs, there is a greater potential for the need to request a rate increase from the PUC to cover the added expenses.

4.6 CITY AND COUNTY OF HONOLULU LAND USE ORDINANCE

The proposed Waialua-Kuilima 46 kV Subtransmission Line does not conflict with the development standards outlined in the City and County Land Use Ordinance (LUO). The LUO classifies a 46 kV subtransmission line as a Utility Installation, Type A, which is a permitted use in all zoning districts.

4.7 COUNTY ZONING

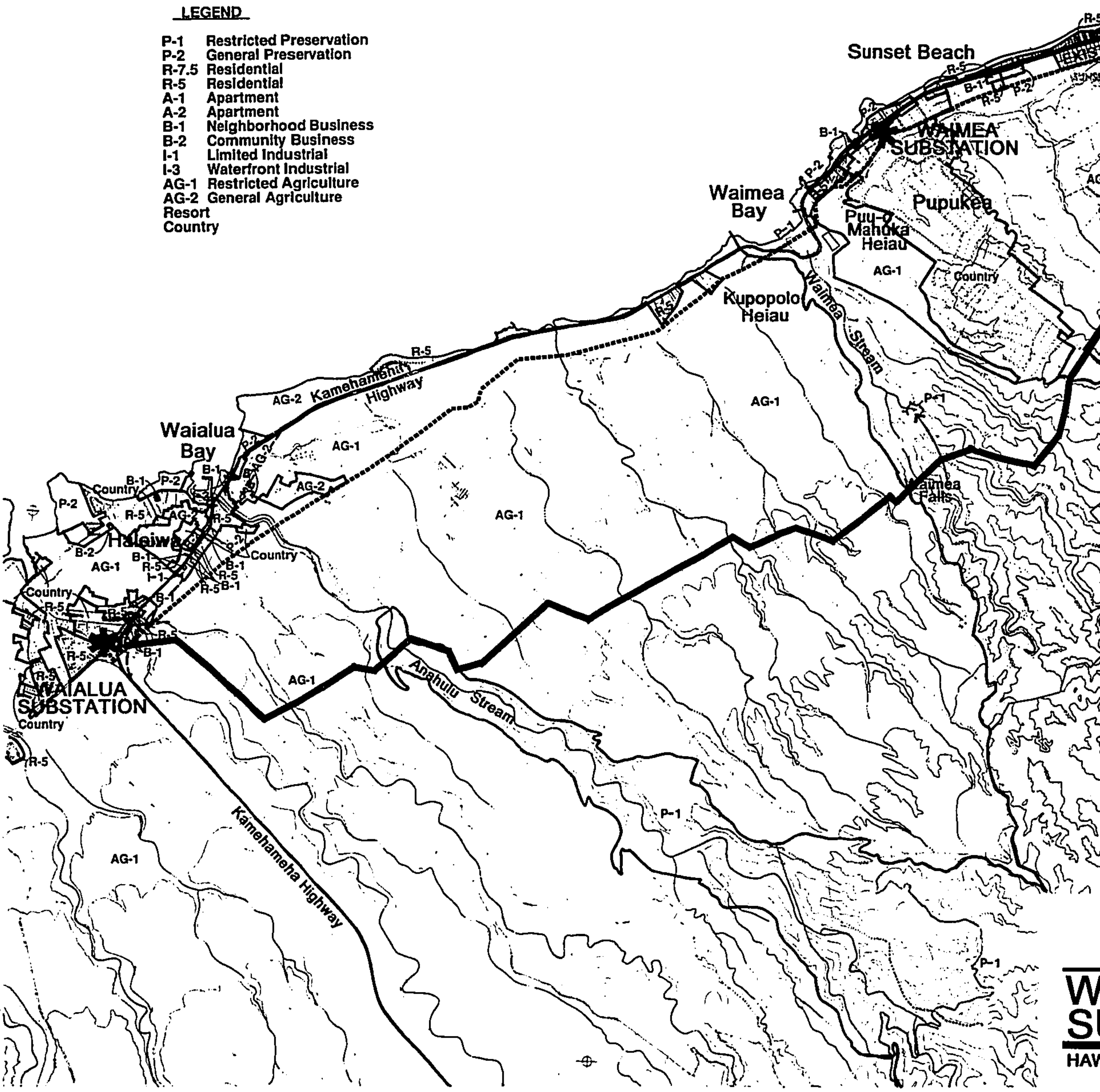
Figure 4-2 shows the County zoning designations for the study area are Restricted Agriculture, General Agriculture, Apartment Use, Neighborhood Business, Rural Residential, Federal, Waterfront Industrial, Industrial, Protective, General Preservation, Resort Use, High-Density Residential, and Mid-Density Residential. The beginning of the proposed line is routed through land zoned Residential (R-5), until it crosses Kamehameha Highway near Weed Circle. Mauka of Kamehameha Highway the proposed line proceeds through land zoned General Agriculture (AG-1), until reaching Waimea Valley. In Waimea Valley, the proposed line crosses through land zoned Restricted Preservation (P-1). After crossing Waimea Valley the line proceeds through lands zoned General Agriculture (Ag-2). Zoning changes will not be required for development of the proposed project.

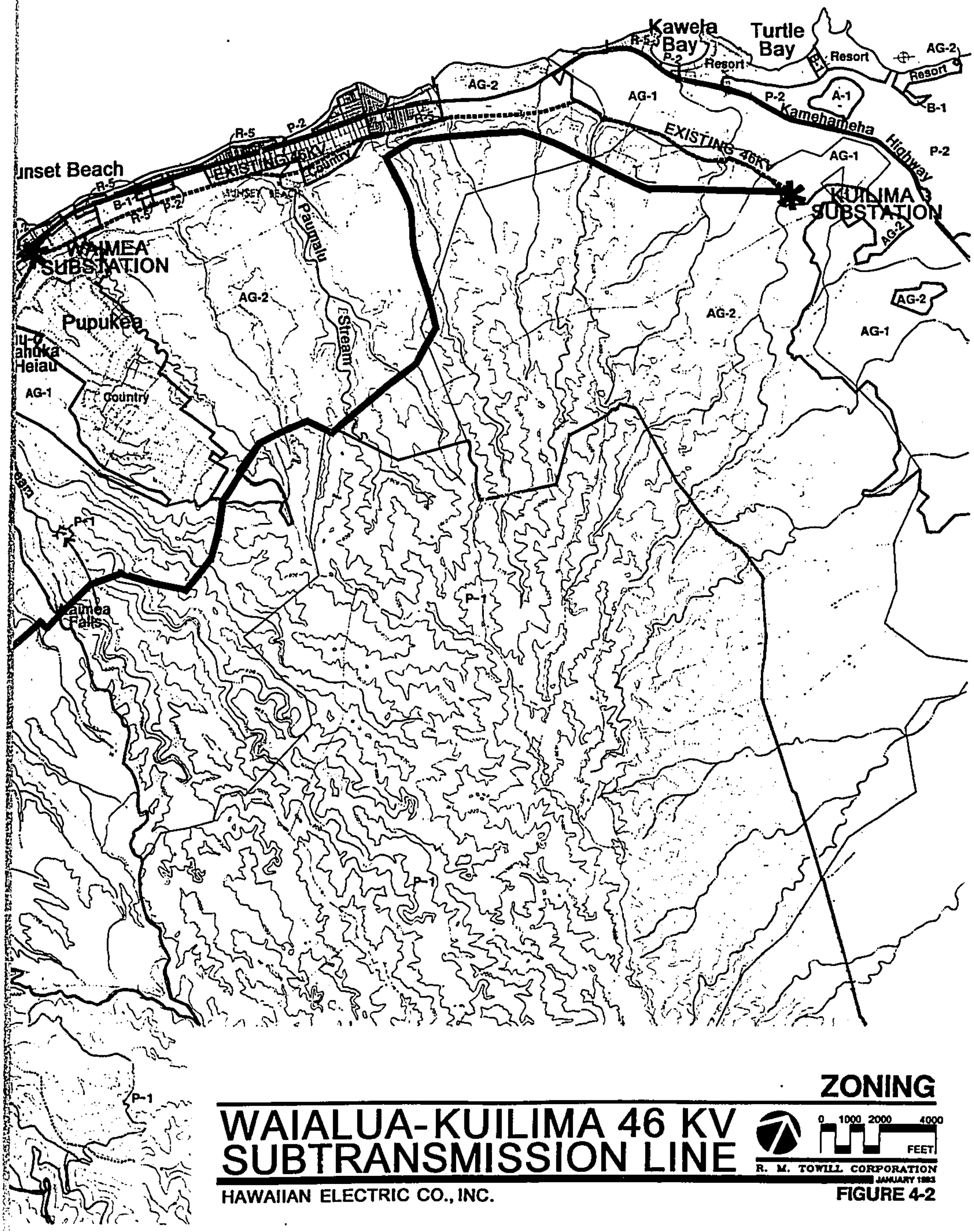
4.8 HALEIWA SPECIAL DISTRICT

The Haleiwa Special District is shown on Figure 4-3. It is generally comprised of parcels abutting Kamehameha Highway between Weed Junction and Haleiwa Beach Park. The general purpose of a Special District is to guide development to protect and/or enhance the physical and visual aspects of an area for the benefit of the community as a whole. According to the City and County of Honolulu Land Use Ordinance, utility lines within any Special District must be placed underground. An exemption may be grated if the applicant can satisfactorily justify that no other alternative will better achieve the District's purpose and objectives. The proposed line will be placed underground within the Haleiwa Special District.

4.9 NORTH SHORE DEVELOPMENT PLAN

The North Shore Development Plan of the City and County of Honolulu, acts as a detailed structure of General Plan objectives for that area. The Plan defines the North Shore as the area which extends from Waialee Gulch near Kawela Bay to Kaena Point. A specific


LEGEND
P-1 Restricted Preservation
P-2 General Preservation
R-7.5 Residential
R-5 Residential
A-1 Apartment
A-2 Apartment
B-1 Neighborhood Business
B-2 Community Business
I-1 Limited Industrial
I-3 Waterfront Industrial
AG-1 Restricted Agriculture
AG-2 General Agriculture
Resort
Country
Sunset Beach
WAIMEA SUBSTATION
Waimea Bay
Pupukea
Puu-o Mahuka Heiau
Kupopolo Heiau
Waimea Stream
Waimea Falls
Waialua Bay
Haleiwa
WAIALUA SUBSTATION
Kamehameha Highway
Anahulu Stream
AG-1
AG-2
P-1
P-2
R-5
B-1
B-2
I-1
Country



ZONING

WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE

HAWAIIAN ELECTRIC CO., INC.

0 1000 2000 4000 FEET

R. M. TOWILL CORPORATION
JANUARY 1993

FIGURE 4-2

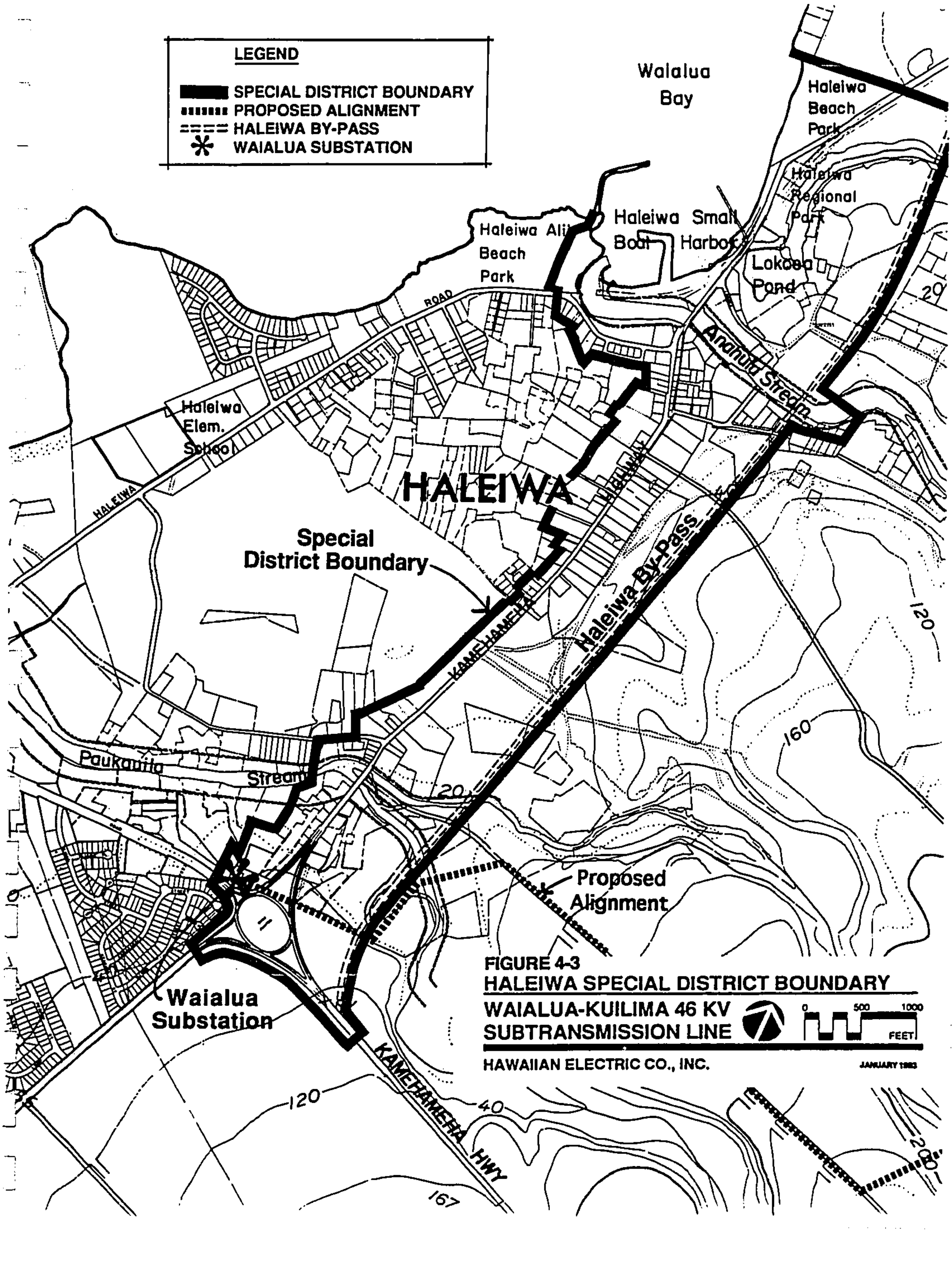


FIGURE 4-3
HALEIWA SPECIAL DISTRICT BOUNDARY
WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE
HAWAIIAN ELECTRIC CO., INC.

objective of the Plan relating to the proposed project is to, "maintain the agricultural, open space character of this district with exception of some increases in residential development in the Haleiwa-Waialua area." The proposed subtransmission line supports this objective by providing additional transmission capacity and maintaining reliable electrical service (line redundancy -- two 46 kV lines instead of one) to the increasing residential development in the Haleiwa-Waialua area.

4.10 SPECIAL MANAGEMENT AREA

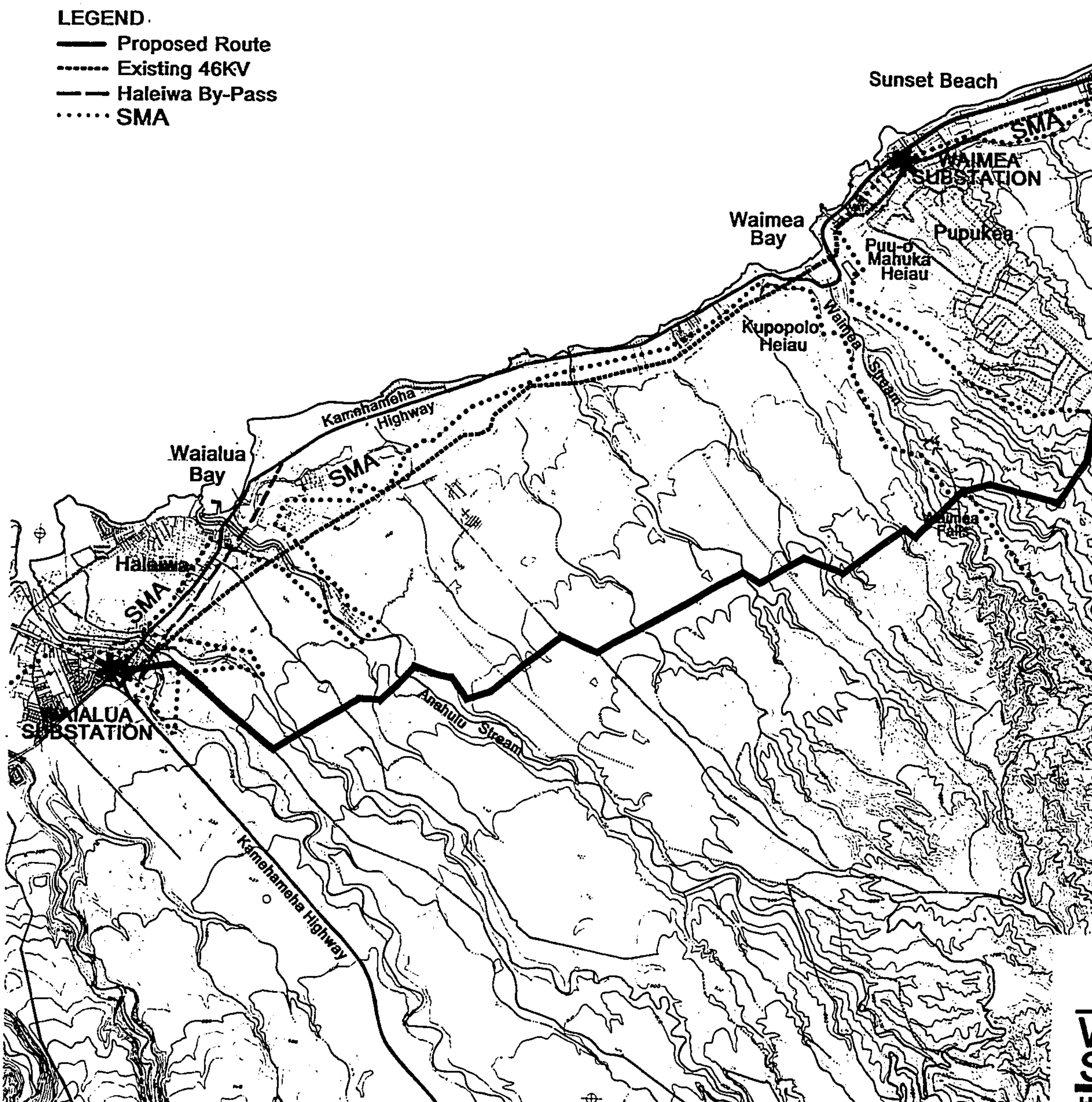
The City and County of Honolulu has designated the shoreline and certain inland areas of Oahu as being within the Special Management Area (SMA). SMA areas are felt to have a sensitive environment and should be protected in accordance with the State's coastal zone management (CZM) policies. Portions of the proposed subtransmission line will be located within the SMA Boundary as defined by the City and County of Honolulu, see Figure 4-4. An SMA permit will be necessary for development of the proposed project. Review of the project under SMA criteria will be conducted during the processing of the SMA permit with the Department of Land Utilization (DLU), City and County of Honolulu. That permit application has been supported in part by this EIS.

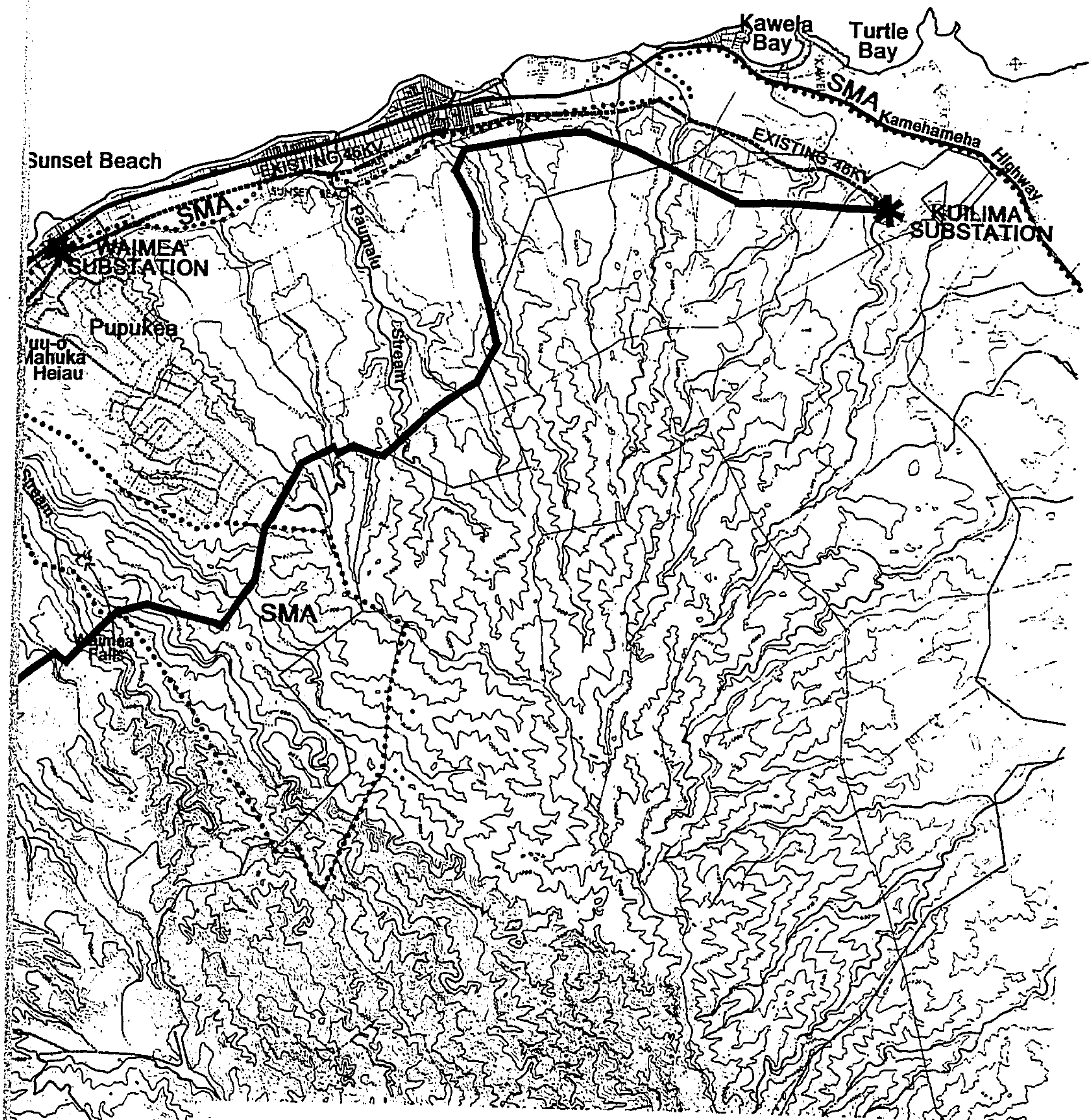
As cited in Section 33-3.2 of the Revised Ordinances of Honolulu, "The objectives and policies for this chapter shall be those contained in section 205A-2, Hawaii Revised Statues." The objectives of the SMA which are relevant to the proposed project are presented below.

(b) Objectives.

(1) Recreational resources;

(A) Provide coastal recreational opportunities accessible to the public.


LEGEND
Proposed Route
Existing 46KV
Haleiwa By-Pass
SMA
Sunset Beach
SMA
WAIMEA SUBSTATION
Waimea Bay
Pupukea
Puu-o Mahuka Heiau
Kupopolo Heiau
Waimea Stream
Waimea Falls
Kamehameha Highway
Waialua Bay
SMA
Haleiwa
SMA
WAIALUA SUBSTATION
Anahulu Stream
Kamehameha Highway



SMA BOUNDARY

WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE

HAWAIIAN ELECTRIC CO., INC.

0 1000 2000 4000 FEET

R. M. TOWILL CORPORATION

FIGURE 4-4

As described in Section 3.3.4, the proposed subtransmission line will not interfere with the use of any existing recreational areas nor will it interfere with the development of future recreational areas.

(2) Historic resources

(A) Protect, preserve, and where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

As discussed in Section 3.3.1, no short or long term impacts are expected from the development of the proposed project on any known historic or archaeological resource.

(3) Scenic and open space resources;

(A) Protect, preserve, and where desirable, restore or improve the quality of coastal scenic and open space resources.

As discussed in Section 3.3.2, the proposed project will have no significant adverse impacts on existing views. Most of the line will be too far inland to be visible to the public.

(5) Economic uses;

(A) Provide public or private facilities and improvements important to the State's economy in suitable locations.

The proposed subtransmission line project will help to ensure reliable, efficient and economic provision of electrical service to the North Shore area of Oahu. In the planning of the project, HECO evaluated numerous routing alternatives against environmental, public health and safety considerations prior to selecting a preferred alignment. This evaluation is discussed in other sections of this Environmental Impact Statement.

(6) Coastal hazards;

(A) Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion and subsidence.

As discussed in Section 3.2.8, the mauka location of the proposed subtransmission line will lower exposure risks to tsunami disasters and flood damage. Foundation designs of any new poles will be constructed to maximize foundation stability.

4.11 CENTRAL OAHU/NORTH SHORE REGIONAL PLAN

The Central Oahu/North Shore Regional Plan was developed to direct a preferred future for the region. The North Shore is defined by the Plan as the area which extends from Waialee Gulch near Kawela Bay Point and includes the area between the Central Oahu plateau and the Pacific Ocean. A specific objective of the Plan relating to the proposed project is to, "maximize benefits for Hawaii's people and residents of the North Shore region". The proposed subtransmission line project supports this objective by providing additional transmission capacity and maintaining reliable electrical service (line redundancy -- two 46 kV lines instead of one) to the residents of the North Shore.

4.12 REQUIRED PERMITS AND APPROVALS

The following lists the Federal, State and County permits and approvals which may be required with the implementation of the proposed project. A brief description of each of the permits and approvals listed is included as Appendix D of the EIS.

4.12.1 Federal

Corps of Engineers Permit

4.12.2 State of Hawaii

Department of Health

- Section 401 Water Quality Certification
- Noise Variance

Department of Land and Natural Resources

- Conservation District Use Application (CDUA)
- Perpetual Easement for Use of State Lands

Office of State Planning

- Hawaii Coastal Zone Management Program Federal Consistency Review

Department of Transportation

- Permit to Perform Work on a State Highway

Public Utilities Commission

- Approval for Construction in a Residential Area
- General Order No. 7 Approval

4.12.3 City and County of Honolulu

Department of Land Utilization

- Flood Determination in General Flood Plain
- Special Management Area Use Permit (SMP)
- Special Districts, Special Design Permits

Department of Public Works

- Construction Dewatering Permit (Temporary)
- Grubbing, Grading and Stockpiling Permit

Department of Transportation Services

- Street Usage Permit
- Permit for Construction Within a County Road Right-of-Way

Building Department

- Building Permit

4.12.4 Other Approvals

Landowners and Easements

- Perpetual Easements

SECTION 5

ALTERNATIVES TO THE PROPOSED ACTION

SECTION 5
ALTERNATIVES TO PROPOSED ACTION

5.1 NO ACTION

Taking no action is not considered to be a feasible alternative as it would result in the continuance of existing low voltage conditions in the North Shore area, which jeopardizes electrical system reliability. This, in turn, would result in failure to meet the existing and growing electrical demands of the customers. Also, without the installation of the 46 kV line, there will be no adequate backup system to provide continuous electrical service should the existing 46 kV line require maintenance or repair.

5.2 ALTERNATIVE CORRIDOR DEVELOPMENT

In evaluating alternatives to the proposed action, the provision of a new 46 kV subtransmission line to service the North Shore was analyzed at the macro scale. Broad corridors in which a new 46 kV line could be routed were established within the project study area. These alternative corridors were evaluated in the corridor study phase of the project. Each corridor extended from either the Waialua or Wahiawa substations, to the Kuilima substation. Factors considered in identifying potential transmission line corridors included:

- Public comments and concerns;
- Government agency comments and concerns;
- Landowner comments and concerns;
- HECO's existing transmission system;
- Potential environmental and land use impacts;
- Economic impacts to HECO and its customers; and
- Current transmission technology.

5.2.1 Corridor Identification Methodology

The identification and selection of alternative corridors for routing the proposed subtransmission line included a process of collecting environmental and land use information and overlaying the data on maps to identify opportunities and constraints for locating corridors. These data maps show existing and proposed land uses, ownership, regulated land areas, topography, archaeological resources and biological resources. A composite constraints map for the study area was compiled for analyzing possible corridor options, see Figure 5-1. From this information, alternative corridors approximately 1,500' wide were identified. The reason for the wide corridors was to allow flexibility for siting alternative subtransmission line alignments during the subsequent detailed micro-analysis and route selection process. The following parameters were used in establishing alternative corridors from the multitude of possibilities.

- Maintain separation from existing 46 kV lines
- Minimize route length
- Minimize number of angles within the corridors
- Minimize number of spans greater than 350 feet
- Avoid military lands
- Minimize disturbance of agricultural lands
- Minimize fragmentation of property
- Avoid, to the extent possible, built-up areas
- Minimize construction costs
- Minimize conservation district impacts
- Minimize special management area impacts
- Minimize easement acquisition
- Minimize natural disaster risks (hurricanes, floods, tsunamis, etc.)
- Ease of access to Waimea Substation
- Ease of route access for construction, maintenance and repair

5.2.2 Corridor Selection Parameters

The following paragraphs briefly describe the rationale for the various parameters used in identifying alternative corridors for the proposed 46 kV subtransmission line.

Separation From Existing 46 kV Lines - Separation from the existing 46 kV line is a primary concern because of the project's main objective of improving reliability. One of the main reasons for siting a new transmission line is the need for an

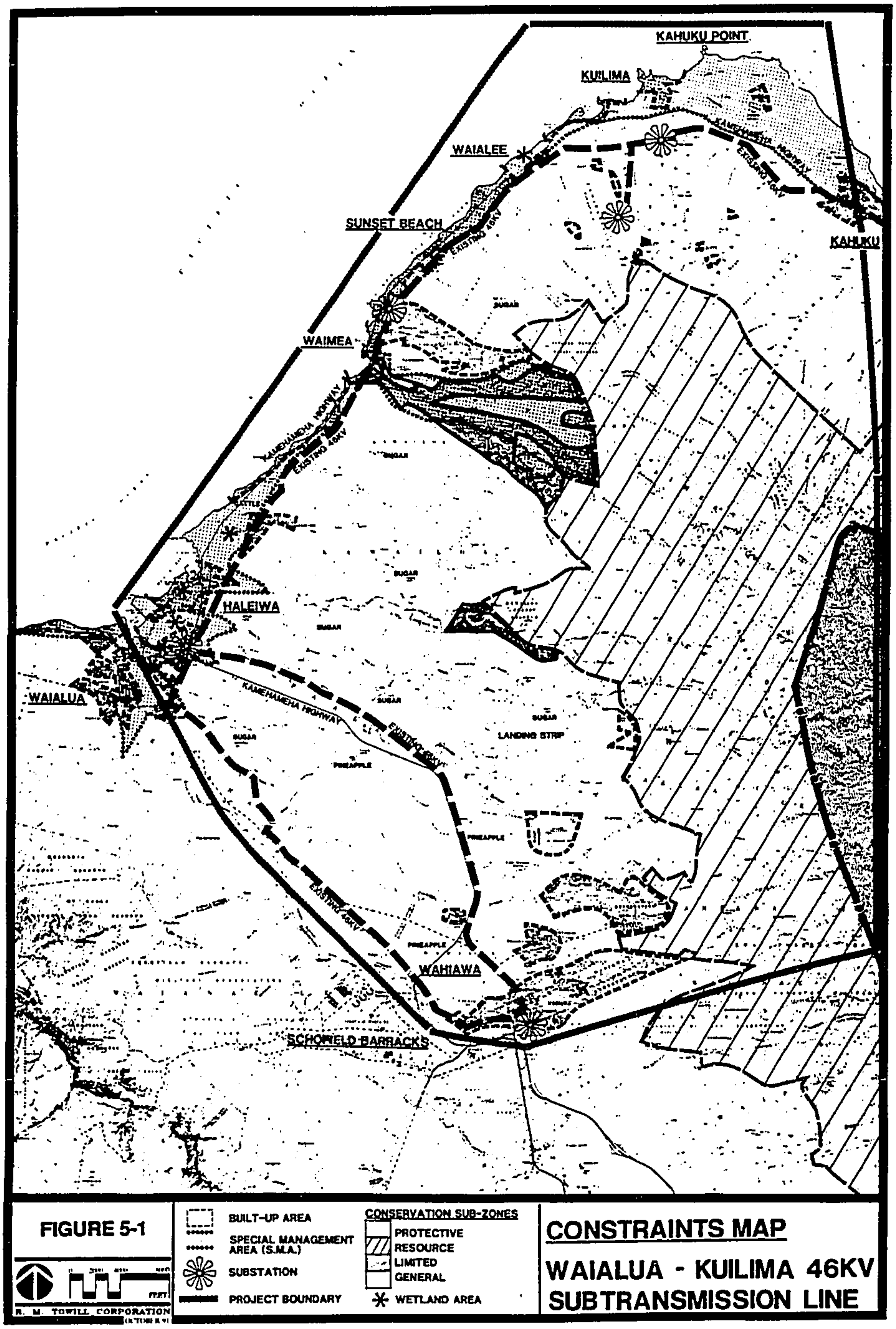


FIGURE 5-1

CONSTRAINTS MAP

WAIALUA - KUILIMA 46KV SUBTRANSMISSION LINE

alternate line in case of failure of the existing 46 kV line. Consequently, there is a need for both lines to be separated and not be exposed to the same set of risks.

Minimize Route Length - Keeping the route length as short as possible is a major concern as the length relates to the overall cost of constructing and maintaining the line. Longer lengths generally results in higher costs.

Minimize Number of Angles - Another measure of project costs is the number of angles within a subtransmission line corridor. Routes with angles, require side anchors. The installation of side anchors is costly and requires additional easements. If numerous angles occur at the corridor level, significant bends in the final line route will have to be accommodated, thus raising costs.

Minimize Spans Greater the 350' - When a subtransmission line crosses a wide and/or deep valley, larger supporting structures are needed at either end to accommodate the longer span. This impacts the overall cost of the final route. Thus, the desire is to minimize crossing valleys greater than a 350 feet wide.

Avoid Military Zones - There is a potential incompatibility between military operations and the subtransmission line. Certain portions of the North Shore area are used for military maneuvers involving helicopter operations. Power lines through these areas could result in restricting some operations.

Minimize Disturbance of Existing Agricultural Land - Approximately 60 percent of the project study area is potential agricultural land, according to the ALISH maps. Major concerns regarding incompatibility with the use, include negative economic impact on the producer, and potential dangers to line structures by agricultural activities.

Minimize Property Fragmentation - There are three major landowners that own approximately 80 percent of land within the project study area. It is within their interest, as well as other landowners, that a new subtransmission line not substantially cut across their parcel of land. If it does, easements will need to be obtained from these owners. It is important that a corridor seek to avoid private property fragmentation. Therefore, it is desirable to follow existing property line to the maximum extent possible and avoid cutting through existing land holdings.

Avoid Built-up Areas - This criteria highlights the public sensitivity to aesthetic and health (EMF) concerns that would be brought about with the routing of a new subtransmission line through built-up areas. Therefore, from the residents standpoint, it is desirable to avoid built-up areas as much as possible.

Minimize Conservation District Impacts - The environmental and aesthetic concern with cutting a subtransmission line route through designated conservation areas is a major limiting factor on route determination. Although passing through Conservation Districts is unavoidable in the North Shore area, it should be minimized and directed through less sensitive sub-zones.

Minimize Special Management Area Impacts - Significant portions of the North Shore area are within the City and County of Honolulu's designated Special Management Area (SMA). Because of the aesthetic, environmental and economic concerns associated with the SMA, it is desirable to minimize the impacts on the SMA when possible.

Minimize Easement Acquisition - The more easements required, the more costly the new line will be. Easements provide accessibility to the line for construction, maintenance and repair. Therefore, it is desirable to maximize the use of existing rights-of-way and minimize the requirement for new easements.

Minimize Flood, Tsunami and Natural Disaster Risks - Maintaining circuit reliability is a major concern of HECO. Therefore, the new subtransmission line needs to be routed to minimize exposure to the same natural disaster risks as the existing 46 kV line.

Access to Waimea Substation - The proposed subtransmission line, if located along the coast, may be connected into the existing Waimea Substation. Thus, corridor selection needs to consider the accessibility to the substation.

Ease of Route Access - Access to the subtransmission line route is a major concern as it impacts construction costs, maintenance costs and repair timeliness. The desire is to maximize the accessibility of the route.

5.2.3 Alternative Corridors

Figure 5-2 depicts the alternative corridors considered for providing the 46 kV service to the North Shore. The following paragraphs briefly describe the alternative corridors that were identified using the above criteria:

Corridor A - Coastal Route. This corridor accommodates the routing of the new subtransmission line along Kamehameha Highway by building over the existing 12 and 4 kV distribution lines located within the State highway right-of-way. Alternative types of construction considered within this corridor will include all overhead, all underground, or a combination of overhead and underground.

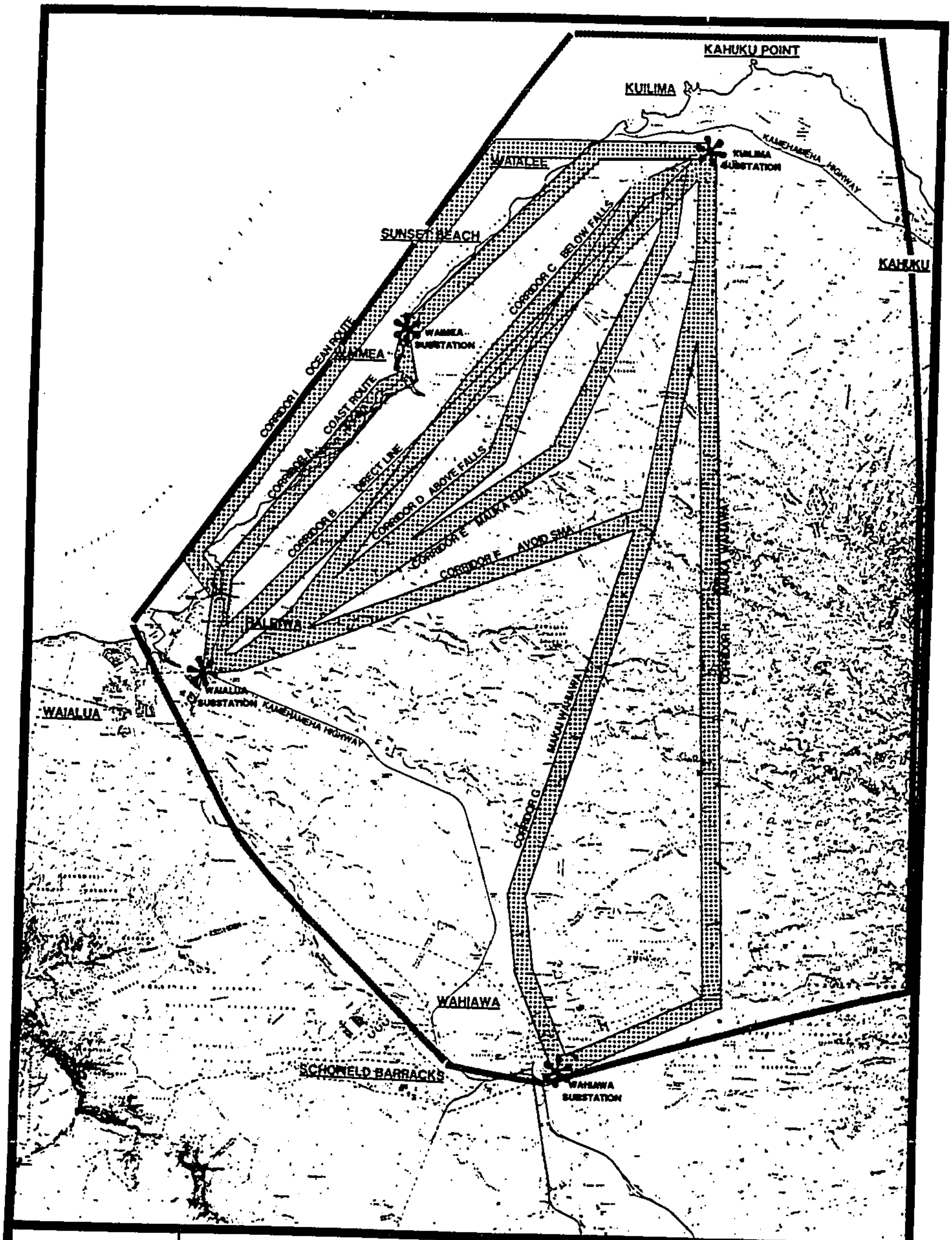


FIGURE 5-2

R. M. TOWILL CORPORATION

PROJECT BOUNDARY

CORRIDOR ALTERNATIVES

WAIALUA - KUILIMA 46KV SUBTRANSMISSION LINE

Corridor B - Direct Line. This corridor assumes that the new subtransmission line will follow the most direct path between the Waialua substation and the Kuilima substation. The corridor is located above the coastal bluff, crossing existing cane fields. It crosses below Waimea Falls and traverses Pupukea-mauka and above Sunset Beach.

Corridor C - Modified Direct Line, Below Waimea Falls. This corridor follows a direct line wherever possible. It is aligned to avoid built-up residential areas when exiting Haleiwa and entering Kuilima substation, and takes advantage of open space and ridge lines. The corridor crosses through the cane fields above the coastal bluff, across Waimea Valley below the Waimea Falls, through Pupukea-mauka and on to Kuilima substation.

Corridor D - Modified Direct Line, Above Waimea Falls. As with Corridor C, this corridor avoids residential areas in the vicinities of the Waialua and Kuilima substations. From Waialua, it crosses the cane fields at mid-elevations, traverses Waimea Valley ridgelines mauka of the falls, crosses the upper portions of Pupukea and proceeds over primarily undeveloped lands to Kuilima.

Corridor E - Mauka SMA. This corridor follows existing road alignments through the Waialua sugar cane fields, crosses the mauka portions of Waimea Valley, bypasses Pupukea and then continues to the Kuilima substation following the route of the existing power line above Pupukea. It also follows the existing line from the Windfarm to the Kuilima substation. The corridor avoids built-up areas and passes mainly through cane fields and undeveloped lands.

Corridor F - Avoid Waimea SMA. Using the same route to exit the Haleiwa area as corridors C and D, this corridor crosses the Waialua cane fields following alignments of existing cane roads. The corridor completely avoids the Waimea SMA area, bypassing it on the mauka side, and crosses heavily wooded uplands of the Koolau Mountains.

Corridor G - Makai Wahiawa. This corridor was considered, using the Wahiawa substation as an alternative source for the proposed 46 kV subtransmission line. It follows the existing easements through Wahiawa and proceeds north across the pineapple fields towards the Kuilima substation. Nearly mid-way, it enters the conservation district that encompass the Koolau Mountains and passes mauka of the Waimea Valley SMA.

Corridor H - Mauka Wahiawa. As with Corridor G, this corridor was based on using the Wahiawa substation as the source for the proposed 46 kV line. This corridor avoids all built-up areas, following an existing easement on the south side of Wahiawa. East of Wahiawa, the corridor enters the conservation district and crosses the Koolau Mountains in a direct path to the Kuilima substation.

Corridor I - Ocean Route. This alternative examines the feasibility of routing the subtransmission line along an ocean/submarine route. Generally, this corridor would enter the ocean at Haleiwa, follow the coastline at a depth of 100 to 300 feet and return to shore somewhere near Waialee before following a direct line to Kuilima substation.

5.2.4 Corridor Evaluation

Evaluation of each of the corridors was based on the criteria listed in paragraph 5.2.1 above. These criteria were selected to measure each corridor's ability to meet regulatory and low cost considerations, and to mitigate the impact of social and environmental factors on residences and conservation land.

Figure 5-3 reflects a comparative evaluation of each corridor with respect to the established criteria. Corridors A (Coastal Route), B (Direct Line), C (Below Waimea Falls) and D (Above Waimea Falls) were rated as the top four corridors. Since both corridors B and C follow nearly the same route and respond similarly to the various evaluation criteria, both are being considered as a single preferred corridor. Because Corridor C is more sensitive to property fragmentation, it is being chosen as the representative corridor. This leaves three preferred corridor options: the Coastal Route, the Direct Route (Below Waimea Falls) and the Mauka Route (Above Waimea Falls). Figure 5-4 illustrates the preferred corridors for the proposed 46 kV line.

Figure 5-3
CORRIDOR EVALUATION

CRITERIA	COAST ROUTE	DIRECT LINE	BELOW FALLS	ABOVE FALLS	MAUKA SUA	AVOID SUA	WAHIAWA MAUKA	WAHIAWA MAUKA	OCEAN ROUTE
ACCESS TO SUBSTATIONS	●	◒	●	◒	⊙	○	○	○	○
NUMBER OF ANGLES	○	●	⊙	⊙	⊙	⊙	◒	◒	○
SPANS GREATER THAN 350'	●	○	○	○	○	○	○	○	○
AVOID MILITARY ZONE	●	●	●	●	●	◒	⊙	○	●
DISTURBANCE OF EXISTING AG LAND	●	○	○	○	○	○	⊙	●	⊙
MINIMIZE PROPERTY FRAGMENTATION	●	○	⊙	⊙	○	○	○	○	●
URBAN IMPACT	○	●	●	●	●	●	●	●	●
CONSERVATION DISTRICT IMPACT	●	●	●	●	◒	◒	⊙	○	○
SPECIAL MANAGEMENT AREA	○	◒	◒	◒	◒	●	●	●	⊙
EASEMENT MILES	●	○	○	○	○	○	○	○	○
FLOOD, TSUNAMI, NATURAL DISASTER	○	⊙	⊙	⊙	⊙	◒	◒	◒	○
EASE OF ROUTE ACCESS	●	⊙	⊙	⊙	⊙	⊙	⊙	⊙	○
CONSTRUCTION COST	◒	●	●	●	●	●	⊙	○	○
RANK ORDER	1	2	2	4	6	5	7	8	9

BEST
●
◒
⊙
○
WORST

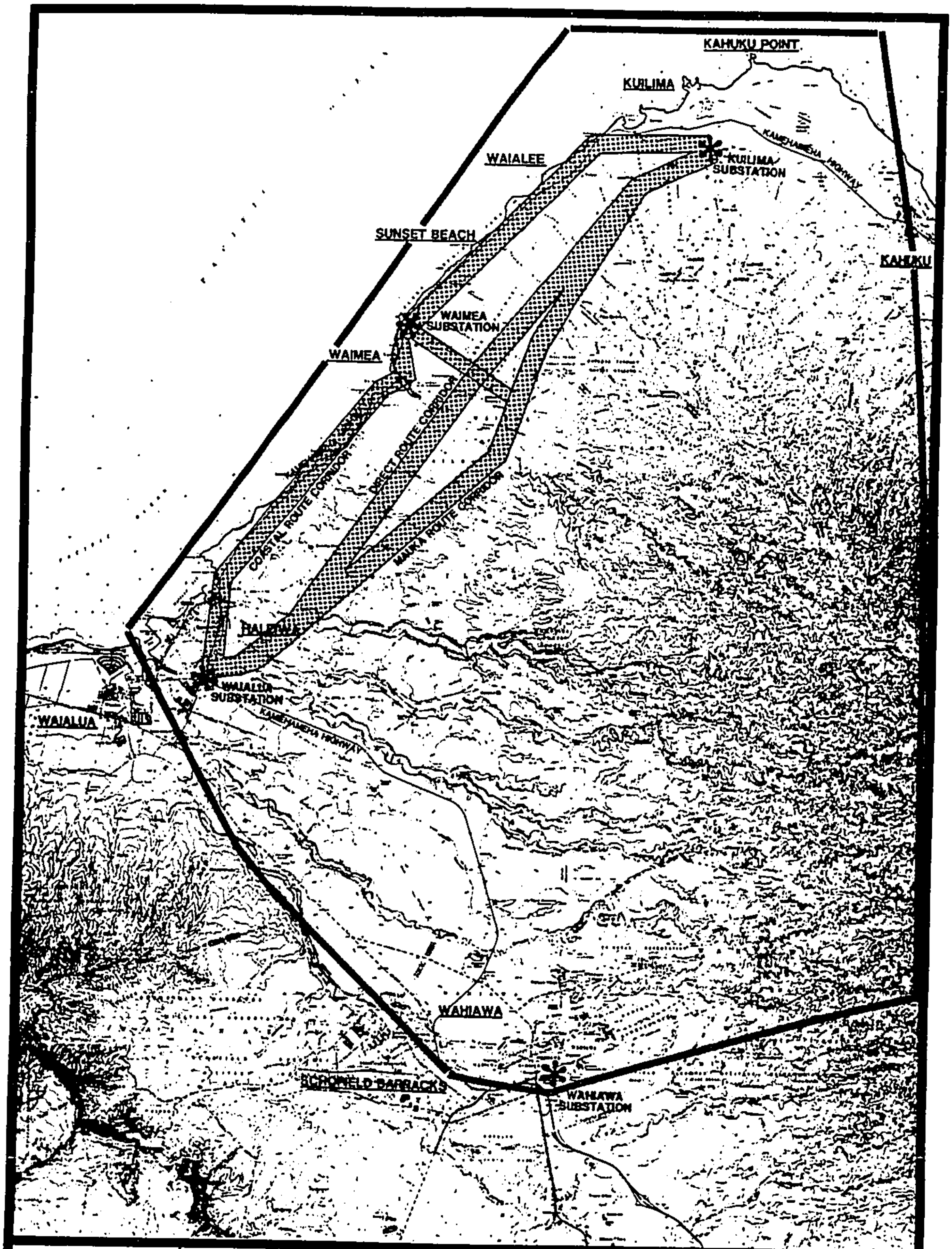


FIGURE 5-4

FEET

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PROJECT BOUNDARY

PREFERRED CORRIDORS

WAIALUA - KUILIMA 46KV SUBTRANSMISSION LINE

5.2.5 Alternative Technologies Evaluation

Along with the identification of possible corridors, an analysis of several electrical system technologies was conducted. These system alternatives are: underground, submarine and overhead lines. The following paragraphs will discuss each of the basic system components, construction and operating effects, and maintenance considerations as they relate to the various alignment alternatives.

Underground System - The underground transmission cable is a solid dielectric type. Solid dielectric cable is the most economical for lower voltage line construction (115-kV and below). The cable system consists of three individual cables. Each cable is insulated with cross-linked polyethylene and has an outside diameter of three inches. Each cable is installed in a separate five-inch PVC conduit. The cables would be spliced in manholes approximately every 300 to 600 feet depending on the manufacturer, the utility's equipment and the topography.

For the proposed project, the underground alternative could be used with the coastal route. Trenching for the installation of the conduits and cables would be within the existing State highway right-of-way. This would require the excavation of a trench four and a half feet deep and two feet wide and the installation of concrete manholes 6 feet in width by 14 feet in length by 6.5 feet in depth. Four 5-inch conduits (three for conductors and one spare) would then be installed.

Impacts

Trenching along the coastal route should have minimal effect on the environment. Since the trench will be within the Highway right-of-way, only minimal removal of vegetation along the roadway will be required.

After installation, there is no visual impact from the underground cables. Underground systems, however, require ground-to-air transition stations at both ends of the underground portion. These transition stations would generally be in the existing substations and would not be appreciably noticeable.

Television and radio interference would be virtually non-existent from an underground system.

Trenching required along the entire route would cause continual disruption of traffic during the construction period. Also, if repairs are needed, potentially there could be disruption to traffic.

The cost of a 46 kV underground system would be about 7 to 8 times the cost of a comparable overhead system. The need for excavation, conduit, and polyethylene cable increases the cost greatly. Also, if the underground route is located next to other underground utilities such as sewer, water and gas pipelines, the cost of relocating or moving these facilities would increase the overall costs of the project.

Submarine System - The submarine cable alternative would require dredging or trenching on the floor of the ocean in the nearshore areas and the laying of three armor jacketed polyethylene cables. The route would enter the ocean south of Kaiaka Bay and run parallel to the coastline to the northeast and come ashore at Waialee and continue overland to the Kuilima Substation. The approximate length of the line would be about 14 miles, with 11 miles of submarine cables and 3 miles of underground cables. The underground cable portion would be the same as above.

Impacts

The construction activities will temporarily disrupt the benthic region around the cable route and may require some removal of coral. Additionally, energy loss through the cable, in the form of heat, would be conducted to the surrounding water, thus having an impact on the surrounding benthic communities.

The electric and magnetic fields at the surface of the water above the submarine route would vary according to the depth of the cable, but generally would be negligible.

There would be no visual impact on the surroundings.

Television and radio interference would be virtually non-existent.

There will be no traffic interruption for the submarine portion; however, the underground portion may cause some disruption between the ocean and the two substations at each end.

Submarine cables may potentially heat up due to bottom mud acting as insulation. This heat may damage the cable causing failure. Also potential damage could occur due to storms or ship anchors.

The cost of maintaining a submarine cable under normal conditions is minimal because there are no manholes to open or splices to inspect. However, emergency repairs to the cable represent a significant cost and the outage duration would be longer. Repairing an damaged or failed submarine cable requires locating the fault, uncovering the damaged section, raising it onto a barge and splicing in a new length of cable.

The installation costs for a submarine cable system would be comparable to an underground cable installation. However, there could be the possibility of significant added costs involved in dealing with obstacles on the ocean bottom and strong wave conditions, requiring special cable anchoring.

Overhead Systems - There are three overhead system designs that could be used for the proposed 46 kV subtransmission line. The first is to build the line above the existing distribution lines along Kamehameha Highway. The second design option would be the use of single pole structures, similar to that of the existing 46 kV line, following new rights-of-way. The third type of design alternative is the use of H-frame structures. An H-fame structure is required to accommodate increase structural loads associated with longer transmission line spans. These conditions would be encountered at gulch and valley crossings and in traversing hilly and mountainous terrain.

- Above Existing Lines

  This alternative requires attaching an extension (approximately 10-12 feet) to the top of existing distribution poles. Ceramic or polymer strut insulators are proposed. Some poles will have inadequate structural capacity to support the increased load; therefore, it could be expected that about 70% of the poles would have to be removed and replaced with stronger poles. Additional guy wire and anchor easements may also be required to support the added circuit.

Impacts

Because this option uses an existing right-of-way, clearing of vegetation will be minimal, primarily in those areas where additional guying for structural integrity will be required. It is likely dead-end structures will have to be reinforced or rebuilt.

The addition of pole extensions and new conductors above the existing distribution systems will have a minor negative visual impact as it will be adding to the visual impact of the existing lines. The existing pole height will increase from 40-45 feet to 50-55 feet above ground.

Where new poles or replacement poles are placed within the highway right-of-way, traffic will be affected during the construction period. To mitigate this, work would have to be restricted to off-peak traffic periods. Traffic could also be disrupted when maintenance or repairs are required, depending on the type of work.

From the maintenance and repair standpoint, this option would be the easiest to maintain for portions adjacent to roadways. Under these conditions, a bucket truck could be used, helping to keep repair times to a minimum.

- Single Pole Structure

The new single pole line would have pole heights that are between 50 and 60 feet, with average spans of about 300' feet between poles. The single pole line would be built within a 25-foot wide right-of-way. It's application would primarily be for crossing relatively flat terrain within new rights-of-way.

<u>Impacts</u>

Clearing of surface vegetation would be required at structure sites. In addition, selective clearing may be required to provide clearance for the conductors in a high wind environment.

Installation of new poles would require excavation work, which could have an impact on any subsurface archaeological features encountered along the route.

A 25-foot wide right-of-way easement would have to be obtained for the route.

The visual impact of a new line in a new right-of-way will normally be greater than over building existing lines as it would be introducing an additional negative feature. However, if the right-of-way is routed primarily through undeveloped areas or areas away from public view, the impact would be less than over-building as the line would not be seen by the general public.

Impacts on traffic would depend upon where the line is located. If it is located outside of existing rights-of-ways, the impact would be minimal as construction work will only require access from existing roads.

Maintenance and repair of the line would be from hours to days depending on the location of the work.

- <u>H-Frame Structure</u>

The H-frame line would have pole structure heights that range from 45 to 60 feet, with average spans of about 800 feet between pole structures. The H-frame line would be built on a 50 to 75-foot wide right-of-way. Variations of the H-frame design would be used for angle and dead-end type structures. Ceramic or polymer strut and suspension insulators would be used.

<u>Impacts</u>

Clearing of surface vegetation would be required at structure sites. In addition, selective clearing may be required to provide 10 feet clearance from conductors during high wind conditions.

Installation of new poles would require excavation work, which could have an impact on any subsurface archaeological features encountered along the route.

A 50 foot wide right-of-way would have to be obtained for the route.

The H-frame structure design has a greater visual impact as it is a larger structure. However, these structures are mostly used in mountainous terrain where the structures are a distance from the general public view and many times hidden by land forms, trees and overgrowth.

Construction of a route over areas that are inaccessible, as in hilly or mountainous terrain, would be costly and time consuming. Access roads would have to be constructed. Helicopter construction may be the only choice for parts of the line that are built in areas not accessible by vehicles. Maintenance and repair would be the most difficult because the line would be inaccessible in some areas. Bucket live line work would be impossible. Repair times would be extended to days. However, this option would not have tsunami or flooding exposure.

5.2.6 Selected Corridors and Technologies

Upon review of the various corridor and technology alternatives, Corridors A, C and D were selected for further studies for developing the proposed Waialua-Kuilima 46 kV Subtransmission Line final routing. The overhead and underground system technologies were chosen as the most viable alternatives that should be considered for further investigation. Both corridor and technology selections were predicated upon expected least amount of impact on environmental resources, the most accessibility for maintenance and repair, and the lowest construction costs.

The primary disadvantages of the more lengthy corridors that cross through the mountainous areas include the need to acquire more and larger right-of-way easements for the route, greater potential for affecting biological and cultural resources, and longer down time for repairs and higher maintenance costs due to limited line accessibility.

The submarine cable option was eliminated from further consideration for several reasons. First, locating and repairing of faults would be time-consuming and costly. And finally, the cost of installing a submarine cable system would be substantially higher than terrestrial alternatives.

5.3 ALTERNATIVE ALIGNMENT EVALUATION AND SELECTION

Following the selection of preferred corridors for further study, the next step in the route selection process was to identify alternative alignments for the proposed 46 kV subtransmission line. Using the selected preferred corridors and public input as a basis for the general location of possible alignments, criteria was established for further guiding identification and evaluation of alternative alignments. The following paragraphs discuss the alignment evaluation criteria, alternative alignments and selected alignment.

5.3.1 Alignment Selection Criteria

The selection criteria has been grouped into two categories: environmental/land use criteria and engineering/cost criteria. The criteria were established for evaluating the subtransmission line options and providing factors to which ratings could be applied to quantitatively arrive at a proposed alignment. The following environmental/land use and engineering/cost criteria guided the identification and evaluation of the alternative alignments.

Environmental/Land Use Criteria

- **Avoid residential areas, schools, recreation areas and other high-public-use areas to the extent possible and minimize conflict with proposed residential projects.** The rationale is public concern over aesthetics, property values and potential adverse effects from electric and magnetic fields.
- **Minimize impacts to environmentally sensitive areas.** The subtransmission line should be sited to minimize potential impacts to wetlands, wildlife habitat and State Conservation District land.
- **Minimize impacts on agricultural lands and operations.** To the extent possible, alignments should avoid productive agricultural land and should use roads, ditches, property lines and other areas that would minimize the disruption of agricultural land and operations such as crop-dusting and harvesting.

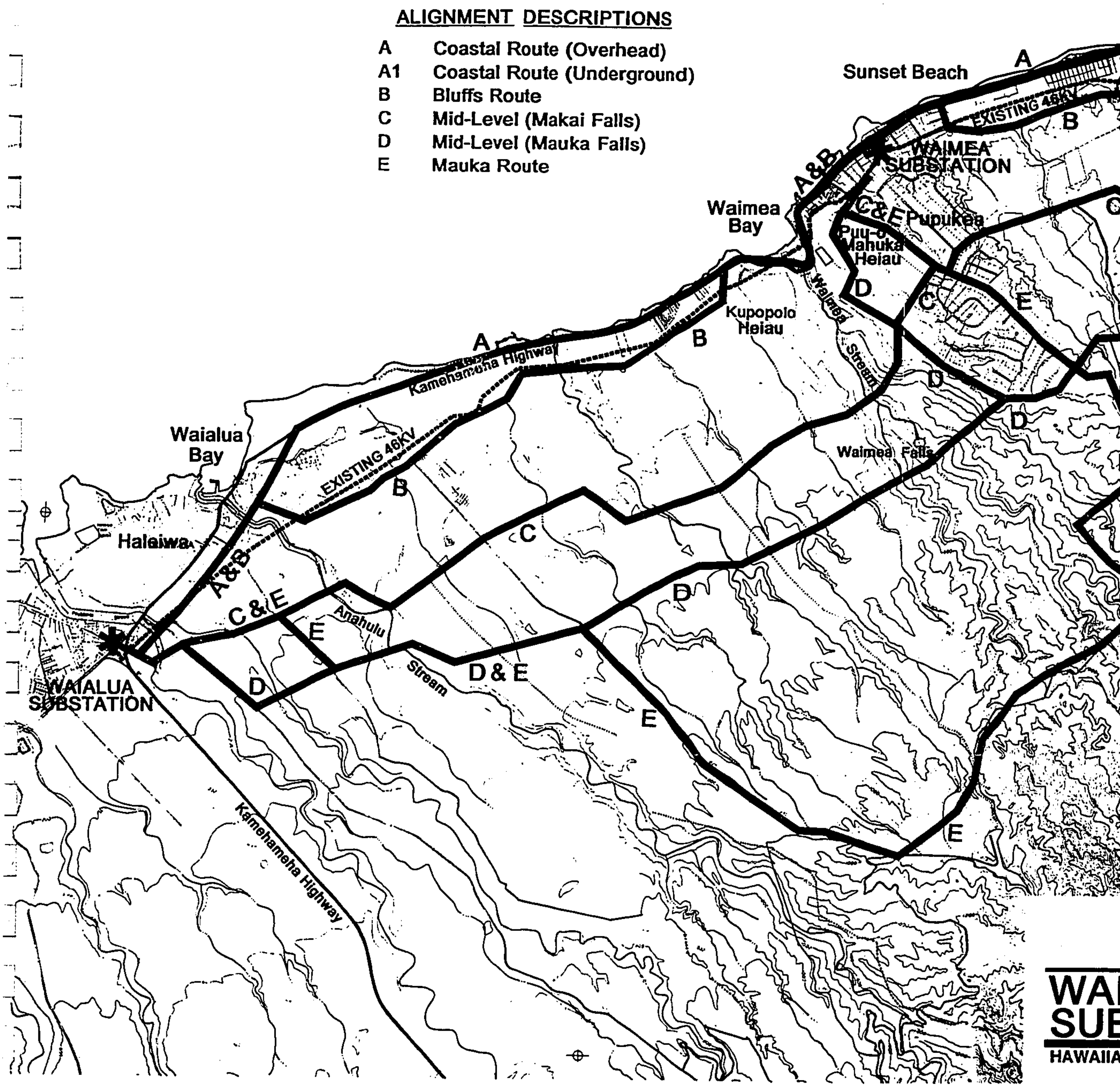
- **Make use of alignments of existing 12 kV distribution lines where possible.** Combining the new 46 kV line with existing 12 kV lines on a single set of poles will minimize the need to acquire a new right-of-way for the proposed line. In addition, combining the new line with existing 12 kV lines reduces the incremental visual effect of the new line, will simplify maintenance as only one set of poles is involved, and, in many cases, can reduce the level of electric and magnetic fields.
- **Follow roads and highways.** Roads and highways are linear rights-of-way that present opportunities for subtransmission line routing because HECO has a franchise with the State of Hawaii which grants HECO the right to use State and City and County roads for their lines.

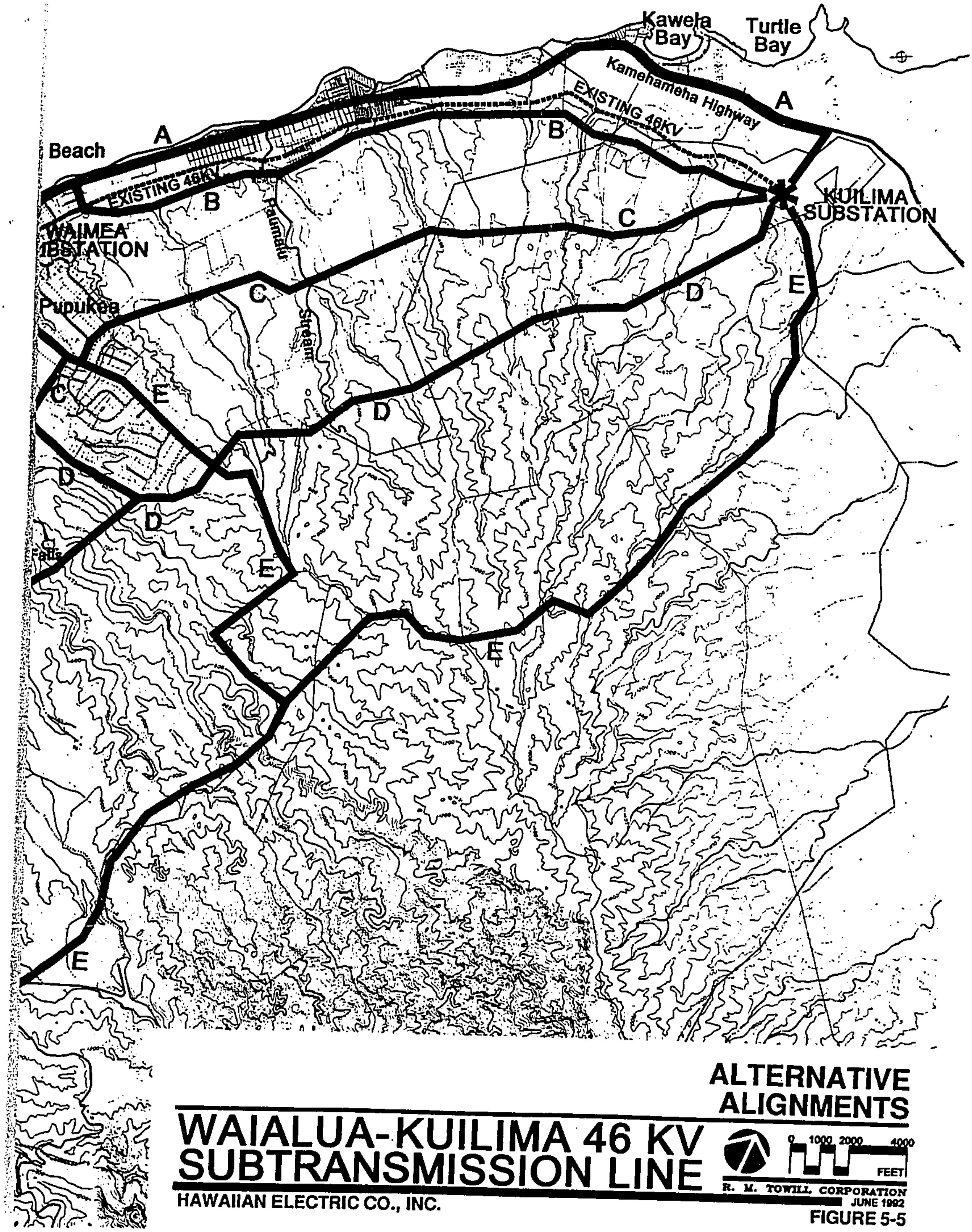
Engineering and Cost Criteria

- **Minimize alignment length.** Generally, the shorter the alignment length, the lower the cost and time of constructing the subtransmission line.
- **Provide for access to pole locations for construction, maintenance and repair.** Adequate access to each pole location is desirable for the construction, maintenance and repair of the new line. In general, access should be available for heavy trucks for construction and for lift trucks for maintenance and repair.
- **Minimize cost.** HECO is regulated by the Public Utilities Commission, and is responsible for providing reliable electrical service to its customers at the most reasonable cost. Therefore, they must make every effort to control costs and minimize impacts on the rate payer.

5.3.2 Alternative Alignments

Using these criteria, various alternative alignments were developed following the selected corridors. Figure 5-5 depicts the alternative alignments considered for the proposed


ALIGNMENT DESCRIPTIONS
A Coastal Route (Overhead)
A1 Coastal Route (Underground)
B Bluffs Route
C Mid-Level (Makai Falls)
D Mid-Level (Mauka Falls)
E Mauka Route
Sunset Beach
A
EXISTING 46KV
B
WAIMEA SUBSTATION
A&B
Waimea Bay
C&E
Pupukea
Puu-o-Mahuka Heiau
D
C
E
Kupopolo Heiau
Waimea Stream
B
A
Kamehameha Highway
D
D
Waimea Falls
Waialua Bay
EXISTING 46KV
B
C
Haleiwa
A&B
D
C & E
E
Anahulu Stream
D & E
E
D
WAIALUA SUBSTATION
E
Kamehameha Highway
WA
SUB
HAWAIIA



ALTERNATIVE ALIGNMENTS

WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE

HAWAIIAN ELECTRIC CO., INC.

0 1000 2000 4000 FEET

R. M. TOWILL CORPORATION

JUNE 1992

FIGURE 5-5

subtransmission line. A brief description of each of the alternative alignments is provided as follows:

Alternate A, Coastal Overhead Alignment - This alignment accommodates much of the routing of the new subtransmission line along Kamehameha Highway by adding the new 46 kV line to the existing overhead distribution (12 kV and 4 kV) line system located within the highway right-of-way. From the Waialua Substation, the proposed line heads mauka towards the Haleiwa Bypass Road. This segment of the line may be placed underground. The line then follows the Bypass on the mauka side heading in the northerly direction until it transitions back onto Kamehameha Highway. Once on Kamehameha Highway, the new 46 kV line follows the existing distribution lines along the highway until it reaches the Kuilima Substation access road across from the Turtle Bay Resort. It then proceeds along the access road to the substation.

Alternate A1, Coastal Underground Alignment - This alignment essentially is the same as Alternate A with the exception that the entire line is placed underground. Although the new 46 kV line will be underground, the existing 12 kV and 4 kV distribution lines will still be required and will remain overhead.

Alternate B, Bluff Alignment - Major portions of this alignment follow the coastal bluffs along the North Shore between Haleiwa and Waimea Bay, and Pupukea and Kuilima Substation. Initially the alignment follows the Haleiwa Bypass until past Anahulu Stream. From there it follows plantation and cane haul roads above the bluffs to Waimea Bay where it connects into Kamehameha Highway. The line stays on Kamehameha Highway around Waimea Bay and portions of Sunset Beach to Pukoa Road. It then follows the base of the bluff along the makai boundary of the

Obayashi property, transitioning to the top of the bluff from the Communications satellite Corporation property to the Kuilima Substation.

Alternate C. Mid-Level Alignment (below Waimea Falls) - This alignment crosses the cane fields at mid-elevations (200-400'), between Haleiwa and Waimea Valley, following cane roads and irrigation ditches wherever possible. It traverses Waimea Valley ridge lines makai of Waimea Fails and crosses the lower portions of Pupukea, connecting into Alapio Road. The alignment then proceeds over primarily undeveloped lands bisecting the Obayashi and Communications Satellite Corporation properties at about the 500-600' elevation, continuing on to the Kuilima Substation. A tap to the Waimea Substation is contemplated if it is feasible. The tap extends down Pupukea Road to the Waimea Sub.

Alternate D. Mid-Level Alignment (above Waimea Falls) - This alignment follows Twin Bridge Road up to about the 250' elevation then crosses the cane fields at mid-elevations using cane roads and irrigation ditches, gradually moving up to the 400-600' elevations. The alignment then traverses Waimea Valley ridgelines mauka of Waimea Falls and crosses the upper portions of Pupukea on the makai side of the Boy Scout Camp. North of Pupukea, the alignment crosses primarily undeveloped lands at the 600-800' elevation, following the mauka boundary of the Obayashi property, the makai boundary of the Girls Scout Camp. Between the Girl Scout Camp and the Kuilima Substation and Kuilima Substation, the alignment follows a U. S. Government cable easement for most of the way. Similar to Alignment C, a tap to Waimea Substation along the southern boundary of Pupukea along the edge of Waimea Valley will be considered if it is feasible.

Alternate E. Mauka Alignment (the Drum Road) - Although this alignment does not fall within one of the previously selected corridors, it was added to the evaluation because the public expressed strong desires that this route be seriously considered. It initially follows alignment as Alignment C to Opaeula Road, then heads mauka until it reaches bout the 250' elevation where it then follows the same alignment as Alignment D. At Kawailoa Road, the alignment proceeds mauka to Drum Road at about the 1,100' elevation. The alignment follows major portions of Drum Road, traversing the lower reaches of the Koolau Summit through the mauka end of Waimea Valley and across undeveloped lands above Pupukea and Waialee. A tap, if feasible to Waimea Substation extends along Pupukea Road as in Alternatives D and E.

5.3.3 Selection Methodology

Following the establishment of alternative alignments, a process of evaluating the alternatives was conducted. The evaluation of the alternative alignments was based on a range of categories which were derived from the basic environmental/land use criteria and the engineering/cost criteria defined in paragraph 5.3.1 above. The categories used for evaluating the alignments are listed below.

Environmental/Land Use Categories:

- Visual Impact Along Alignment (residential areas, public outdoor areas, roadways, agricultural lands)
- Cultural and Historic Resources (State/National registered sites, other known or possible sites)
- Flora and Fauna (endangered species, wetlands, open areas)
- Land Ownership (State, County, Federal, private)
- Land Regulations (within SMA, Conservation District, Special District)
- Existing and Proposed Land Uses (residential areas, schools, communication sites, parks, other utilities)
- Natural Disaster (flood and tsunami)

- Topography (slopes greater than 20%)

Engineering/Cost Categories:

- Alignment Length
- Existing Easements and Rights-of-Ways
- Maintenance Access
- Construction Costs

Constraint criteria were then established to be used as guidelines for assigning constraint ratings to various data factors of the categories above identified for evaluating the subtransmission line options. The constraints were arranged into "high", "medium" or "low" groups for each factor, reflecting the degree to which the data factor could affect the location of a subtransmission line. For example, if a particular factor conflicted with the siting of a subtransmission line, it was ranked "high". "Medium" constraint ratings were applied if the data factor would constrain subtransmission line alignments. The "low" constraint rating was assigned to factors judged to be compatible with subtransmission lines or that could provide opportunities for siting. Generally, low constraint areas include areas near or parallel to existing subtransmission lines, utility corridors, or major roadways. The constraint criteria established for rating the data factors are summarized below.

High Constraint - Areas with the following characteristics:

- Unique, highly valued, or complex resource areas
- Significant potential conflict with a current or planned use
- Areas possessing substantial hazards to construction or operation of a transmission line
- Resource areas with identified hazards typically requiring long-term and costly mitigation or high design and construction costs

- Areas that could require lengthy, complex review and permitting with the likelihood of approval uncertain or low

Medium Constraint - Areas with the following characteristics:

- Important, valued resources
- Resource hazards
- Special status resources
- Resources with some potential conflict with current or planned use
- Areas possessing some hazard to construction or operation of a transmission line
- Resource areas or conflicts with identified hazards that may require potentially difficult mitigation.

Low Constraint - Areas with the following characteristics:

- Areas that have not been classified as exclusion, high constraint, or medium constraint
- Require permits are routinely issued
- Little or no conflict with a transmission line
- No unique or special resources
- Resource conflicts or hazards to construction or operation can be routinely mitigated through compensation, location or design.

Descriptions of each of the environmental and land use categories identified are provided in the following paragraphs along with general constraints ratings for the associated data factors.

Land Jurisdiction

- Siting Issues - Land jurisdiction does not in itself constrain subtransmission line location; however, parcel size and ownership can affect right-of-way location and acquisition. The acquisition of a right-of-way (usually 25 to 50 feet wide) would have a more significant impact on the potential use of small parcels than it would on large ones. Landowners are concerned that subtransmission line rights-of-way would divide their land holding into small, irregularly shaped parcels that could reduce the value of their property. In addition, the negotiations involved in acquiring the right-of-way easements through an area with numerous small parcels, each with different owners, could take substantially longer than through areas with a single owner.

  Other factors that influence line location include the permits, policies, and guidelines that regulate development within certain jurisdictions. Some portions of military lands are used for specialized and sensitive functions that may be incompatible with siting a subtransmission line or that may require special permits. These requirements may vary by owner: Federal, State, City & County, or private landowners. Therefore, identifying and mapping major jurisdictional boundaries within the study regional determines ownership patterns and helps to establish the broad guidelines that can influence alignment location.

- Constraint Rating -- High

  Military Lands. Military lands are rated high constraint because of the high degree of uncertainty as to the negotiations, reviews, and approvals required to site a subtransmission line across military lands.

Private. Private lands represent a major portion of the land area within the study region. Private lands are rated high constraint because utilities will require negotiation of easements over private lands for utility uses.

- Constraint Rating -- Low

  State and the City and County of Honolulu Lands. Most other public lands present a low constraint for the siting of a subtransmission line. Utility companies such as HECO normally seek a perpetual easement for utility uses of public lands. Siting within public lands is typically not prohibited, but would be subject to negotiation and the permit requirements of the agency with jurisdiction over the land.

Land Regulation

- Siting Issues - Land regulation identifies areas subject to regulatory controls of State and City and County government agencies to protect resources and to guide future development.

  In only one category of land within the study area does government regulation expressly prohibit the construction and operation of a subtransmission line: land designated "Conservation District, Protective Subzone." There are also several areas where the siting of subtransmission lines would be discouraged by regulatory controls designed to protect special resource values. Siting subtransmission lines through these areas would be subject to regulatory review and permits.

  Conservation Land Use District Lands. The State of Hawaii has classified Conservation lands into four subzones: Protective, Resource, Limited and General. The most restrictive is the Protective Subzone, which prohibits the construction of transmission lines. The Limited and Resource Subzones are less restrictive. While regulations governing these two subzones does not preclude transmission lines, their stated objectives and narrow range of permitted uses suggest a high regulatory constraint. Least restrictive is the General Subzone, within which subtransmission lines would be normally allowed and permitted. To determine if a subtransmission line would be allowed to cross Conservation District lands, HECO would have to submit a Conservation District Use Application (CDUA) to the Board of Land and Natural Resources for approval.

Special Management Area (SMA). As part of the Coastal Zone Management policies, the State of Hawaii created the SMA for the purpose of controlling development "within an area along the shoreline...to avoid permanent losses of valuable resources and the foreclosure of management options, and to ensure that adequate access, by dedication or other means, to publicly owned or used beaches, recreation areas, and natural reserves is provided." (State of Hawaii, Hawaii Revised Statute 205A). On Oahu, the City and County of Honolulu Department of Land Utilization (DLU) designates and administers the SMA. Any "development, the valuation of which exceeds $125,000 or which may have substantial adverse environmental or ecological effect" (Revised Ordinances of Honolulu, Section 33-1.3) within the designated SMA, requires a Special Management Area Use Permit (SMA Use Permit) approved by the City Council. Development includes "construction, reconstruction, demolition or alteration of the site of any structure." "Structure" includes both transmission and distribution lines. Permits for construction and use of land within the SMA boundary require review by the City and County of Honolulu DLU, a public hearing, and approval by the City Council.

Special District. The City and County of Honolulu Land Use Ordinance identifies Special Districts in certain areas of the community which are in need of restoration, preservation, redevelopment or rejuvenation. The purpose is to guide development to protect and enhance the physical and visual aspects of an area for the benefit of the community as a whole. In the project vicinity, Haleiwa has been designated as a Special District. The Haleiwa Special District encompass properties along Kamehameha Highway between Weed Circle and Haleiwa Beach Park. On the mauka side of Kamehameha Highway, the boundary follows the mauka edge of the proposed Haleiwa Bypass Highway.

- Constraint Rating -- High

State Conservation District, Protective, Resource and Limited Subzones. Subtransmission lines are neither expressly permitted nor prohibited by the regulations governing Conservation District lands in general. The Protective Subzone is rated high constraint because it is the most highly restricted of the Conservation District subzones. Development within the Protective Subzone has usually been denied by the Land Use Commission unless no alternatives to the proposed action exist. If no alternatives exist, the review and approval process may take 6 months to complete. Conservation District Resource and Limited Subzone lands are rated high constraint because HECO would have to apply to the Board of Land and Natural Resources for a Conservation District Use Permit in order to site the subtransmission line. Although Resource and Limited Subzones are less restrictive than Protective Subzone they are more restrictive than General Subzones.

Special Management Area. Development within the SMA requires an SMA Use Permit issued by the City Council of the City and County of Honolulu.

SMA lands are rated high constraint because of the need to apply for the SMA Use Permit if the subtransmission line is to be sited within the SMA boundary.

Special District. Major infrastructure improvements in the Haleiwa Special District will require permit action; therefore, location within the district is considered a high constraint.

- Constraint Rating -- Medium

  Conservation District General Subzone. This subzone is least restrictive; however, will still require processing of a Conservation District Use Application by the Board of Land and Natural Resources.

Existing and Proposed Land Use

- Siting Issues - The study region has a mix of various land uses which include urban, military, recreational and agricultural uses. The relative sensitivity of different land uses varies according to the number of people, the visual qualities of the area, and the types of activities that occur in each area. For example, areas with existing subtransmission lines or linear facilities would be less affected by the presence of a new subtransmission line right-of-way than would areas that currently have no subtransmission lines. Residential areas are considered more sensitive than areas used for agriculture because of the concentration of human uses and the public concerns about visual quality in these areas.

  -- Residential and other high public use areas, such as schools, should be avoided, where possible, because of the public concern for potential health concerns, visual quality, and property values.

- For safety reasons, some military operations, training areas, are incompatible with subtransmission lines.
- Some agricultural practices (e.g., sugarcane field burning, aerial applications, and harvesting) may conflict with subtransmission lines.
- Conservation buffers and shorelines are important resource areas that are protected from development by local and federal policies.

Projects proposed for development may influence corridor selection. Many of the public concerns about subtransmission lines in existing high public use areas (such as visual impacts and potential health effects) would also apply to these proposed project areas. Where possible, these areas should be avoided to prevent siting conflicts. Because some of the proposed projects are in the planning stages, potential conflicts between subtransmission line siting and new development can be minimized through early consultation with the project proponents.

- Constraint Rating -- High

Communications Site. Facilities in this category include antennas, transmitters, and receivers operated by radio stations, the military, and the FCC. The FCC planning guidelines state that electric fields near the monitor should be avoided where possible. Subtransmission lines have the potential to affect the radio receivers by causing electrical interference and, in some cases, errors in the direction finder. The communications equipment must be sited beyond measurable electromagnetic radiation from any other source (e.g., transmitters or subtransmission lines). For these reasons, the design of subtransmission line alignments and tower placement near the communications equipment would require careful planning and negotiations with the operators; therefore, communications sites are considered a high constraint to siting.

Military Training Areas. Military training and operations areas should be avoided because subtransmission lines may intrude on and disrupt the military activities taking place beneath or above them.

Residential Areas and Schools. Because of public concerns over subtransmission line impacts related to health, aesthetics, and property values, land uses that have daily, high concentrations of people have been rated as high constraints. Included in this group where people spend a significant amount of time are residential areas, and elementary, intermediate, or high schools.

- Constraint Rating -- Medium

Parks, Outdoor Public Areas and Cemeteries. Recreational areas that receive significant use by the public include parks, playgrounds, golf courses, and playing fields adjoining schools. Because the public may be concerned over the aesthetics and health effects of subtransmission lines, these uses have been categorized as medium constraints. Similarly, cemeteries are considered medium constraint areas due to aesthetics and social considerations.

Public and Semi-Public Facilities and Commercial Areas. Facilities in this category include churches, fire stations, police stations and community halls. Commercial areas include retail shops, restaurants, services, and shopping centers. These are buildings and facilities that are used regularly by many people but are not residences. Given these facilities have high public use, there may be public concerns about the aesthetic and health effects of siting subtransmission lines near them; therefore, these categories have been rated medium constraint.

Agricultural. There are some potential conflicts between agricultural areas (including areas leased for agricultural use) and subtransmission lines. One potential conflict is the loss of productive farmland (by poles and foundations) or access rods (if needed) for construction and maintenance of the lines. A second potential conflict is related to the safety of aircraft performing aerial crop spraying near subtransmission lines.

- Constraint Rating -- Low

  Utilities. Utilities (other electrical lines, water, and sewer) offer opportunities for a subtransmission alignment because they typically are linear facilities located in existing rights-of-way. Therefore, the incremental disruption and cost of siting a subtransmission line along an existing utility corridor may be less than selecting an alternative route.

Biological Resources

- Siting Issues - The principal areas of biological concerns are the locations of endangered, threatened, or sensitive animal or plant species, wetlands and any native wildlife habitat. Subtransmission lines do not necessarily conflict with these resources; however, the permit requirements of both Federal and State agencies for activities within these sensitive areas may be substantial and should be considered in siting decisions.

- Constraint Rating -- High

  Wetlands. Wetlands are highly productive and ecologically important habitats, which are rare and declining in all parts of the world. The principal reason for the marked decline of waterbirds and other water-dependent wildlife is the loss of wetlands. Wetlands serve a variety of physical functions (e.g., bioaccumulation and filtering of certain water pollutants) that make them extremely valuable to the integrity of both aquatic and terrestrial ecosystems.

Wetlands are protected from unnecessary dredge and fill actions by the Federal Water Pollution Control Act (Clean Water Act, 1977, as amended 1981), Section 404, as implemented by the permitting agency, the U.S. Army Corps of Engineers. Any action within these habitats must be proposed, reviewed, and approved by the Corps of Engineers. Full compliance requires concurrence by the USFWS that there is no net loss of habitat value associated with the action. Because of the extensive review and approval process that may result from construction in wetlands, they are rated a high constraint to transmission line siting.

Endangered, Threatened, and Sensitive Wildlife Species Habitat and Significant Areas of Density or Diversity for Special Status Plants. These are habitats containing communities of plants or animals designated by the Federal government or the State of hawaii as threatened, endangered, or sensitive. Such species are protected under the Federal Endangered Species Act (1973) and HRS 195-D, Conservation of Wildlife and Plants (as interpreted by Administrative Rule, Title 13, Subtitle 5, Chapter 124, indigenous Wildlife, Endangered and Threatened Wildlife and Plants) and Introduced Wild Birds, which aim to conserve the species and the habitat. Any action within these habitats must be in compliance with both the Federal and State laws. It could take a lengthy amount of time to reach a determination of the significance of the species or habitat, to form a biological opinion, and to decide on and implement any mitigation measures required.

Natural Disasters

- Siting Issues - Tsunami inundation areas are areas along the coastline subject to flooding from tsunamis, storm run-ups or tidal waves. Because the tsunami zone covers a significant area of the North Shore where the new subtransmission line is to be sited, the tsunami flooding area is considered a constraint to siting.

  Likewise, subtransmission lines located within the 100-year floodplain are subject to soil erosion and scouring during flooding, thus location in flood zones is considered a major constraint. Areas within the 100-year floodplain are, therefore, considered to be a constraint to siting the subtransmission lines. Further, special permits to construct in flood zones are required.

- Constraint Rating -- High

  Tsunami Inundation Area and Flood Zone. Because location of a subtransmission line within a tsunami inundation area or a flood zone would expose the line to a higher than normal risk of damage; therefore,it is categorized as a high constraint.

Topography

- Siting Issues - Areas with steep slopes constrain subtransmission line siting because of the difficulties in designing and constructing facilities through such areas. Additionally, the length of subtransmission lines through these areas may be longer than for flatter ground. Although these problems can be mitigated, they tend to increase project construction cost.

- Constraint Rating -- Medium

  Slopes Greater Than 20 Percent. Slopes affect the length of the subtransmission line, the location of the line, the position of poles, the length of access roads, construction methods for access roads, and the amount of earth movement required for vegetation removal and for constructing access roads and foundations. A common threshold used to distinguish steep from gentle slopes for land use suitability analysis is 20 percent. This standard was considered appropriate for identifying medium constraint areas for subtransmission line siting.

Visual Resources

- Siting Issues - Scenic quality is a dominant element in Hawaii's beauty. Recognizing the importance of visual resources to the community, the General Plan of the City and County of Honolulu established Objective B of Chapter 3, "Natural Environment" (City and County of Honolulu, 1988):

  -- Objective B: To preserve and enhance the natural monuments and scenic views of Oahu for the benefit of both residents and visitors.

  -- Policy 1: Protect the Island's well-known resources: Its mountains and craters forests and watershed areas, marshes, rivers, and streams; shoreline, fishponds and bays; and reefs and offshore islands.

  -- Policy 2: Protect Oahu's scenic views, especially those seen from highly developed and heavily travelled areas.

-- Policy 3: Locate roads, highways, and other public facilities and utilities in areas where they will least obstruct important views of the mountains and the sea.

The extent of overhead subtransmission lines' visual impact depends largely on the capability of the natural landforms to absorb the introduced features. For example, a landform that includes a variety of topographic and vegetation patterns offers opportunities for locating overhead lines without significantly detracting from scenic quality. Conversely, low or open vegetative cover provides fewer opportunities to absorb the new visual element.

The degree to which an area is seen by viewers is determined by the amount and type of its use. For example, urban/residential areas commonly receive the most use, even if only by the immediate population. The coastal area and extensive sugarcane fields of the North Shore are open to public view and are seen by many people although, perhaps, for shorter durations and less often.

- Constraint Rating -- High

Recognized Shoreline Views, Parks and Beaches. Scenic quality is important along shorelines, at beaches, and within parks. The importance of shoreline views is recognized by the City and County of Honolulu Coastal View and Study and Special Management Area regulations. In additional, the General Plan calls for preserving and enhancing Oahu's scenic views. For these reasons, recognized shoreline views, parks, and beaches are rated high constraint.

Existing Residential Areas. Existing residential areas are rated high constraint because the visual quality of residential areas is important to residents.

- Constraint Rating -- Medium

  Proposed Residential Areas. Although visual quality is typically important to people in residential areas, proposed residential areas are considered medium constraint because there may be opportunities to modify the design or site layout of the residential project or the subtransmission line in order to minimize visual impacts.

- Constraint Rating -- Low

  Agricultural Plains View. The views of subtransmission lines within the agricultural plans are an important consideration in alignment selection; however, with proper siting, subtransmission lines can be a compatible element of the agricultural landscape.

  Existing Transportation Corridors (With an Existing Line), Uplands, and All Other Areas. These are rated as low constraint because they represent opportunities for the siting of a subtransmission line based on existing land use and its ability to absorb the visual impact of subtransmission lines.

Cultural Resources

- Siting Issues - In general, the presence of a single archaeological or historic site may be too small to have a major influence on the overall alignment of a subtransmission line. A single site can usually be avoided by carefully planning a subtransmission line alignment. However, areas containing large complexes of archaeological resources could affect line location.

- Constraint Rating -- High

  State/National Register of Historic Sites and Known or Probable Archaeological Sites. Cultural resources do not usually constrain subtransmission line siting because their locations are usually small or discrete units that can be avoided during the alignment and right-of-way selection. However, any sites in the State/National Register as well as known archaeological locations are of public concern. As such, they must be avoided during construction of the project. Reviews, studies, and approvals during the design of the project may be time-consuming and costly; thus, these areas are considered a high constraint to siting.

5.3.4 Alignment Selection Process

Each of the alternative alignments were evaluated and compared using the environmental/land use and engineering/cost criteria previously described. To analyze the environmental sensitivity of each alternative, a quantitative sensitivity analysis was conducted. The constraint criteria was used as the basis for the analysis. Because both overhead and underground alternatives were considered, and because they both differ in relative sensitivity to some of the environmental data factors, two constraints criteria ratings were established. For example, existing and proposed residential areas are generally rated high constraint areas. For the environmental constraint rating analysis, residential areas are rated as a high constraint for overhead lines, but rated medium constraint for underground lines. This is because the major concerns pertaining to aesthetics, health and property values remain high with an overhead line, whereas for an underground line, aesthetics is no longer a major concern. Tables 5-1 and 5-2 summarize the constraints ratings for both overhead and underground alternatives.

TABLE 5-1

ENVIRONMENTAL AND LAND USE CONSTRAINTS RATING--OVERHEAD LINE
WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE

ENVIRON/LAND USE CRITERIA	HIGH CONSTRAINT	MEDIUM CONSTRAINT	LOW CONSTRAINT
LAND OWNERSHIP	• Military Lands • Private Lands		• State Lands • City and County Lands
LAND REGULATION	• Conservation District, Protective, Resource and Limited • Special District • Special Management Area	• Conservation District, General	
EXISTING AND PROPOSED LAND USE	• Residential Areas • Schools • Communications Sites • Military Training Areas	• Agricultural Lands • Commercial/Business Areas • Cemeteries • Parks • Outdoor Public Areas • Other Public Facilities	• Other Utilities
NATURAL DISASTER *	• Tsunami Inundation Area • Flood Zone		
TOPOGRAPHY		• Slopes Greater Than 20%	
BIOLOGICAL RESOURCES	• Wetlands • Areas of Known Rare and Endangered Species		• Open Areas
VISUAL RESOURCES	• Residential Areas • Outdoor Public Areas--Shoreline/Beaches • Roadway With Existing Line	• Proposed Residential Areas	• Agricultural Plains • Uplands
CULTURAL RESOURCES	• State/National Register of Historic Sites • Other Known or Possible Archaeological Sites		

*Natural Disasters = Note that hurricane winds impacts were assumed equal for all overhead alignments.

TABLE 5-2

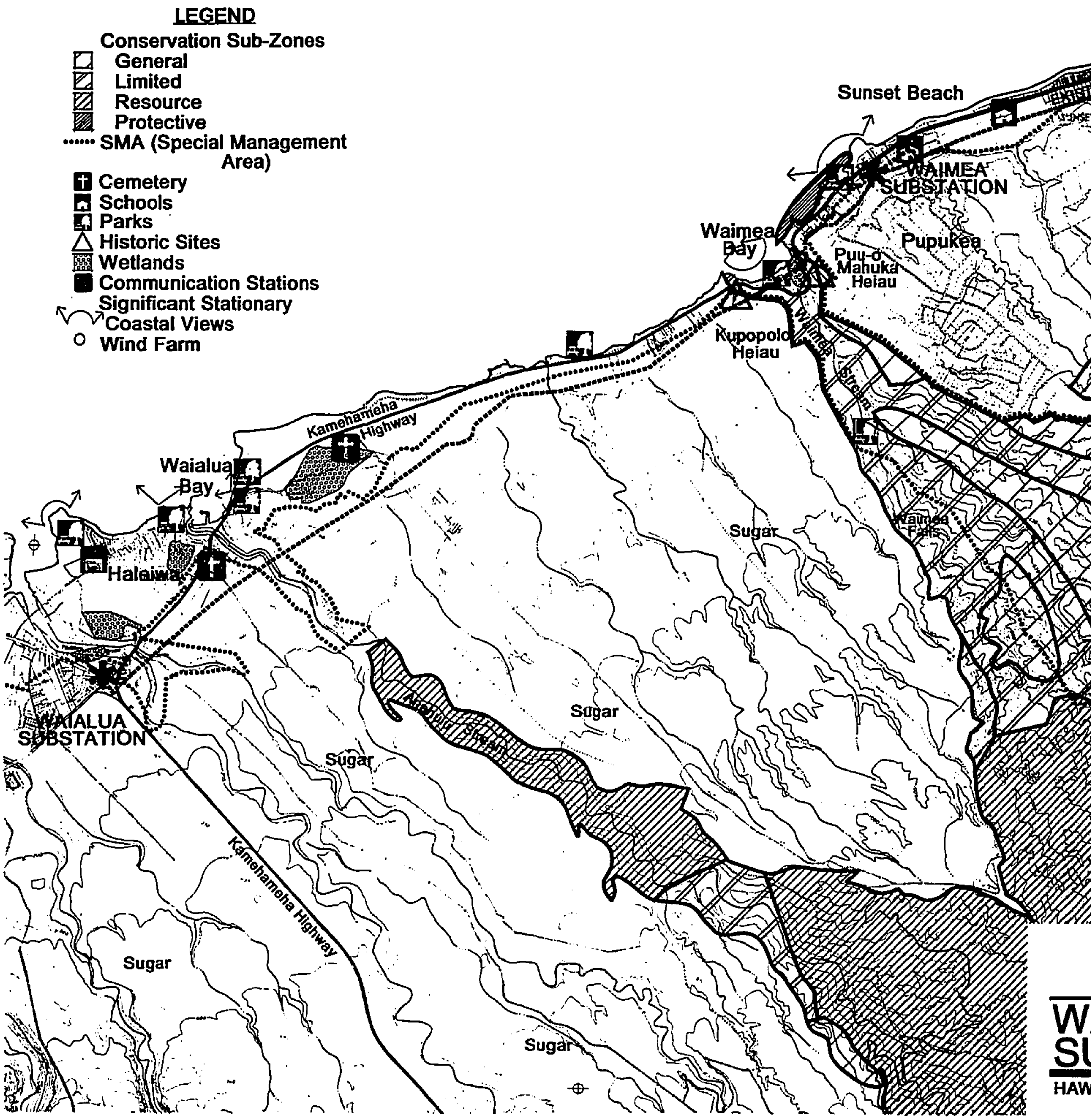
ENVIRONMENTAL AND LAND USE CONSTRAINTS RATING--UNDERGROUND LINE
WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE

ENVIRON/LAND USE CRITERIA	HIGH CONSTRAINT	MEDIUM CONSTRAINT	LOW CONSTRAINT
LAND OWNERSHIP	• Military Lands • Private Lands		• State Lands • City and County Lands
LAND REGULATION	• Conservation District, Protective, Resource and Limited • Special Management Area	• Conservation District, General	
EXISTING AND PROPOSED LAND USE	• Communications Sites • Proposed Development • Other Utilities • Agricultural Lands	• Residential Areas • Schools • Parks • Outdoor Public Areas • Military Training Areas	• Commercial/Business Areas
NATURAL DISASTER			• Tsunami Inundation Area • Flood Zone
TOPOGRAPHY AND SOILS	• Slopes Greater Than 10%	• Slopes 5-10%	• Slopes less than 5%
BIOLOGICAL RESOURCES	• Wetlands • Areas of Known Rare and Endangered Species • Conservation Lands and Forest Reserves		• Pasture and Agricultural Lands
VISUAL RESOURCES			• Residential Areas • Outdoor Public Areas--Shoreline/Beaches • Roadways • Agricultural Plains
CULTURAL RESOURCES	• State/National Register of Historic Sites • Other Known or Possible Archaeological Sites		

Environmental Sensitivity Analysis - The sensitivity analysis was accomplished by measuring the distance, in inches on a 1' = 1,000' scale constraints map, that each alignment alternative passed through or adjacent to areas rated high or medium constraint. For alignment segments where there were overlapping high and medium constraints, the more restrictive (high constraint) was recorded. The overhead constraint ratings were applied to the overhead sections only, and similarly, the underground constraint ratings were applied to the underground sections only. A map showing some of the constraints associated with the routing of the subtransmission line are shown on Figure 5-6.

For Land Ownership, Land Regulation, Natural Disaster, Topography and Cultural Resources factors, an alignment was assumed to affect the factor only if it passed directly through the area (i.e., if the alignment was located just outside of the boundary of the Special Management Area (SMA), no impacts to the SMA were assumed). However, for Visual Resources, Existing and Proposed Land Use, and Biological Resources, in addition to passing directly through areas, impacts were assumed to occur if the alignment was adjacent to the area. For example, if an overhead alignment was located on the other side of a road from a residential area, it was assumed there would be visual impacts to the residential area.

The distance that each alignment passed through a high or medium constraint area was measured and summed. For the segments of the alignments which were measured as high constraint areas, the measurement were summed and doubled to weight the high constraint heavier than measured medium constraint areas. Table 5-3 reflects the results of the measured constraints. It should be noted that because existing distribution lines provide a siting opportunity, the length of the distribution lines located along an alignment are subtracted from the constraint total. Additionally, to reflect the fact that a longer alignment is likely to have more


LEGEND
Conservation Sub-Zones
General
Limited
Resource
Protective
SMA (Special Management Area)
Cemetery
Schools
Parks
Historic Sites
Wetlands
Communication Stations
Significant Stationary Coastal Views
Wind Farm
Sunset Beach
WAIMEA SUBSTATION
Waimea Bay
Pupukea
Puu-o Mahuka Heiau
Kupopolo Heiau
Kamehameha Highway
Waialua Bay
Haleiwa
WAIALUA SUBSTATION
Sugar
Sugar
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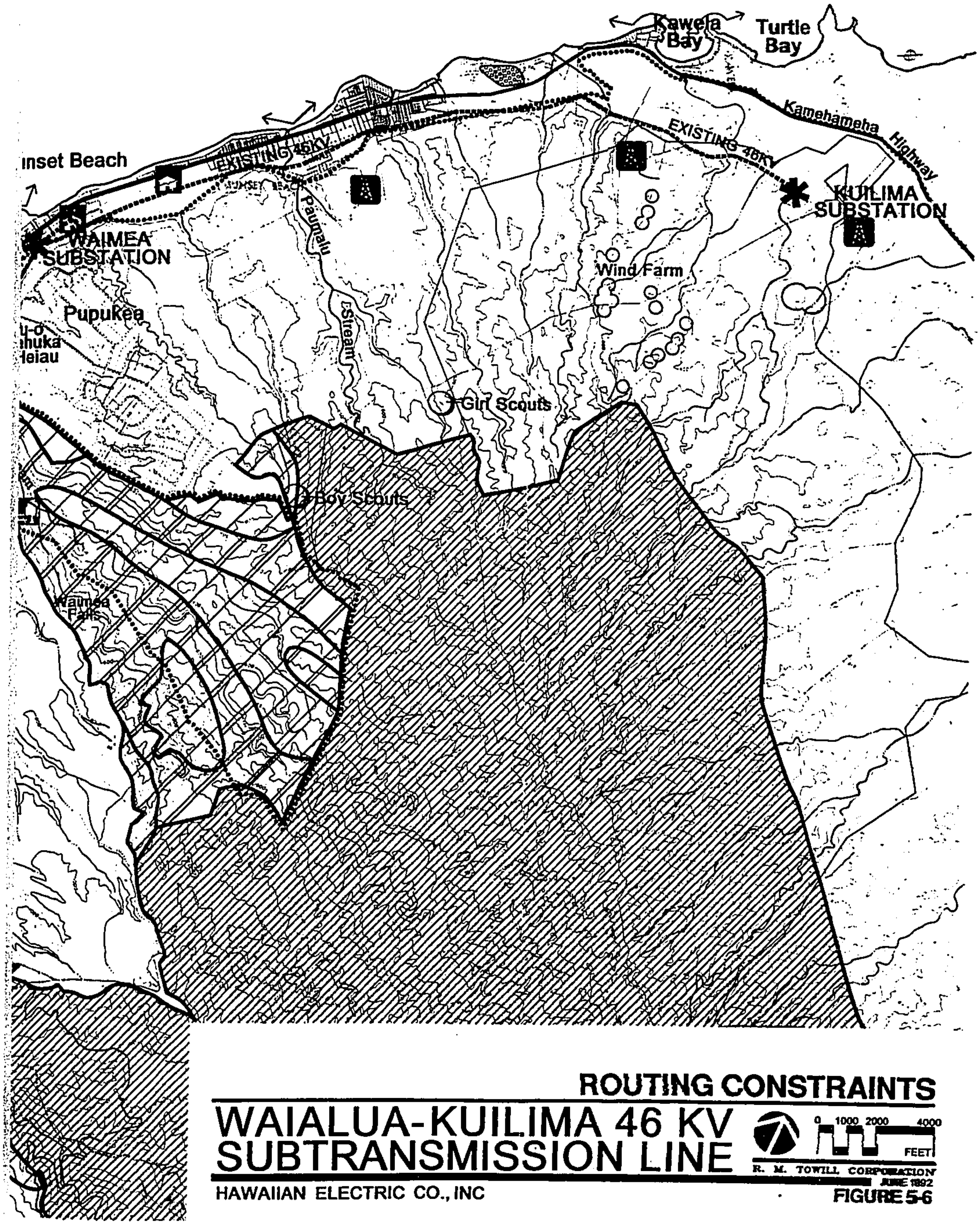
Sugar
Sugar
Kamehameha Highway



ROUTING CONSTRAINTS

WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE

HAWAIIAN ELECTRIC CO., INC

FIGURE 5-6

TABLE 5-3
ENVIRONMENTAL SENSITIVITY ANALYSIS
Waialua - Kuilima 46 KV Subtransmission Alignment Alternatives

	Evaluation Factors																
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
Alignment	(+) Length (inches)	(+) Land Ownership Easement (High)	(+) Land Regulation (High)	(+) Existing & Proposed Land Use (High)	(+) Natural Disaster (High)	(+) Biology (High)	(+) Visual (High)	(+) Cultural >50% for OH (High)	(+) Land Regulation (Medium)	(+) Existing & Proposed Land Use (Medium)	(+) Topography (Medium)	(+) Visual 2x (Medium)	(-) Collocation With Existing Line	(+) Number of Landowners Impacted	(+) Traffic Impacts 2x for Trenching	Sub Total	TOTAL OF SCORES Hi=2x
Line A (Coastal, Overhead)	68.00	4.000	61.500	23.000	68.000	n/a	65.500	12.000	n/a	40.000	n/a	n/a	55.000	3.000	1.000	223.000	457.000
Line A1 (Coastal, Underground)	68.00	3.000	60.000	22.000	n/a	n/a	n/a	23.000	n/a	26.500	5.000	n/a	n/a	3.000	2.000	144.500	252.500
Line B (Bluff)	64.25	45.250	23.500	20.000	28.000	n/a	55.000	8.000	n/a	30.000	23.000	15.000	3.000	9.000	0.500	254.250	434.000
Line C (Mid-Level, Makai)	67.75	60.250	10.000	15.000	3.000	3.000	16.000	11.500	3.000	52.000	22.000	6.000	4.000	8.000	0.500	206.250	325.000
Line D (Mid-Level, Mauka)	72.50	58.500	19.250	10.500	3.000	8.000	15.000	11.500	3.000	52.000	29.000	n/a	4.000	6.000	0.500	212.250	338.000
Line E (Mauka)	99.25	70.500	38.500	37.500	3.000	23.000	15.000	14.000	3.000	58.500	40.000	n/a	12.000	5.000	0.500	296.500	498.000

Notes:

N/A = Not applicable

1: Columns B through P derived by measurement of the portion of the alignment to which the factor applies (measurement in inches on map scale, 1" = 1,000')

2: Column Q sums across columns C to M minus Col. N plus Col. O & P

3. Col R doubles the score for Col. C to Col. I.

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potential for environmental impacts than shorter alignments, the length of each alignment was added to the constraint score. In comparing the raw scores, the lower scores represent lower potential environmental impacts. Table 5-4 is the same environmental sensitivity analysis with all the measurements converted into ratios. This was done to normalize the different measurements so that they can be compared and applied to further analysis with engineering/cost factors. The computation for each category is the ratio of each alignment measurement to smallest alignment measurement for that category (the smallest measurement having a ratio equalling 1).

The following summarizes the environmental and land use analyses for each of the alternative alignments:

- Alignment A, Coastal Overhead - A major advantage of this alignment is that it is located almost entirely within an existing right-of-way, Kamehameha Highway, thus minimizing the crossing of private land. This minimizes the impact on the valuable sugar lands of the Waialua Sugar Company. Because of its location within a right-of-way, it also will have very little impact on the biological resources (flora and fauna) in the area. However, being located close to the coast exposes the line to potential damage from tsunamis.

  Most of the alignment falls within the Special Management Area, which requires City Council approval for use. The portion of the alignment which crosses through the Waimea Bay area is within the State Conservation District, Limited Subzone. This requires the State Board of Land and Natural Resources approval. The segments exiting the Waialua Substation and along the Haleiwa Bypass Road also fall within the Haleiwa Special District and are

TABLE 5-4
ENVIRONMENTAL SENSITIVITY ANALYSIS
Waialua - Kuilima 46 KV Subtransmission Alignment Alternatives

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Evaluation Factors																
Alignment	(+) Land Ownership (High)	(+) Land Regulation (High)	(+) Existing & Proposed Land Use (High)	(+) Natural Disaster (High)	(+) Biology (High)	(+) Visual (High)	(+) Cultural (>50% for O) (High)	(+) Land Regulation (Medium)	(+) Existing & Proposed Land Use (Medium)	(+) Topography (Medium)	(+) Visual 2x (Medium)	(-) Collocation With Existing Line	(+) Number of Landowners Impacted	(+) Traffic Impacts 2x for Trenching	Sub Total	TOTAL OF SCORES Hi=2x	Ratio of Col S
Line A (Coastal, Overhead)	1.333	6.150	2.190	22.667	n/a	4.367	1.500	n/a	1.509	n/a	n/a	-18.333	1.000	2.000	24.383	62.590	2.023
Line A1 (Coastal, Underground)	1.000	6.000	2.095	n/a	n/a	n/a	2.875	n/a	1.000	1.000	n/a	n/a	1.000	4.000	18.970	30.940	1.000
Line B (Bluff)	15.083	2.350	1.905	9.333	n/a	3.667	1.000	n/a	1.132	4.600	30.000	-1.000	3.000	1.000	72.070	105.408	3.407
Line C (Mid-Level, Makai)	20.083	1.000	1.429	1.000	1.000	1.067	1.438	1.000	1.962	4.400	2.000	-1.333	2.667	1.000	38.712	65.728	2.124
Line D (Mid-Level, Mauka)	19.500	1.925	1.000	1.000	2.667	1.000	1.438	1.000	1.962	5.800	n/a	-1.333	2.000	1.000	38.958	67.487	2.181
Line E (Mauka)	23.500	3.850	3.571	1.000	7.667	1.000	1.750	1.000	2.208	8.000	n/a	-4.000	1.667	1.000	52.212	94.550	3.056

Notes:
N/A = Not applicable
1: Columns B through O are ratios derived from measurement of the portion of the alignment to which the factor applies.
2: Column P sums across columns B to L minus Col. M plus Col. N and O.
3. Col. Q doubles scores for Col. B to Col. H & Col. L
4. Col. O imposes a traffic disruption penalty for trenching along a public highway.
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subject to special district requirements outlined in the City and County of Honolulu Land Use Ordinance.

The alignment passes through the rural coastal communities along the North Shore, which are comprised of mainly residential and commercial uses. Because of its location adjacent to some of the developed areas, this alignment would be the most visible to the public. However, because it will be collocated with existing lines, overbuilding existing poles with extensions or replacing existing poles with slightly taller new poles, the overall visual impact will be much less than installing new poles and lines in a completely new alignment.

This alignment crosses several areas of archaeological concern; however, as impacts would generally be limited to excavation for new pole foundations next to existing poles, it should not have a major affect on archaeological resources.

- Alignment A1, Coastal Underground - As with Alignment A, a major advantage of this alignment is that most of it is located within the Kamehameha Highway right-of-way. This would minimize the impacts on private landowners. Also, being an underground alternative, there would be no impacts on biological and visual resources.

Most of the alignment falls within the Special Management Area, which requires City Council approval for use. The portion of the alignment which crosses through the Waimea Bay area is within the State Conservation District, Limited Subzone. This requires the State Board of Land and Natural Resources approval. The segments exiting the Waialua Substation and along the Haleiwa Bypass Road also fall within the Haleiwa Special District and are subject to special district requirements outlined in the City and County of Honolulu Land Use Ordinance.

Because this alternative requires trenching for the installation of the underground line, there would be concern where the alignment crosses identified areas of archaeological sensitivity. These include the Waialua/Haleiwa area, Anahulu, Waimea, Pupukea/Paumalu, and Waiale'e.

This alignment rated the highest for environmental and land use considerations.

- Alignment B, Bluff - This alignment is the shortest; however, over 70% of it's length would cross private lands, impacting a number of landowners. Portions of the alignment would traverse the outer edges of sugar cane fields and military use lands.

About a third of the length of the alignment is located within the Special Management Area. This includes portions of the line which pass through Haleiwa, Waimea Bay and Sunset Beach. The portion which crosses through the Waimea Bay area is also within the State Conservation District, Limited Subzone. The segments exiting the Waialua Substation and along the Haleiwa Bypass Road also fall within the Haleiwa Special District and are subject to special district requirements outlined in the City and County of Honolulu Land Use Ordinance.

The alignment passes through portions of Haleiwa and Sunset Beach, making it visible to the public in these areas. Additionally, the new poles and lines that would be located along portions of the bluff that are visible from Kamehameha Highway would have a negative visual impact.

Although major portions of the alignment are located on the bluffs, there are some areas where it falls within the tsunami inundation area and 100-year flood zones.

In the ascent and descent of the bluffs, the line would encounter steep slope conditions. It also would require crossing several gulches and ravines.

- Alignment C, Mid-Level Makai - Over 11 miles of this alignment would cross private lands, impacting a number of landowners. About half of the alignment crosses through prime agricultural land. It bisects the community of Pupukea and then crosses large areas of undeveloped lands. The lands adjacent to and north of Pupukea, are proposed for future housing. Beyond this area, the land is used by the military for training. With most of the line situated at higher elevations, exposure to tsunami and flood hazards is minimal.

  This alignment has the least amount of length that would pass through regulated lands. It crosses the Special Management Area at various locations in the vicinity of Haleiwa and the crossing at Waimea Valley. It also traverses the Limited and Conservation Subzones, of the State Conservation District at Waimea Valley. The location of the crossing is makai of Waimea Falls, over portions of the park.

  In addition to crossing large expanses of sugarcane fields, the alignment would pass through stretches of heavily forested undeveloped land. It would also cross a number of wide gulches, which would require special H-frame support structures.

This alignment crosses several areas of archaeological concern, specifically areas in the vicinity of Anahulu Stream, Waimea Valley and Paumalu. Because the areas affected are undeveloped, there may be some negative impacts.

- Alignment D, Mid-Level Mauka - Almost the entire alignment would cross through privately owned land. Where possible, the alignment follows the boundaries of properties to avoid dissecting the properties. Of all the alternatives, this alignment would have the least impact on existing and proposed development. As with Alignment C, where the alignment crosses agricultural lands, the proposed subtransmission line will be placed along side service roads and field boundaries as much as possible to minimize the impact on the agricultural operations. As the alignment heads north beyond Waimea Valley, it is routed along the edge of the military training areas to minimize impacts to operations in the training area. The alignment also has the potential of some impact on biological resources as it crosses more undeveloped areas.

  In exiting Waialua Substation and crossing Waimea Valley, the alignment crosses through a small portion of the Special Management Area. In addition, the alignment passes through a portion of the State Conservation District lands as it crosses Anahulu Stream and Waimea Valley. The Conservation District Subzones affected include General, Limited and Resource.

It also would have some degree of visual impact on residential and outdoor public areas where the line crosses Waimea Valley.

This alignment crosses over or near areas of archaeological concern, specifically areas in the vicinity of Anahulu Stream, Waimea Valley and upper Paumalu where the lines will be suspended over the valleys. Because the areas affected are undeveloped, care will need to be taken when placing overhead lines.

- Alignment E, Mauka - This alignment is the longest of all the alternatives, covering nearly 19 miles, including a tap that extends almost five miles to the Waimea Substation. Close to 16 miles of the alignment would be over privately owned lands. Over a third of the alignment would go through prime agricultural land. Another eight miles traverses rugged, heavily vegetated open areas, of which close to five miles are on Army leased land. The terrain in these areas consists of numerous ridges, valleys, gulches and ravines. This alignment would have the greatest impact on biological resources as the alignment crosses through undeveloped, heavily forested areas that contain native vegetation.

The alignment crosses through Special Management Areas mauka of the Waialua Substation and at Waimea Valley. It also passes through State Conservation Districts at Anahulu Stream, upper Waimea Valley, Kawailoa Forest Reserve and Kahuku Forest Reserve. The portions crossing the forest reserves are within the Resource Subzone of the State Conservation District.

This alignment crosses two areas of archaeological concern: the areas in the vicinity of Anahulu Stream and upper Waimea Valley. Because the areas affected are undeveloped, there may be some negative impacts.

Engineering and Cost Sensitivity Analysis - Each alignment was analyzed in terms of engineering and cost considerations as discussed in paragraph 5.5.1 above. As in the case of the environmental/land use criteria, a quantitative analysis was conducted on the engineering/cost criteria. Table 5-5 reflects the results of the sensitivity analysis. Each of the categories of the analysis are briefly described below.

- Alignment Length. This category reflects the ratio of the alignment length to the shortest alignment. The shorter the length, less cost and time will be required to construct the subtransmission line depending on terrain. The length of each of the alignments are:

Alignment	Approximate Length (Miles)
A - Coastal, Overhead	12.9
A1 - Coastal, Underground	12.9
B - Bluff	12.2
C - Mid-Level, Makai	12.8
D - Mid-Level, Mauka	13.7
E - Mauka	18.8

- Existing Right-of-Way. This category indicates the percentage of the alignment which is located within an existing public right-of-way. The greater amount of alignment within a right-of-way, the less engineering and cost requirements.

TABLE 5-5
ENGINEERING AND COST SENSITIVITY ANALYSIS
Waialua - Kuilima 46 KV Subtransmission Alignment Alternatives

A	B	C	D	E	F	G	H	I
Alignment	(+) Alignment Length Ratio	(-) Existing ROW Ratio	(+) Access for Const. & Maint. Ratio	(+) Relocation Cost Ratio	(+) Construction Cost Ratio	(+) Redundancy and Line Protection Ratio	Total Sum (B to G)	Ratio of Sum
Line A (Coastal, Overhead)	1.058	-0.949	1.000	1.217	1.251	2.000	5.578	1.000
Line A1 (Coastal, Underground)	1.058	-0.949	1.500	7.786	5.046	n/a	14.441	2.589
Line B (Bluff)	1.000	-0.280	2.000	2.242	1.238	7.000	13.199	2.366
Line C (Mid-Level, Makai)	1.054	-0.114	2.000	1.582	1.000	1.000	6.523	1.169
Line D (Mid-Level, Mauka)	1.128	-0.034	2.500	1.000	1.018	1.000	6.612	1.185
Line E (Mauka)	1.545	-0.141	4.000	1.099	1.333	1.000	8.835	1.584

Notes:

1: Column B is the ratio of the alignment's length to the shortest alignment

2: Column C is percentage of alignment within existing public right-of-way (higher number indicates greater length in existing ROW)

3: Col D shows access as either good = 1 (75-100% in public ROW), fair = 2 (50-75% in public ROW), poor = 3 (less than 50% in public ROW); very poor =4 (less than 25%)

4: Column E shows ratio of relocation cost based on percent replacement required.

5. Col. F shows the ratio of construction cost.

6. Col. G shows the alignment reliability factor considering the number of crossing made of the extg. 46kv line, if not underground.

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- Access for Construction and Maintenance. The better access to the subtransmission line accommodates construction, and improves responsiveness and lowers cost for maintenance and repair requirements. This category generalizes the accessibility of the alignment and arranges them into good, fair or poor groups. Good access is given a "0" rating, fair access a "1" rating and poor access a "2" rating.

- Relocation Cost. This category reflects the ratio of the anticipated costs for the potential future relocation of the proposed line. The costs include the system replacement costs for the portions of the line which could potentially require relocation.

- Construction Cost. This category reflects the ratio of the alternative's total construction cost to the lowest cost alternative. Construction cost estimates, excluding easements, for each of the alternative alignments are summarized below:

Alignment	Estimated Cost (Millions)
A - Coastal, Overhead	$10.1
A1 - Coastal, Underground	$40.6
B - Bluff	$10.0
C - Mid-Level, Makai	$8.1
D - Mid-Level, Mauka	$8.2
E - Mauka	$10.7

- Redundancy and Line Protection. This category considers an alignment reliability factor based on the number of times the alternative alignments cross the existing 46 kV line. It reflects the ratio of the number of existing line crossings for each alignment to the number of crossings for the alignment with the least number of crossings. The more times the alignment crosses the existing line the less reliable the alternative as there are more opportunities for the new line to fall and knock out the existing line below it.

The following summarizes the engineering and cost analyses for each of the alternative alignments:

- Alignment A, Coastal Overhead - As indicated earlier, this alignment is located within an existing right-of-way which equates to less cost requirements for easements. However, because much of this alignment is within areas subject to coastal hazards, such as tsunamis and hurricanes, the more stringent design requirements would result in higher costs. The line will be the most accessible alignment, which will accommodate construction, and improves responsiveness and reduces costs for maintenance and repairs. The cost for constructing this alternative ranks fourth among the six alternatives.

- Alignment A1, Coastal Underground - Location within an existing right-of-way is a major benefit of this alternative. Despite excellent access all along the alignment, the physical accessibility to the line itself is hampered because it is buried underground, making it difficult for fault location and subsequent repair. At an estimated construction cost of over $40 million, it is by far the most expensive alternative, more than five times the cost of the lowest cost alternative.

- Alignment B, Bluff - This alignment would require obtaining easements for over eight and a half miles of the alignment. Accessibility for construction and maintenance of this alignment would be difficult as major portions cross steep terrain and undeveloped areas. Despite access difficulties, which would complicate construction of the line, the construction cost for this alignment is ranked third.

Another major disadvantage of this alignment is the line would cross the existing 46 kV line at several locations. This compromises the reliability of the system should lines go down at the points of crossing.

- Alignment C, Mid-Level Makai - Costs for over 11 miles of easements would be required for this alignment. Because only a small portion of this alignment is located within public rights-of-way, accessibility for construction and maintenance would be more difficult, time consuming and costly. This alignment is the least costly of the six alignments evaluated.

- Alignment D, Mid-Level Mauka - Nearly all the alignment is located outside of public rights-of-way, which would result in the acquisition of easements. Accessibility for construction and maintenance would be through the use of existing cane haul roads and services roads. This alignment is the ranks second lowest from among the six alternatives.

- Alignment E, Mauka - This alignment would be the most expensive to construct of all the overhead alternatives because of it's length, inaccessibility and crossing of rough terrain. As indicated above, nearly 16 miles of the alignment is located outside of public rights-of-way, and therefore easements will need to be acquired for this alignment. In addition, because most of the alignment would cross through sugar cane fields and undeveloped areas, accessibility would be poor adding to construction and maintenance costs. Also, the alignment traverses lands that are highly dissected with gulches and ravines, which would complicate engineering and add to the overall cost of this alternative.

Composite Sensitivity Analysis - The results of the environmental/land use and engineering/cost sensitivity analyses were compiled into a composite sensitivity analysis. The composite analysis varied the weight given to the environmental/land use criteria and the engineering/cost criteria to test the sensitivity of the alternate alignment rankings. The intent was to assess how the different alignments would fair when more importance is given to environmental/land use factors (70% environmental/30% engineering), engineering/cost factors (70% engineering/30% environmental), and when both groups are considered equally. Table 5-6 shows the composite weighted rankings for the alternative alignments.

With the equally weighted composite scores, the Coastal Overhead (Line A) and Mid-Level Makai (Line C) alternatives ranked first and second, with the Mid-Level Mauka (Line D) alternative next. For the environmental weighted composite scores, both Coastal Underground (Line A1) and Coastal Overhead (Line A) alternatives ranked highest, with the Mid-Level Makai (Line C) ranking third. Finally, the engineering weighted composite rankings had the same top three alternatives as the equally weighted composite scores. As can be seen, based on a comprehensive quantitative environmental and engineering analysis, the Coastal Overhead alternative alignment numbers rate this alternative to be the best. However, in closely examining the outcome of this analysis, it was also apparent that the Mid-Level Makai and Mauka alternatives were options that followed very closely in their scores. Because of this, a closer comparison of the top three alternatives was conducted.

TABLE 5-6

COMPOSITE SENSITIVITY ANALYSIS

Waialua - Kuilima 46 KV Subtransmission Alignment Alternatives

	Composite		Environmental		Engineering	
A	B	C	D	E	F	G
Alignment	Equal Weight Ratio	Ranking Equal Weighted 50:50	Ratio	Ranking Environmental Weighted 70:30	Ratio	Ranking Engineering Weighted 70:30
Line A (Coastal, Overhead)	1.51	1	1.72	2	1.31	1
Line A1 (Coastal, Underground)	1.79	4	1.48	1	2.11	5
Line B (Bluff)	2.89	6	3.09	6	2.68	6
Line C (Mid-Level, Makai)	1.65	2	1.84	3	1.46	2
Line D (Mid-Level, Mauka)	1.68	3	1.88	4	1.48	3
Line E (Mauka)	2.32	5	2.61	5	2.03	4

Col. C = ranking based on equal weighting of environmental and engineering ratios

Col. E = Composite ranking which weights the environmental scored by 70%, and the engineering by 30%.

Col. G = the opposite weighting as col. E

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5.3.5 Preferred Alignment Selection

The factors considered in further evaluating the top three alignment alternatives were cost, environmental concerns, community concerns and permitting. Selection of the factors was based on issues that contributed to lower cost, community acceptance and reducing the permitting requirements. Table 5-7 summarizes the comparative evaluation of Alignments A, C an D. The following subparagraphs provide expanded discussions of some issues that have been further examined in selection of the preferred alignment.

Cost - In 1992 there was a significant number of hurricanes and typhoons which struck populated areas worldwide, inflicting significant damage to those areas. Included among these was Hurricane Iniki, which was the most destructive hurricane to hit the Hawaiian Islands this century. This event, which caused severe damage to electrical systems on the Island of Kauai, prompted HECO to take a closer look at the ability of their overhead infrastructure systems to withstand the effects of a hurricane. A design analysis of pole structures was conducted with the resultant decision by HECO to upgrade the specifications of their poles to be able to withstand higher loads imposed by winds and flooding. This resulted in boosting the costs of pole installation over 100% for flood zones and other areas by about 35%. The impact of the cost increase was significant in the cost comparison between the top three alternatives. Because much of the Coastal Route (Alignment A) traverses flood zones and nearly the entire routes of the Mid-Level Makai and Mauka alternatives Alignments C and D) are outside of flood zones, the cost advantages of Alignments C and D over Alignment A were widened. From the cost factor, this has made the mid-level options more desirable.

Community Concerns - Public feedback on the project was received through meetings and interviews with the various sectors of the public and responses from the project Environmental Impact Statement Preparation Notice. The feedback received are

TABLE 5-7

COMPARATIVE ANALYSIS OF ALIGNMENTS 'A', 'C', AND 'D'

FACTORS CONSIDERED	ALIGNMENT A	ALIGNMENT C/D
COST	- Higher construction cost	+ Lower construction cost
	- Longer construction time	+ Shorter construction time
	+ Maximum use of existing easement	- Higher easement costs
	+ Maintenance access good	- Maintenance access more difficult
ENVIRONMENT	+ Minimal impact on environment	- Route selection can minimize impact
	- Visual impact high	+ Minimal visual impact
	- Subject to tsunami damage/high wi	- Requires provision for high winds
COMMUNITY	- Underground desired	+ Maximum use of overhead lines
	- Traffic disruption potential high	+ Minimal traffic disruption
	- Not heavily favored by community	+ High community acceptance
PERMITTING	- High probability for underground	+ Standard permitting requirements
	requirement	
RELIABILITY	- Subject to auto damage	+ Greater separation from existing polelin
fn: analysis.xls		

summarized in Table 5-8. Community/public, landowner and agency concerns taken in aggregate, did not reflect an agreed upon preference of alignment. The general public/community consensus ranged from favoring an underground alternative to acceptance of a mauka overhead routing. Major landowners and developers, on the other hand, generally supported the placement of the new subtransmission line along Kamehameha Highway. An exception was the Obayashi Company, which favored the mauka (Alignment D) option. As summarized in Table 5-7, the mauka alignments have several advantages over the coastal alignment. In comparing Alignment C and D, the community as well as landowners considered crossing Waimea Valley makai of Waimea Falls not desirable. Therefore, Alignment D (Mid-Level Mauka) would be considered the preferred alignment.

It should be noted that the evaluation of the alternative alignments originally considered a 46 kV tap off the new Waialua-Kuilima 46 kV subtransmission line to serve the existing Waimea Substation which is located approximately midway between the Waialua and Kuilima Substations (see Figure 5-5). The Waimea Substation is currently served by a 46 kV tap off the existing 46 kV subtransmission line along the North Shore. Should an outage occur on the portion of the 46 kV line between Waialua and Waimea Substations, a troubleman would have to manually open the 46 kV switch between Waialua and Waimea Substations, and close the normally open switch at Kahuku Substation to transmit power from Koolau Substation in Kaneohe. Besides being inconvenienced by the power outage during the time the switches are being manually opened and closed, customers served by the Waimea Substation could also experience low voltage problems due to the long distance between the Koolau and Waimea Substations. A tap off the new Waialua-Kuilima 46 kV subtransmission line would have alleviated both problems.

However, during the public informational meetings, concerns were raised by residents against a new 46 kV subtransmission poleline traversing overhead through the Pupukea

COMMUNITY CONCERNS/ISSUES
WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE

GROUP TYPE	GROUP NAME	VISUAL	SAFETY/RELIABILITY	UNDERGROUND	EMF	COST	OTHER OPTIONS/CONCERNS	PREFERRED ALTERNATIVE
COMMUNITY GROUPS	Public Information Meeting	* Impact of pole extensions * Profile of poles needed	* Exposure to tsunami/natural disasters * Increased danger of fallen poles for coastal OH route * Impacts from cars and coastal environment reduce route reliability	* Possibility of undergrounding with other utilities * Consider undergrounding 12 kV line * Look at underground in Waimea Bay area	* Impacts on radio reception	* Potential decrease in maintenance cost for UG system on coastal route * Evaluate alternatives including maintenance costs	* Routing thru Pupukea	* Varied
	North Shore Neighborhood Board	* Impact of pole extensions		* Underground 46 kV on Coastal Route * Look at possibility of placing all lines underground	* Effects along coastal route	* Look at life cycle costs	* Impact of Mauka Route on military med-evac * Look at coming from Wahiawa and follow Drum Road from Helemano	* Underground * Drum Road from Wahiawa
	North Shore Communities for Quality Development	* Impact of pole extensions on coastal views	* Capability of existing poles to support pole extensions * OH vs. UG, which is safer?		* Effects on human body	* Cost of lines and who will fund? * What will increase be in electric bill?		* No preference indicated
	Sunset Beach Community Association	* Impact of pole extensions * Impact of Alignment B (Bluffs Route)	* Danger of line falling on highway * Capability of existing poles to support pole extensions * Increased injury risk from traffic accident (sturdier poles)	* Underground 46 kV on Coastal Route * Look at possibility of placing all lines underground	* Effects along coastal route * Interference with reception	* Cost of UG vs long-term maintenance costs * Cost of repair following hurricane * Why can't HECO bear some of cost? * Higher costs if underground in future	* Was pole extensions a viable option when existing 46 kV line was put in? * Look at composite route * Increased traffic for coastal installation	* Underground * Mauka route - Drum Road
	Waialua Community Assoc.		* Reliability an important factor			* Cost to individual rate payer		* Kamehameha Hwy alignment
LANDOWNERS	Bishop Estate	* Impact on visual quality	* Accident potential along highway			* Estimated cost to individuals?	* Working Master Plan for North Shore	* Kamehameha Hwy alignment
	Campbell Estate	* Impact on resort area (height and distance between poles)		* Consider for 12 kV line also			* Relocation clause required if on Campbell lands * Working Master Plan for Kahuku area	* Underground * Mauka Route (Drum Road) second choice
	Castle and Cooke	* Height and appearance of new poles	* Looking at developing helipad mauka of highway at Chun's				* Cane burning-problem in operations when lines go through fields * Alignments B, C and D affect growing area for Waialua Sugar	* Kamehameha Hwy alignment, due to limited impact on sugar operations
	Obayashi Hawaii Corp.	* Impact of coastal route on project-view of lines from above * Impact of overhead lines in project		* Option for alignments B and C? * Possibility of undergrounding in the Pupukea and Sunset Beach areas?			* Viability of Wahiawa tap? * Alignment B not favorable because on bluff & poles may be in some lots	* Alignment D, tap to Waimea along Pupukea Road
	Waimea Falls Park	* Impact of alignments crossing park * Cross mauka portions of valley	* Reduced redundancy with coastal OH in case of flood, tsunami & hurricane	* Desirable visually	* Impact on radio/TV reception	* Cost needs to be averaged out over life of the alignment	* Look at Drum Road feasibility * Master Plan includes trails and cabins	* No preference indicated
PUBLIC OFFICIALS	Councilwoman Rene Mansho						* Avoid makai side of highway & SMA	* Underground
	Rep. Robert Bunda							* No preference indicated
	Rep. Alex Santiago		* Reliability important for N. Shore					* No preference indicated
	Sen. Gerald Hagino				* Health concerns of EMF, high voltages related to certain health issues	* Concern for the most cost effective route	* Impact on traffic during construction	* No preference indicated
GOV'T AGENCIES	Dept. of Land and Natural Resources	* Concern for CDUA	* Need for fire contingency plan	* Likely to have adverse impact on numerous subsurface sites			* Mitigation plan for alignments affected by threatened or endangered species * Avoid Protective Subzone	* Kamehameha Hwy alignment
	Dept. of Education				* Effects on students and faculty		* Construction interference on school	* No preference indicated
	Dept. of Transportation						* Future plan to widened hwy to 4 lanes	* No preference indicated
	Dept. of General Planning	* Show impacts of alternatives		* Policy, UG in urban or scenic coastal areas				
	Army, DPW		* Orange markers required on lines. * Impact on training areas a concern				* Overhead line in training area	* Prefer the Coastal Alignment
	Dept. of Land Utilization	* Concern over aesthetics			* Health issues a concern		* Impact on traffic during construction * Impact on coastal recreational use * Runoff into Waimea Stream	* No preference indicated

FN: CONCERNS.WK1 FEBRUARY 23, 1995

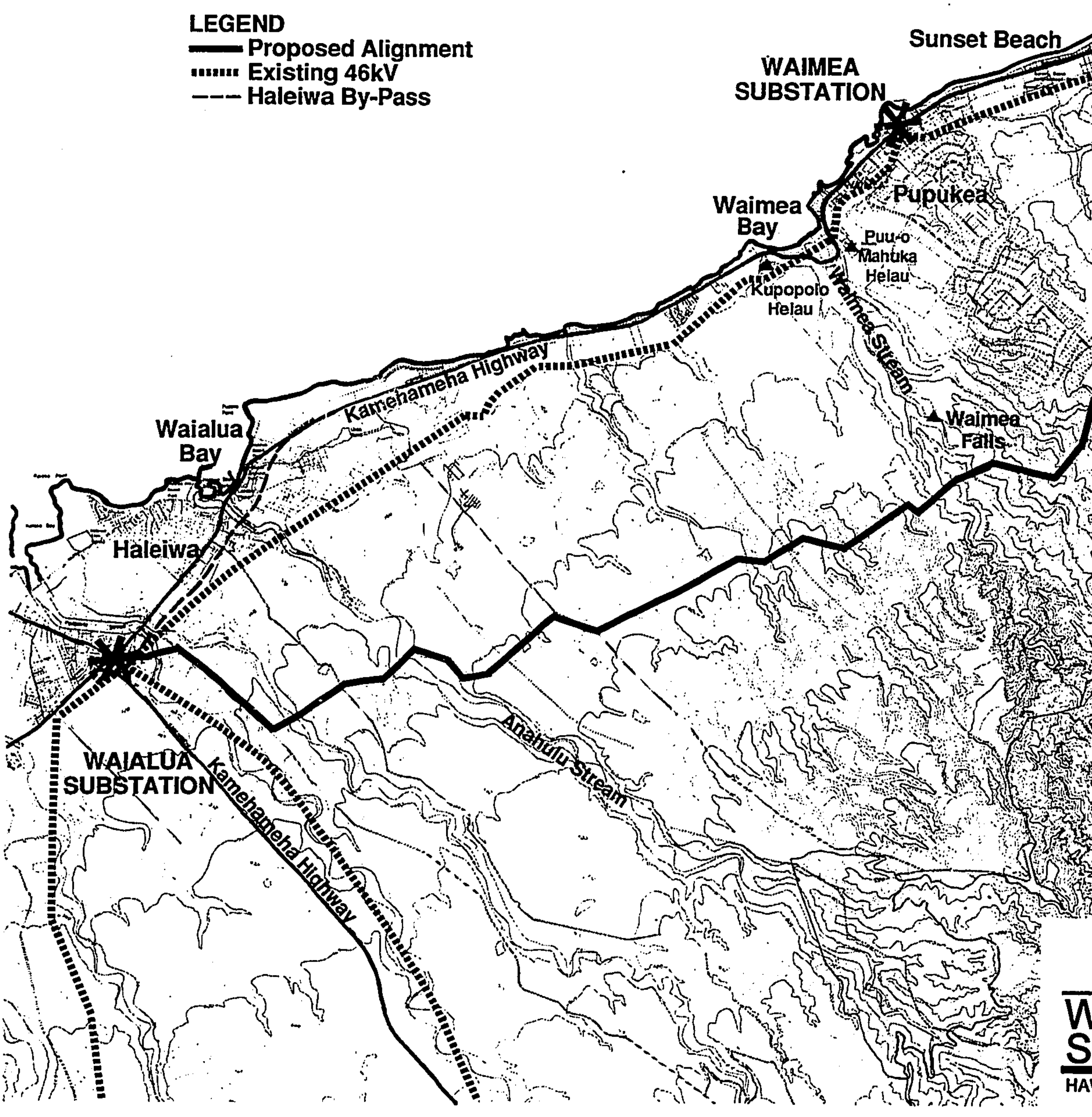
TABLE 5-8

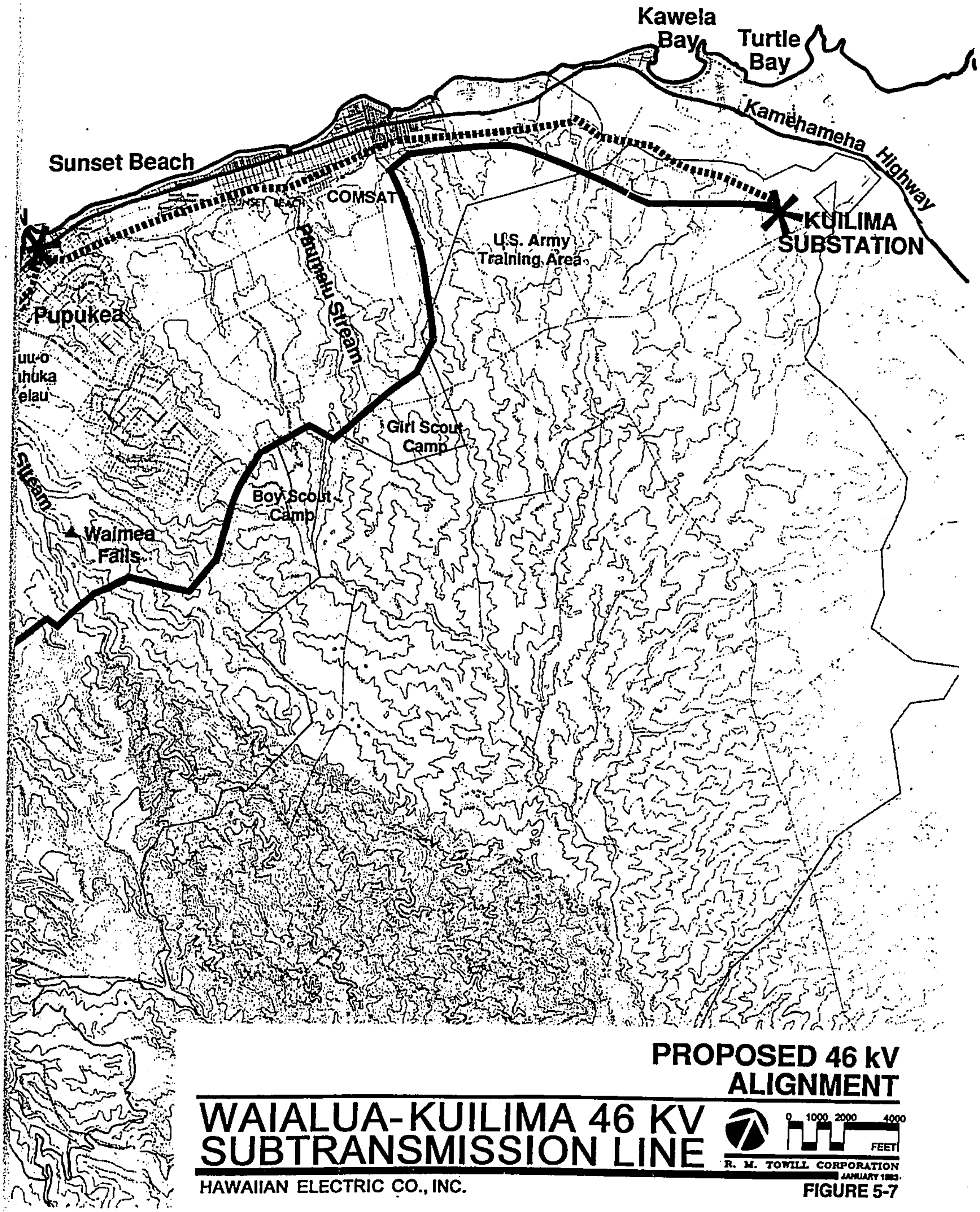
subdivision. Also associated with this tap was the additional construction costs. Alternatives to accomplish the same objectives as a second tap to Waimea Substation were investigated. Once such alternative was to automate the switching function at the subtransmission and distribution levels at both the Waimea and Kuilima Substations, and to physically run the existing 46 kV subtransmission line into and out of Waimea Substation rather than only providing a tap into the substation. This alternative provided for increased reliability at the Waimea Substation as well as negated the need for an overhead tap from the new Waialua-Kuilima 46 kV subtransmission line. The preferred alignment as described in the next section takes this alternative into consideration and no tap is shown from the preferred alignment to Waimea Substation.

5.3.6 Preferred Alignment - Alignment D (Mid-Level, Mauka)

Based on the evaluation covered in paragraph 5.3.5 above, the Mid-Level Mauka alignment (Alignment D) was selected as the preferred alignment. This alignment was selected over Alignment A (Coastal) primarily because of lower costs and general community acceptance. Selection over Alignment C (Mid-Level, Makai) was focused more on general public acceptance as Alignment C would span Waimea Valley makai of Waimea Falls, bisect the Pupukea Community and cross the middle of the proposed Obayashi development.

Figure 5-7 reflects the proposed alignment. It should be noted that the selected alignment has been further refined to minimize impacts on lands that are currently used by the U.S. Army for field training. This change was prompted by concerns expressed by the Army on the negative impact of restrictions being placed on flying operations and limiting land navigation training flexibility. It should be noted that continued discussions will be held during the design phase of this project with each of the affected landowners to minimize impacts on their properties.


LEGEND
Proposed Alignment
Existing 46kV
Haleiwa By-Pass
Sunset Beach
WAIMEA
SUBSTATION
Pupukea
Waimea
Bay
Puu-o
Mahuka
Heiau
Kupopolo
Heiau
Waimea Stream
Waimea
Falls
Kamehameha Highway
Waialua
Bay
Haleiwa
WAIALUA
SUBSTATION
Kamehameha Highway
Anahulu Stream



PROPOSED 46 kV
ALIGNMENT

WAIALUA-KUILIMA 46 KV
SUBTRANSMISSION LINE

HAWAIIAN ELECTRIC CO., INC.

R. M. TOWILL CORPORATION

FIGURE 5-7

SECTION 6

IRREVERSIBLE AND IRRETRIVABLE COMMITMENTS

SECTION 6
IRREVERSIBLE AND IRRETREIVABLE COMMITMENTS

The proposed 46 kV subtransmission line project will require an irreversible and irretrievable commitment of a number of resources for its completion. These resources will include capital, materials, manpower and energy. Financial, material and manpower resources will be irretrievably committed to the planning, design and construction of the proposed action. Energy will also be required for the completion and operation of the project.

SECTION 7

UNRESOLVED ISSUES

SECTION 7
UNRESOLVED ISSUES

7.1 EASEMENT REQUIREMENTS

An issue that requires resolution prior to the installation of the proposed subtransmission line is the acquisition of easements along the alignment to permit the construction, operation and maintenance of the subtransmission line on private property. Almost the entire length of the proposed alignment will traverse privately owned property. The landowners affected include Castle and Cooke, Bishop Estate, Campbell Estate, Waimea Falls Park, the State of Hawaii and a number of other smaller property owners. In addition to the landowners, lessees, such as the Department of the Army and Waialua Sugar Company, will also be contacted in order to gain access across property under lease.

Paragraph 2.4 of this EIS covers in detail the process for acquiring right-of-way easements. Briefly summarizing the process, each of the landowners affected will be contacted to review the proposed alignment in order to gain concurrence on the proposed right-of-way. In all instances, HECO will work with the affected landowners and lessees in order to minimize potential land impacts. Following this action, discussions will be held to negotiate a price for the easement. If negotiations are not successful and adjustments to the routing of the line are impractical, HECO may exercise it's right of eminent domain. In the case of lands leased by the Army, however, if a mutually satisfactory alignment cannot be reached, then an alternative route will need to be selected from among those presented in this document. Further, this right to condemn land for the proposed alignment will only be used if the landowner refuses to grant an acceptable easement and there are no other alternatives. In such a case, fair compensation will be provided.

The actual number, location and cost for each easement required to construct the proposed line will not be resolved until the design phase of the project.

7.2 ELECTRO-MAGNETIC EFFECTS

The discussion presented in Section 3 and Appendix C regarding the affects of electric and magnetic fields (EMF) generated from power lines indicated that the predominant view of the scientific community is that the evidence gathered thus far does not demonstrate that power lines adversely affect human health. Because there is no conclusive evidence on the health effects associated with electric and magnetic fields, HECO's has adopted a policy to minimize EMF effects on humans wherever feasible by: 1) avoidance, where alternatives are available, the lines will be directed away from residential areas, 2) engineering, by configuring the conductors in a manner that reduces the fields generated.

HECO will continue its research and consult with governmental agencies like the State Department of Health, and the scientific community in order to gain a better understanding of this phenomena.

SECTION 8

PARTIES CONSULTED FOR PREPARATION OF THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

SECTION 8
PARTIES CONSULTED FOR PREPARATION OF THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

The following lists the agencies, organizations and individuals who were consulted through direct solicitation for information and/or requested to comment on the environmental impact statement preparation notice.

FEDERAL

U. S. Department of Interior, Fish and Wildlife Service
U. S. Department of Interior, Soil Conservation Service
U. S. Department of Commerce, National Marine Fisheries Service
U.S. Environmental Protection Agency
U. S. Army Corps of Engineers
  Operations Branch
Directorate of Public Works

STATE

Land Use Commission
Office of Environmental Quality Control
Office of State Planning
Department of Agriculture
Department of Business, Economic Development and Tourism, Energy Division
Department of Land and Natural Resources, State Historic Sites Division
Department of Land and Natural Resources, Division of Land Management
Department of Land and Natural Resources, Division of Forestry
Department of Land and Natural Resources, Office of Conservation and
  Environmental Affairs

Board of Land and Natural Resources
Dept. of Business and Economic Development
Department of Health
Department of Transportation
Department of Education
Senator Gerald Hagino
Representative Alex Santiago

CITY AND COUNTY OF HONOLULU

Department of General Planning
Department of Land Utilization
Department of Public Works
Department of Transportation Services
Office of the Managing Director
Neighborhood Commission
Councilwoman Rene Mansho
Councilwoman Donna Kim
Councilman Arnold Morgado

ORGANIZATIONS

Hawaiian Telephone Company
Oceanic Cablevision
Bishop Estate
Castle and Cooke
Campbell Estate
North Shore Neighborhood Board
Wahiawa Neighborhood Board

Haleiwa Community Association

Pupukea Highland Community Association

Sunset Beach Community Association

Sunset Hill Community Association

Waialua Community Association

North Shore Communities for Quality Development

Waimea Falls Park

Sierra Club

Audobon Society

Hawaii Thousand Friends

Sunset Beach Elementary School

Waialua Elementary School

Waialua Intermediate and High School

Haleiwa Elementary School

Kahuku Elementary School

Kahuku Intermediate and High School

Kahuku Public and School Library

Wahiawa Public Library

North Shore News

Hawaii Farm Bureau

Zion Securities

SECTION 9

LIST OF PREPARERS

SECTION 9
LIST OF PREPARERS

NAME	COMPANY	TITLE
Stephen Kellogg	R. M. Towill Corporation	Principal Planner
Chester Koga	R. M. Towill Corporation	Project Planner
Peter Yuh	R. M. Towill Corporation	Staff Planner
Andrew McIntyre	R. M. Towill Corporation	Staff Planner
Jonna Meamber	R. M. Towill Corporation	Staff Planner
Kyle Shinseki	R. M. Towill Corporation	Planner Assistant
Julie Leneghan	R. M. Towill Corporation	Graphics Designer
Ken Yamada	R. M. Towill Corporation	Project Engineer
Steve Ikenaga	R. M. Towill Corporation	Engineer
Mark Conroy	Sargent and Lundy Engineers	Project Engineer
Tim Krause	Sargent and Lundy Engineers	Environmental Coordinator
Ken Simpson	Sargent and Lundy Engineers	Engineer
Hallett Hammatt	Cultural Surveys Hawaii	Principal
Michael Pfeffer	Cultural Surveys Hawaii	Archaeologist
Evangeline Funk	Botanical Consultants	Principal

SECTION 10

LIST OF REFERENCES

SECTION 10
LIST OF REFERENCES

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SECTION 11

COMMENTS AND RESPONSES TO THE ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
1151 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

June 18, 1992

REC'D JUN 2 ? 1992 RMTC

Mr. Chester T. Koga, AICP
Project Planner
R. M. Towill Corporation
420 Waiakamilo Rd., #411
Honolulu, HI 96817-4941

Dear Mr. Koga:

Subject: Hawaiian Electric Company's Proposed Waialua-Kuilima 46KV Subtransmission Line

We have reviewed the environmental impact statement preparation notice regarding the subject matter and have the following comments to offer:

1) A well-detailed botanical survey should be done especially on the direct and mauka corridors. Although a majority of the corridors traverse canefields and pasture lands, the gulches have been known to harbor native plant species, one of which is listed as a threatened and endangered species *Eugenia koolauensis*). Should the direct or mauka corridors traverse any threatened and endangered plant species, a mitigative plan will be necessary.

2) We would require a fire contingency plan (approved by this office) detailing fire preventive measures before, during and after construction of the project.

Thank you for the opportunity in allowing the Division of Forestry and Wildlife to comment on this project.

Very truly yours,

Michael G. Buck
Administrator

cc: Oahu Branch DOFAW
Roger Evans, OCEA

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

September 21, 1992

Mr. Michael G. Buck, Administrator
Division of Forestry and Wildlife
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Buck:

SUBJECT: Environmental Impact Statement Preparation Notice
Waialua-Kuilima 46 KV Subtransmission Line Project
North Shore, Oahu, Hawaii

This letter is in response to your comments of June 18, 1992 regarding the above named project.

1. We will be conducting a botanical survey of the proposed subtransmission line. The findings of this study will be included in the Draft EIS. Should any plant or animal specie, considered rare, threatened, or endangered be encountered, we will develop an appropriate mitigation measure, or in the first instance, avoid the area.

2. If the selected alignment for the subtransmission line traverse the cane lands or forested areas we will develop a fire contingency plan for review and approval by your office.

Thank you for taking the time to comment. When the Draft EIS is completed we will forward a copy to your office for review. Should you have any other comments please do not hesitate to call me at 543-7819.

Sincerely,

Ken Morikami
Project Manager

cc: Department of Land Utilization
R.M. Towill Corporation

An HEI Company

DEPARTMENT OF GENERAL PLANNING
CITY AND COUNTY OF HONOLULU

RECD JUN 2 3 1992

ET 05/92-1928

June 22, 1992

MEMORANDUM

TO: DONALD A. CLEGG, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: BENJAMIN B. LEE, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE (EISPN) FOR HAWAIIAN ELECTRIC COMPANY (HECO) PROPOSED WAIALUA-KUILIMA 46KV SUBTRANSMISSION LINE

In response to R. M. Towill's letter of June 9, 1992, we have reviewed the subject EISPN for HECO's proposed Waialua-Kuilima 46KV Subtransmission Line and have the following comments to offer:

- As a matter of policy, we recommend that any high voltage transmission lines passing within urban or scenic coastal areas be installed underground.
- The criteria used for the corridor evaluation (p. 20) should be revised to separate quantitative and qualitative factors. For instance, urban impacts should not be included with and weighted equally to criteria such as the number of angles.
- Once the alignment of the subtransmission line is selected, the Draft Environmental Impact Statement (DEIS) should identify properties involved within the proposal.
- The DEIS should explain why the existing 46KV alignment was not considered as one of the alternative alignment for the new 46KV subtransmission line.
- The DEIS should assess visual impacts of the different alternatives using photo overlays or similar illustrations.

Thank you for the opportunity to comment. Should you have any questions, please contact Eugene Takahashi of our staff at 527-6022.

BENJAMIN B. LEE
Chief Planning Officer

BBL:js

cc: Hawaiian Electric Company, Inc.
R. M. Towill Corporation
Office of Environmental Quality Control

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

September 21, 1992

Mr. Benjamin B. Lee, Director
Department of General Planning
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Dear Mr. Lee:

SUBJECT: Environmental Impact Statement Preparation Notice
Waialua-Kuilima 46 KV Subtransmission Line Project
North Shore, Oahu, Hawaii

This letter is in response to your comments of June 22, 1992 regarding the above named project.

1. The decision whether or not to place the subtransmission line underground has not been determined at this time. We are in the process of evaluating both environmental and engineering factors to make this decision.

2. Thank you for your suggestion of separating the qualitative and quantitative measures. We are in fact doing this as we proceed to select a preferred alignment. The findings of this analysis will be presented in the Draft EIS.

3. Property owners who will be affected by this project will be identified. In certain instances, we have met with landowners to obtain their comments.

4. The existing 46 kv alignment was not considered because of our desire to provide a redundant circuit. Placing this new subtransmission line in the same easement would not meet our route selection criteria. We will expand on this issue in the Draft EIS.

5. As part of the analysis for the selection of a preferred alignment, we will be developing a method of visual analysis using photographs. The findings will be presented in the Draft EIS.

HEI Co

Thank you for taking the time to comment. When the Draft EIS is completed we will forward a copy to your office for review. Should you have any other comments please do not hesitate to call me at 543-7819.

Sincerely,

Ken T. Morikami

Ken Morikami
Project Manager

cc: Department of Land Utilization
R.M. Towill Corporation

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
Room 104, Old Federal Building
335 Merchant Street
Honolulu, Hawaii 96813
Telephone 587-3822

REC'D JUN 2 . 1992

June 22, 1992

Mr. Donald A. Clegg, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Attention: Ms. Dana Teramoto

Dear Mr. Clegg:

Subject: Environmental Impact Statement Preparation Notice (EISPN) for the Waialua-Kuilima 46 KV Subtransmission Line Project, North Shore, Oahu, Hawaii

We have reviewed the EISPN for the subject subtransmission line project transmitted by Chester Koga's letter dated June 9, 1992, and have the following comments.

1) Inasmuch as the various corridor alternatives for the project cross the State Land Use Conservation, Agricultural and Urban Districts at various points in their alignments, we suggest that the Draft EIS include a map of the corridor alternatives in relation to the State Land Use Districts.

2) Figure 4-1, Corridor Alternatives, is difficult to read; we suggest that this map clearly outline the perimeter of the Conservation District with the Subzone information contained within this outline.

We have no other comments to offer at this time.

Thank you for the opportunity to comment on this matter.

If you have any questions, please call me or Steve Tagawa of my staff at 587-3822.

Sincerely,

ESTHER UEDA
Executive Officer

EU:fl

cc: Ken Morikami
Chester Koga

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

September 21, 1992

Ms. Esther Ueda, Executive Officer
Land Use Commission
Room 104, Old Federal Building
335 Merchant Street
Honolulu, Hawaii 96813

Dear Ms. Ueda:

SUBJECT: Environmental Impact Statement Preparation Notice
Waialua-Kuilima 46 KV Subtransmission Line Project
North Shore, Oahu, Hawaii

This letter is in response to your comments of June 22, 1992 regarding the above named project.

1. We will include maps in the Draft EIS that delineate the various state land use districts that will be impacted by this project.

2. We will further delineate the Conservation Districts and sub-zones that are affected by the proposed project.

Thank you for taking the time to comment. When the Draft EIS is completed we will forward a copy to your office for review. Should you have any other comments please do not hesitate to call me at 543-7819.

Sincerely,

Ken Morikami
Project Manager

cc: Department of Land Utilization
R.M. Towill Corporation

OBAYASHI HAWAII CORPORATION
725 Kapiolani Boulevard, Fourth Floor
Honolulu, Hawaii 96813
Telephone (808) 593-0000
Facsimile (808) 593-0777

OBAYASHI

June 22, 1992

Mr. Ken Morikami
Project Manager
Hawaiian Electric Company, Inc.
820 Ward Avenue
Honolulu, HI 96814

Re: Environmental Impact Statement Preparation Notice
Waialua-Kuilima 46 kV Subtransmission Line Project

Dear Mr. Morikami:

Pursuant to our meeting of June 4, 1992, Obayashi Hawaii Corporation is providing comments on the EIS Preparation Notice for the North Shore, Oahu 46 kV line project. As we discussed, Obayashi is planning to develop the Lihi Lani Recreational Community on its 1,143-acre property in Pupukea. A copy of our current conceptual land use master plan was forwarded to your office and to R. M. Towill following the June 4 meeting. Our comments address concerns about the proposed alternative corridors for the new subtransmission line, as it relates to the Lihi Lani project and the surrounding community.

Of the three alternative corridors proposed for the new North Shore 46 kV line, the Direct Corridor and Mauka Corridor would both affect portions of Lihi Lani. Areas planned for golf course, hiking and riding trails, horse ranch, campground and conservation park would be crossed by routings within these proposed corridors. Views of utility poles and transmission lines crossing these areas would be undesirable. For this reason, Obayashi would prefer for HECO to consider shifting these corridors to cross the Obayashi property along its mauka boundary with lands of the State Forest Reserve. It is possible that Obayashi could grant an easement along the mauka boundary to accommodate the new 46 kV line. The State of Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife has encouraged Obayashi to ultimately provide a fire break clearing in the forest along their mauka boundary. This clearing could be used for the new transmission line route.

The proposed Coastal Corridor, which would involve extension of the existing utility poles located along Kamehmeha Highway, would create the least impact on Lihi Lani. This corridor does not appear to be favored by

Sunset Beach residents who would experience views of the higher poles and transmission lines. We respect the position of the general community on this issue.

We also understand that HECO is considering the possible use of the Lihi Lani site for a mauka-makai return connector route linking the Waimea substation with the new 46 kV subtransmission line. Obayashi would prefer for HECO to not locate this line along a route which would be visible to future residents of Lihi Lani, such as the ridges. If HECO identifies the Lihi Lani site as a preferred route for this mauka-makai connection, the gulches crossing the property (Kalunawaikaala, Pakulena, Paumalu) could possibly accommodate this tranmission line without adversely affecting views at Lihi Lani.

Thank you for this opportunity to present our comments on the EA and Preparation Notice for your new transmission facility. We would like to remain in close contact during the planning process for this facility, and look forward to meeting with you and your consultant in the future. Please contact me or Jeff Overton at Group 70 if you have any questions or require further information.

Sincerely,

OBAYASHI HAWAII CORPORATION

Craig Yamagishi

Craig Yamagishi
Lihi Lani Project Coordinator

cc OEQC, Brian Choy
R. M. Towill, Chester Koga
Group 70, Jeff Overton

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

REPLY TO ATTENTION OF

June 24,1992

Operations Division

SUBJECT: Waialua-Kuilima 46 KV Subtransmission Line

REC'D JUN 2 . 1992 RMTC

Ms. Dana Teramoto
Department of Land Utilization
City and County of Honolulu
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Dear Ms. Teramoto:

At the request of R. M. Towill Corporation, we have reviewed the EIS Preparation Notice for the subject project. Since the proposed project may involve work in the waters of the United States and its adjacent wetlands, a Department of the Army (DA) permit may be required. Section 6 of the notice recognizes the potential need for a DA permit, and Section 7 identifies the U.S. Army Corps of Engineers as an agency to be consulted during the preparation of the Draft Environmental Impact Statement.

We appreciate the opportunity to review the notice and look forward to reviewing the plans for DA permit requirements as the planning progresses. The applicant or consultant should contact the Operations Division at 438-9258 on permit matters.

Sincerely,

Michael T. Lee
Chief, Operations Division

Copies furnished:

Hawaiian Electric Company, Inc., Attn: Ken Morikawa, 820 Ward Avenue, Honolulu, Hawaii 96815

R.M. Towill Corporation, Attn: Chester Koga, 420 Waiakamilo Road, Suite 411, Honolulu, Hawaii 96817-4941

Office of Environmental Quality Control, 220 S. King Street, Central Pacific Plaza, Fourth Floor, Honolulu, Hawaii 96813

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

September 1, 1992

Mr. Michael T. Lee, Chief
Operations Division
Department of the Army
U.S. Army Engineering District, Honolulu
Fort Shafter, Building 230
Honolulu, Hawaii 96858-5440

Dear Mr. Lee:

SUBJECT: Environmental Impact Statement Preparation Notice
Waialua-Kuilima 46 KV Subtransmission Line Project
North Shore, Oahu, Hawaii

This letter is in response to your comments of June 24, 1992 regarding the above named project.

The need for Department of the Army permits have been recognized and have been taken into account in our planning phase of work. We will further consult with your Operations Division in the event that the need for a Department of the Army permit become evident. To date, our planning efforts have been directed away from wetlands and waters of the United States.

Thank you for taking the time to comment. When the Draft EIS is completed we will forward a copy to your office for review. Should you have any other comments please do not hesitate to call me at 543-7819.

Sincerely,

Ken T. Morikami

Ken Morikami
Project Manager

cc: Department of Land Utilization
R.M. Towill Corporation

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

REX D. JOHNSON
DIRECTOR

DEPUTY DIRECTORS
JOYCE T. OMINE
AL PANG
JEANNE K. SCHULTZ
CALVIN M. TSUDA

IN REPLY REFER TO:
HWY-PS
2.2576

JUN 25 1992

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Mr. Donald A. Clegg, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Attention: Dana Teramoto

Dear Mr. Clegg:

Environmental Impact Statement Preparation Notice (EISPN), Waialua-Kuilima 46KV Subtransmission Line (Hawaiian Electric Company, Inc.), North Shore, Oahu

We are providing the following comments on the subject EISPN at the request of R. M. Towill Corporation, the project consultant:

1. We have future plans to widen Kamehameha Highway to a four-lane facility. The applicant should coordinate early with our Highways Division to determine the setback requirements for the appropriate placement of their transmission lines.

2. Plans for construction work within the State highway right-of-way must be submitted for our review and approval.

Very truly yours,

T. Harano

T. HARANO
Chief
Highways Division

c: Hawaiian Electric Company, Inc.
✓R. M. Towill Corporation
Office of Environmental Quality Control

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

September 21, 1992

Mr. T. Harano, Chief
Highways Division
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

Dear Mr. Harano:

SUBJECT: Environmental Impact Statement Preparation Notice
Waialua-Kuilima 46 KV Subtransmission Line Project
North Shore, Oahu, Hawaii

This letter is in response to your comments of June 25, 1992 regarding the above named project.

We appreciated the information regarding the Department's plans to widen Kamehameha Highway to four lanes. Should the coastal alignment be selected, we will direct our consultants to coordinate our activities with your highway planners. However, please note that construction is expected to begin by the end of 1993. If HECO will be required to place the new poles within the future setback area, the State of Hawaii must acquire the necessary property before HECO starts construction.

We will be sending to your office plans for any work that will take place within the highway right-of-way.

Thank you for taking the time to comment. When the Draft EIS is completed we will forward a copy to your office for review. Should you have any other comments please do not hesitate to call me at 543-7819.

Sincerely,

Ken T. Morikami

Ken Morikami
Project Manager

cc: Department of Land Utilization
R.M. Towill Corporation

An HEI Company

JOHN WAIHEE
GOVERNOR OF HAWAII

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

JOHN C. LEWIN, M.D.
DIRECTOR OF HEALTH

In reply, please refer to:

RMT | | WES
HAWAII | | KTS
HEALTH | | SRK
REC'D JUL 1 7 1992 RMTC
BDE | |
GSY | |
UKM | |

July 15, 1992

92-208/epo

Department of Land Utilization
City & County of Honolulu
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Attention: Ms. Dana Teramoto

Dear Ms. Teramoto:

Subject: Environmental Impact Statement Preparation Notice for Waialua-Kuilima 46 KV Subtransmission Line Project, North shore, Oahu, Hawaii

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

Noise

1. Activities associated with the construction phase of the project must comply with the provisions of Department of Health (DOH) Administrative Rules, Chapter 11-43, "Community Noise Control for Oahu."

   a. The contractor must obtain a noise permit if the noise levels from construction activities are expected to exceed the allowable levels of the regulations.

   b. All equipment and on-site vehicles requiring an exhaust of gas or air must be equipped with mufflers.

   c. The contractor must comply with the requirements specified in the regulations and conditions issued with the permit.

3. Traffic noise from heavy vehicles travelling to and from the project site must be minimized near existing residential

areas and must comply with the provisions of DOH Administrative Rules, Chapter 11-42, "Vehicular Noise Control for Oahu."

If you should have any questions, please call Mr. Jerry Haruno of the Noise and Radiation Branch at 586-4700.

Very truly yours,

for JOHN C. LEWIN, M.D.
Director of Health

c: Noise and Radiation Branch
Hawaiian Electric Company, Inc.
R. M. Towill Corporation
Office of Environmental Quality Control

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

September 1, 1992

Dr. John C. Lewin, M.D.
Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801

Dear Dr. Lewin:

SUBJECT: Environmental Impact Statement Preparation Notice
Waialua-Kuilima 46 KV Subtransmission Line Project
North Shore, Oahu, Hawaii

This letter is in response to your comments of July 15, 1992 regarding the above named project.

Thank you for noting the necessary compliance with the Community Noise Control for Oahu. The appropriate noise permits will be obtained for work that will exceed the allowable levels. We will ensure that all machinery that have exhausts (gas or air) will be properly muffled.

To the extent practicable, we will minimize traffic noise of vehicles traveling to and from the project area near existing residential areas and will comply with the provisions of the DOH Administrative Rules, Chapter 11-42, "Vehicular Noise Control for Oahu.".

Thank you for taking the time to comment. When the Draft EIS is completed we will forward a copy to your office for review. Should you have any other comments please do not hesitate to call me at 543-7819.

Sincerely,

Ken T. Morikami

Ken Morikami
Project Manager

cc: Department of Land Utilization
R.M. Towill Corporation

JOHN WAIHEE
GOVERNOR OF HAWAII

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

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES
JOHN P. KEPPELER II
DONA L. HANAIKE

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION PROGRAM
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

REF:OCEA:SOK

RMT	/	WES	
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SOK		SRK	
REC'D Jul 2 1992 RMTC			
RDE			
GSY			
DKM			

JUL 2 1992

FILE NO.: 92-801
DOC. ID.: 1056

Mr. Chester T. Koga
Project Planner
R. M. Towill Corporation
420 Waiakamilo Rd., Suite 411
Honolulu, Hawaii 96817-4941

Dear Mr. Koga:

SUBJECT: Environmental Impact Statement Preparation Notice (EISPN) for Waialua-Kuilima 46kV Subtransmission Line Project North Shore, Oahu

Thank you for giving our Department the opportunity to comment on this matter. We have reviewed the submitted EISPN and have the following comments.

Division of Aquatic Resources Comments:

Three acceptable corridors were chosen from 10 options, all of which are acceptable from the aquatic resources standpoint. One option, an ocean route, was rejected and would have been extremely detrimental to inshore biological resources. Whatever corridor is finally selected, activity that would lead to modification or disturbance to stream flows, beds, banks or estuaries should be avoided.

Division of Land Management Comments:

The Waialua-Kuilima 46 kV subtransmission line project will provide the subject area a means of continuous uninterrupted service and the added capacity to provide for anticipated future load requirements.

In view of this, as the proposed project will span a route of approximately twelve miles, we have no objections as long as the applicant comply with processing of all of the permits and approvals as listed in the Environmental Impact Statement.

Division of Water and Land Development Comments:

The Kuilima 46 kV subtransmission line corridors cross streams and coastal high hazard areas where flooding levels should not be increased due to its construction.

Historic Preservation Division Comments:

Three routes are proposed for the sub-transmission line: a coastal route, which generally follows Kamehameha Highway; a direct route, which passes through canefields mauka of the Highway and crosses Waimea Valley below Waimea Falls; and a mauka route, which crosses Waimea Valley above the Falls. The direct and mauka routes are overhead systems. The coastal route is a combined overhead/underground system that might require excavation of a 4.5' deep trench for a length of 12 miles.

We believe that the mauka and direct routes are likely to have the least effect on historic sites. Given some flexibility in design and route it should be possible to ensure that construction along either of these routes has no effect on historic sites. The coastal route is likely to have an adverse effect on numerous subsurface sites if the 12 mile long trench is excavated.

The first step in the historic preservation review process for this project would be a literature review and documents search for the proposed corridors. This work will provide detailed information on known site locations relative to the proposed corridors and identify areas that have not been inventoried for historic sites. Typically, this work would be followed by inventory survey of previously unsurveyed areas along the route chosen for construction and, if necessary, development of a mitigation plan to ensure that construction has either "no effect" or "no adverse effect" on historic sites.

Division of Forestry and Wildlife Comments:

1) A well-detailed botanical survey should be done especially on the direct and mauka corridors. Although a majority of the corridors traverse canefields and pasture lands, the gulches have been known to harbor native plant species, one of which is listed as a threatened and endangered species (Eugenia koolauensis). Should the direct or mauka corridors traverse any threatened and endangered plant species, a mitigative plan will be necessary.

2) We would require a fire contingency plan (approved by this office) detailing fire preventive measures before, during and after construction of the project.

<u>Office of Conservation and Environmental Affairs Comments:</u>

Of the nine (9) alternatives discussed in the report, the Kamehameha Highway coastal alignment, which would follow the existing 12kV and 4kV distribution line between the Waialua substation and Kuilima substation, appears to be the most favored alternative, at this time. Improvement of utility infrastructure within an existing alignment appears to be the most environmentally benign and logical alternative, if trenching can be minimized or avoided. Should this alternative be selected, the need for clearing, construction, and new access roads would likely be minimized.

In addition, a Conservation District Use Application (CDUA) would be required for any utility easements that transit Conservation District land.

Thank you for your cooperation in this matter. Please feel free to call Sam Lemmo at our Office of Conservation and Environmental Affairs, at 587-0377, should you have any questions.

Very truly yours,

John P. Keppeler

for WILLIAM W. PATY

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

September 21, 1992

Mr. William Paty, Chairman
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Paty:

SUBJECT: Environmental Impact Statement Preparation Notice
Waialua-Kuilima 46 KV Subtransmission Line Project
North Shore, Oahu, Hawaii

This letter is in response to your comments of July 21, 1992 regarding the above named project. Our responses are organized according to your Departments Divisions:

Aquatic Resources:

We are currently evaluating five alignments for the proposed subtransmission line. We do not currently anticipate the need to disturb any streams flows, stream beds, banks or estuaries.

Land Management:

When a specific alignment is determined, an inventory of permits required will be developed. In addition, should the selected line cross State lands, we will be discussing this matter with the Land Management Division.

Water and Land Development:

We do not anticipate that there will be any impact on flood elevations resulting from the installation of the subtransmission line as it crosses through areas of flooding.

Historic Preservation:

We are currently in the process of evaluating the potential of the subtransmission line affecting sites of known and potential archaeological and historic significance. We will attempt to avoid sensitive sites of historic and cultural significance.

Forestry and Wildlife:

We will be undertaking a special botanical survey of the proposed alignments to determine if there are any rare, threatened, or endangered species. Should we select a mauka alignment (other than Kamehameha Highway), we will prepare a fire contingency plan for your review and approval.

An HEI Company

Mr. William Paty
September 21, 1992
Page 2

Conservation and Environmental Affairs:

We appreciate your indication of alignment preference (Kamehameha Highway). We are cognizant of the requirement for a Conservation District Use Application for any easement that cross Conservation District lands.

Thank you for taking the time to comment. When the Draft EIS is completed we will forward a copy to your office for review. Should you have any other comments please do not hesitate to call me at 543-7819.

Sincerely,

Ken Morikami
Project Manager

cc: Department of Land Utilization
R.M. Towill Corporation

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

September 21, 1992

Mr. Craig Yamagishi, Project Coordinator
Obayashi Hawaii Corporation
725 Kapiolani Boulevard, Fourth Floor
Honolulu, Hawaii 96813

Dear Mr. Yamagishi:

SUBJECT: Environmental Impact Statement Preparation Notice
Waialua-Kuilima 46 KV Subtransmission Line Project
North Shore, Oahu, Hawaii

This letter is in response to your comments of June 22, 1992 regarding the above named project.

We appreciated your taking the time to review your project with us and sharing your thoughts regarding the selection of a specific alignment. We would like to acknowledge your desire for Hawaiian Electric to place the subtransmission line along the mauka edge of the Lihi Lani project because of concerns over views. Further, if we select this mauka route, we will be taking a second look at the potential of placing the subtransmission tap in one of the suggested gulches.

Thank you for taking the time to comment. When the Draft EIS is completed we will forward a copy to your office for review. Should you have any other comments please do not hesitate to call me at 543-7819.

Sincerely,

Ken T. Morikami

Ken Morikami
Project Manager

cc: Department of Land Utilization
R.M. Towill Corporation
Jeffrey Overton

ENV 92-144

June 23, 1992

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MEMORANDUM

TO: MR. DONALD A. CLEGG, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

ATTENTION: DANA TERAMOTO

FROM: C. MICHAEL STREET, ACTING DIRECTOR AND CHIEF ENGINEER

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE (EISPN) - WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE TMK:VARIOUS

We have reviewed the subject EISPN and have no comments to offer at this time.

C. Michael Street

C. MICHAEL STREET
Acting Director and Chief Engineer

cc: Hawaiian Electric Company
R.M. Towill Corporation
Office of Environmental Quality Control

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

September 21, 1992

Mr. C. Michael Street, Acting Director
Department of Public Works
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Street:

SUBJECT: Environmental Impact Statement Preparation Notice
Waialua-Kuilima 46 KV Subtransmission Line Project
North Shore, Oahu, Hawaii

Thank you for taking the time to review the above named document. When the Draft EIS is completed we will forward a copy to your office for review. Should you have any questions please do not hesitate to call me at 543-7819.

Sincerely,

Ken T. Morikami

Ken Morikami
Project Manager

cc: Department of Land Utilization
R.M. Towill Corporation

Sent: June 29, 1992
FACILITIES' COPY #
R.M. Towill Corp
CHARLES T. TOGUCHI

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

OFFICE OF THE SUPERINTENDENT

June 23, 1992

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Mr. Dana Teramoto
Department of Land Utilization
City and County of Honolulu
650 South King Street, 7th Floor
Honolulu, Hawaii 97813

Dear Mr. Teramoto:

SUBJECT: Environmental Impact Statement Preparation Notice (EISPN) - Hawaii Electric Company Proposal Waialua-Kuilima 46 KV Subtransmission Line

After review of the subject EISPN the Department of Education has the following comments:

1) Corridor A is identified as one of the three preferred corridors on Page 22 of the document. The Department prefers corridors C or D which do not pass alongside Sunset Beach Elementary School.

2) Construction of either an overhead or underground system along corridor A will create interference with the daily operation of the school for a significant period of time. Page 24 mentions increased noise levels, air emissions, and disruption to traffic which are of great concern related to the effects on learning.

3) The increased high voltage will produce potentially dangerous electric and magnetic fields (EMF) for which the effects on the students and staff is unknown.

Should there be any questions regarding our comments, please call the Facilities Branch at 737-4743.

Thank you for the opportunity to comment.

Sincerely,

Charles T. Toguchi
Superintendent

CTT:hy (AH)

cc: A. Suga, Asst. Supt.
J. Sosa, WDO
Hawn. Elec. Co., Inc.
R. M. Towill Corp.
Offc. of Env. Quality Control

AFFIRMATIVE ACTION EQUAL OPPORTUNITY EMPLOYER

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

September 21, 1992

Mr. Charles T. Toguchi, Superintendent
Department of Education
P.O. Box 2360
Honolulu, Hawaii 96804

Dear Mr. Toguchi:

SUBJECT: Environmental Impact Statement Preparation Notice
Waialua-Kuilima 46 KV Subtransmission Line Project
North Shore, Oahu, Hawaii

This letter is in response to your comments of June 23, 1992 regarding the above named project.

Thank you for sharing your preference for the selection of a preferred corridor mauka of the Sunset Beach Elementary School. We can fully appreciate your concern that this project not disrupt the operations of the school. To the extent feasible and practicable, we will mitigate any adverse impacts to the school. Should our plans directly affect the Sunset Beach Elementary School, we will work closely with the school and your Facilities Branch to minimize any adverse impacts.

We acknowledge your concern for the potential effects of electric and magnetic fields on the students and staff. Every possible effort will be made to minimize potential EMF impacts. This will be discussed in our Draft EIS.

Thank you for taking the time to comment. When the Draft EIS is completed we will forward a copy to your office for review. Should you have any other comments please do not hesitate to call me at 543-7819.

Sincerely,

Ken T. Morikami

Ken Morikami
Project Manager

cc: Department of Land Utilization
R.M. Towill Corporation

DEPARTMENT OF GENERAL PLANNING
CITY AND COUNTY OF HONOLULU

RECD JUN 2 3 1992

ET 05/92-1928

June 22, 1992

MEMORANDUM

TO: DONALD A. CLEGG, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: BENJAMIN B. LEE, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE (EISPN) FOR HAWAIIAN ELECTRIC COMPANY (HECO) PROPOSED WAIALUA-KUILIMA 46KV SUBTRANSMISSION LINE

In response to R. M. Towill's letter of June 9, 1992, we have reviewed the subject EISPN for HECO's proposed Waialua-Kuilima 46KV Subtransmission Line and have the following comments to offer:

- As a matter of policy, we recommend that any high voltage transmission lines passing within urban or scenic coastal areas be installed underground.
- The criteria used for the corridor evaluation (p. 20) should be revised to separate quantitative and qualitative factors. For instance, urban impacts should not be included with and weighted equally to criteria such as the number of angles.
- Once the alignment of the subtransmission line is selected, the Draft Environmental Impact Statement (DEIS) should identify properties involved within the proposal.
- The DEIS should explain why the existing 46KV alignment was not considered as one of the alternative alignment for the new 46KV subtransmission line.
- The DEIS should assess visual impacts of the different alternatives using photo overlays or similar illustrations.

Thank you for the opportunity to comment. Should you have any questions, please contact Eugene Takahashi of our staff at 527-6022.

BENJAMIN B. LEE
Chief Planning Officer

BBL:js

cc: Hawaiian Electric Company, Inc.
R. M. Towill Corporation
Office of Environmental Quality Control

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

September 21, 1992

Mr. Benjamin B. Lee, Director
Department of General Planning
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Dear Mr. Lee:

SUBJECT: Environmental Impact Statement Preparation Notice
Waialua-Kuilima 46 KV Subtransmission Line Project
North Shore, Oahu, Hawaii

This letter is in response to your comments of June 22, 1992 regarding the above named project.

1. The decision whether or not to place the subtransmission line underground has not been determined at this time. We are in the process of evaluating both environmental and engineering factors to make this decision.

2. Thank you for your suggestion of separating the qualitative and quantitative measures. We are in fact doing this as we proceed to select a preferred alignment. The findings of this analysis will be presented in the Draft EIS.

3. Property owners who will be affected by this project will be identified. In certain instances, we have met with landowners to obtain their comments.

4. The existing 46 kv alignment was not considered because of our desire to provide a redundant circuit. Placing this new subtransmission line in the same easement would not meet our route selection criteria. We will expand on this issue in the Draft EIS.

5. As part of the analysis for the selection of a preferred alignment, we will be developing a method of visual analysis using photographs. The findings will be presented in the Draft EIS.

Thank you for taking the time to comment. When the Draft EIS is completed we will forward a copy to your office for review. Should you have any other comments please do not hesitate to call me at 543-7819.

Sincerely,

Ken Morikami
Project Manager

cc: Department of Land Utilization
R.M. Towill Corporation

Subject 46 KV Subtransmission Line

Topics for inclusion in E.I.S. might best include discussions of the following topics:

A. Coastal Route Corridor

1. Total life expectancy of this choice on "old existing" poles vs. a new infrastructure. Note: The prospect of adequate redundancy is reduced with this choice in case of flood, tsunami, and/or hurricane.

2. Can 46 KV line be attached to Kam Hwy/Waimea bridge similar to 14" water line so more overhead wouldn't be necessary?

3. The existing Kam Hwy alignment is very close to the highway, specifically how will high voltage lines affect already weak radio reception in cars and/or adjacent houses? What about television reception?

4. Underground infrastructure is desirable visually and should include an integrated inventory of other proposed/future infrastructure improvements (i.e. municipal sewer; highway expansion; bike paths; coastal park's expansion plans and other public facilities.)

5. Selected alignment should accurately define the overhead/underground mix and final corridor to within 10' of actual.

6. Denser population with more social impacts.

B. Direct Route (below Waimea Falls) Corridor

1. Accurate visual representation needs to be created to assess negative visual impacts on aesthetically historically sensitive areas like Waimea Falls Park. Existing views are important.

2. Precise alignment through populated areas...not generalizations.

C. Mauka Route (above Waimea Falls)

1. Go all the way to drum road for easy access. Good planning for future.

D. Construction cost needs to be averaged over "life" of selected alignment.

E. Please keep Waimea Falls Park informed as you proceed and copy us in on the draft E.I.S.

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

September 21, 1992

Mr. Robert Leinau, General Manager
Waimea Falls Park
59-864 Kamehameha Highway
Haleiwa, Hawaii 96792

Dear Mr. Leinau:

SUBJECT: Environmental Impact Statement Preparation Notice
Waialua-Kuilima 46 KV Subtransmission Line Project
North Shore, Oahu, Hawaii

This letter is in response to your comments of June 23, 1992 regarding the above named project.

A. Coastal Route

1. We have stated that the purpose of this proposed subtransmission line is to provide greater reliability of service to customers along the North Shore. While at the outset it may seem that placing the subtransmission line along Kamehameha Highway would expose the line to floods, tsunamis and hurricanes, please recall that we will still have the existing subtransmission line thereby providing the necessary redundancy.

2. We are currently exploring the feasibility of placing the subtransmission line in a structure to be attached to the bridge at Waimea.

3. We do not anticipate that this new 46kv subtransmission will affect radio or television reception in the area.

4. Should an underground technology be used, we have discussed the potential of placing this new subtransmission line in conjunction with other planned infrastructure and we have found that the timing of the proposed sewer system is much beyond our currently implementation phase. The Department of Transportation has also indicated that they have plans to expand Kamehameha Highway; however, the proposed timing of this work is also beyond our implementation schedule.

5. The work program for this 46 kv subtransmission line includes the defining of a specific route. We will, to the extent we are able, define a route within 100 feet.

We generally do not specify with any greater accuracy than this because specific engineering design may require changes in the route selected. Generally, however, we will not change the selected alignment unless required to do so.

6. The proposed subtransmssion line project, per se, will not be an inducement to growth in the North Shore. The proposed project is required now to serve the existing population.

B. Direct Route (below Waimea Falls)

1. As part of our efforts we will be preparing visual simulations to assess the visual impacts.

2. As the project moves from the corridor analysis to the selection of a preferred alignment, we will be getting into more detail. The next level of analysis will be in sufficient detail to assess impacts to specific properties. This analysis will be shared at public meetings and in the Draft EIS.

C. Mauka Route (above Waimea Falls)

As part of our analysis, we will be examining the feasibility of using Drum Road.

D. Construction Costs

We will be examining the construction costs over the average life of the subtranmission line. This information will be shared at public meetings and in the Draft EIS.

Thank you for taking the time to comment. When the Draft EIS is completed we will forward a copy to you for review. Should you have any other comments please do not hesitate to call me at 543-7819.

Sincerely,

Ken T. Morikami

Ken Morikami
Project Manager

cc: Department of Land Utilization
R.M. Towill Corporation

APPENDICES

Archaeological Study - APPENDIX A

Botanical Study - APPENDIX B

Electromagnetic Effects Study - APPENDIX C

Permit Descriptions - APPENDIX D

COMMENTS AND RESPONSES TO THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

United States Department of the Interior

GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
677 Ala Moana Blvd., Suite 415
Honolulu, HI 96813

March 29, 1993

RECD MAR 31 1993 RMTC

Dana Teramoto
Department of Land Utilization
City and County of Honolulu
650 South King Street, 7th Floor
Honolulu, HI 96813

Dear Dana Teramoto:

Subject: Waialua-Kuilima 46kv Subtransmission Line, Draft Environmental Impact Statement (DEIS), Waialua and Koolauloa, Oahu

We are in receipt of the subject DEIS. We regret that due to prior commitments, we are unable to review the DEIS by the May 7th deadline.

As requested, we are returning the DEIS to your office for your future use.

Sincerely,

William Meyer
District Chief

Enclosure

cc: Mr. Ken Morikami
Hawaiian Electric Company, Inc.
820 Ward Avenue
Honolulu, Hawaii 96814

Mr. Chester Koga
R. M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840 0001

June 23, 1993

Mr. William Meyer, District Chief
Geological Survey
U.S. Department of the Interior
677 Ala Moana Blvd. Suite 415
Honolulu, Hawaii 96813

Dear Mr. Meyer:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments of March 29, 1993.

Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken Morikami
Project Manager

KM:CTK

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

REPLY TO ATTENTION OF

April 1, 1993

Planning Division

Ms. Dana Teramoto
Department of Land Utilization
City and County of Honolulu
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Dear Ms. Teramoto:

Thank you for the opportunity to review and comment on the Draft Environmental Impact Statement for the Waialua-Kuilima 46KV Subtransmission Line, Oahu. We do not have any additional comments beyond those provided in our previous letter dated June 24, 1992.

Sincerely,

ORIGINAL SIGNED

Kisuk Cheung, P.E.
Director of Engineering

Copies Furnished:
Mr. Ken Morikami
Hawaiian Electric Company
820 Ward Avenue
Honolulu, Hawaii 96814

✓Mr. Chester Koga
R.M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817

Office of Environmental Quality Control
State of Hawaii
220 South King Street, 4th Floor
Honolulu, Hawaii 96813

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu HI 96840 00C

June 23, 1993

Mr. Kisuk Cheung, Director of Engineering
Department of the Army
U.S. Army Engineering District, Honolulu
Fort Shafter, Hawaii 96858-5440

Dear Mr. Cheung:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project.

As stated in your June 24, 1992 letter, should our project require a Department of the Army permit, we will coordinate our efforts with your office.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken Morikami
Project Manager

KM:CTK

HEIC

DEPARTMENT OF THE NAVY
COMMANDER
NAVAL BASE PEARL HARBOR
BOX 110
PEARL HARBOR, HAWAII 96860-5020

IN REPLY REFER TO
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Ms. Dana Teramoto
Department of Land Utilization
City & County of Honolulu
650 South King Street, 7th Floor
Honolulu, HI 96813

Dear Ms. Teramoto:

DRAFT ENVIRONMENTAL IMPACT STATEMENT
WAIALUA-KUILIMA 46KV SUBTRANSMISSION LINE PROJECT

Thank you for the opportunity to comment on the subject Draft Environmental Impact Statement (DEIS). The Navy has no comment to make at this time.

Our point of contact is Mr. Bill Liu, Facilities Engineer, at 471-3324.

Sincerely,

W.K. Liu

W. K. LIU
FACILITIES ENGINEER
BY DIRECTION OF
THE COMMANDER

Copy to:
Mr. Brian J. J. Choy
Office of Environmental Quality Control
220 South King Street, 4th Floor
Honolulu, HI 96813

Mr. Ken Morikami
Hawaiian Electric Company, Inc.
820 Ward Avenue
Honolulu, HI 96814

Mr. Chester Koga
R. M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, HI 96817

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840 000

June 23, 1993

Mr. William K. Liu, Facilities Engineer
Department of the Navy
Naval Base Pearl Harbor
Box 110
Pearl Harbor, Hawaii 96860-5020

Dear Mr. Liu:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken Morikami
Project Manager

KM:CTK

An HEI Company

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
220 SOUTH KING STREET
FOURTH FLOOR
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185

BRIAN J. J. CHOY
Director

May 4, 1993

Mr. Donald Clegg
Department of Land Utilization
City and County of Honolulu
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Attention: Ms. Dana Teramoto

Subject: Draft Environmental Impact Statement for the Waialua-Kuilima 46 KV Subtransmission Line Project, North Shore, Oahu

Thank you for the opportunity to review the subject document. We do not have any comments to offer.

Sincerely,

Brian J. J. Choy
Director

BC:jt

c: Hawaiian Electric Company, Inc.
R. M. Towill Corporation

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840 0001

June 23, 1993

Mr. Brian J.J. Choy, Director
Office of Environmental Quality Control
220 South King Street, 4th Floor
Honolulu, Hawaii 96813

Dear Mr. Choy:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken Morikami
Project Manager

KM:CTK

JOHN WAIHEE
GOVERNOR OF HAWAII

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

KEITH W. AHUE, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES
JOHN P. KEPPELER II
DONA L. HANAIKE

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

REF:OCEA:KCK

File No.: 93-518
DOC. ID.: 2681

APR 29 1993

The Honorable Donald A. Clegg, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Clegg:

SUBJECT: Draft Environmental Impact Statement (DEIS): Waialua-Kuilima 46kV Subtransmission Line, North Shore, Oahu, TMK: various

We have reviewed the DEIS information for the proposed subtransmission line project and have the following comments:

Brief description:

The proposed project involves installation of a partially underground and partially overhead electrical transmission line between Waialua and Kuilima. A number of biologically significant streams and gulches will be crossed by the overhead lines.

Historic Preservation Division

The Historic Preservation Division (HPD) comments that the preferred alternative alignment, designated Mid-Level Mauka (D), is located primarily in old sugarcane lands, where it is likely to have "no effect" on historic sites. However, the alignment does cross three areas where it has the potential to have an "adverse effect" on historic sites. These areas are shown in Figure 3-6 of the DEIS and include the lowlands around Waialua, through the Anahulu Valley, Waimea Valley, and the mauka portion of the Pupukea/Paumalu uplands.

According to the DEIS, Hawaiian Electric Company, Inc. proposes to mitigate these potential adverse effects by surveying areas of known historic sites and being careful in the placement of infrastructure in areas where there might be historic sites. In HPD's experience this procedure does not extend adequate protection to historic sites and is insufficient to ensure a determination of either "no effect" (if there are no historic sites along the proposed route) or "no adverse effect" (if there are historic sites along the proposed route). Instead, HPD will require that an archaeological inventory survey of the proposed route be completed well before construction

activities. This survey can follow an established staked alignment to increase the accuracy of the survey and reduce costs, but it should precede the final location of infrastructure elements so that the option of preserving significant historic sites is not lost. When an acceptable inventory survey report is submitted and reviewed, HPD will be in a position to determine more accurately the likely effects of the proposed project on historic sites.

Office of Conservation and Environmental Affairs

The Office of Conservation and Environmental Affairs comments that portions of the proposed alignment, as shown on Figure 4-1, traverse the Conservation District in the Anahulu Stream and Waimea Valley areas. As such, a Conservation District Use Application filed with this Department and approved by the Board of Land and Natural Resources, will be required for use of these areas.

Division of Aquatic Resources

The Division of Aquatic Resources comments that installation of the lines should avoid disturbance to streams, including those labeled as gulches. If any modifications, including temporary fords, are needed for stream beds and banks, a Stream Channel Alteration Permit may be required from the Commission on Water Resource Management.

Division of Forestry and Wildlife

The Division of Forestry and Wildlife (DOFAW) comments that their earlier concerns regarding the need for a botanical survey have been addressed. DOFAW has no comments on the survey which is contained as Appendix B. Should this project be approved, DOFAW again requests that a requirement for a fire contingency plan be one of the conditions for the approval of the project.

We have no other comments to offer at this time. Thank you for the opportunity to comment on this matter.

Please feel free to contact Steve Tagawa at our Office of Conservation and Environmental Affairs, at 587-0377, should you have any questions.

Very truly yours,

Keith W. Ahue
KEITH W. AHUE

cc: Ken Morikami
Chester Koga

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

June 23, 1993

Mr. Keith W. Ahue, Chairman
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Ahue:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project. In response to your comments and concerns we would like to respond as follows:

1. Historic Preservation. We will undertake an archaeological inventory survey of the final alignment to determine if there are any site of historic value. The findings of this survey will be transmitted to your office for review well before construction.

2. Conservation and Environmental Affairs. A Conservation District Use Application will be filed with your office requesting permission to cross Conservation District lands prior to installation of the poleline.

3. Aquatic Resource. We do not anticipate disturbing any streams or gulches. However, should we find that stream disturbance is necessary, we will consult with the Commission on Water Resource Management.

4. Forestry and Wildlife. As part of our construction plans, we will prepare a fire contingency plan and file it with your Department.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken Morikami
Project Manager

KM:CTK

JOHN WAIHEE
GOVERNOR

MAJOR GENERAL EDWARD V. RICHARDSON
DIRECTOR OF CIVIL DEFENSE

ROY C. PRICE, SR.
VICE DIRECTOR OF CIVIL DEFENSE

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE DIRECTOR OF CIVIL DEFENSE
3949 DIAMOND HEAD ROAD
HONOLULU, HAWAII 96816-4495
PHONE (808) 734-2161

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April 12, 1993

TO: Dana Teramoto
Department of Land Utilization
City and County of Honolulu

FROM: Roy C. Price, Sr.
Vice Director of Civil Defense

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS); WAIALUA-KUILIMA 46kV SUBTRANSMISSION LINE

State Civil Defense (SCD) appreciates this opportunity to comment on the DEIS by the Hawaiian Electric Company, Inc., on the island of Oahu, Waialua-Kuilima 46kV Subtransmission Line, Oahu, Hawaii. We do not have negative comments specifically directed at the DEIS. However, we do have a concern that the installation of overhead 46kV power lines could adversely impact the proper operation of the outdoor siren warning system located along the various routes listed as follows:

Corridor A: Coastal Route (Overhead)
SCD has nine sirens located at various locations in the area from Waialua to Kuilima. Seven may be directly impacted by this alignment.

Corridor A1: Coastal Route (Underground)
No Comments

Corridor B: Bluffs Route
No Comments

Corridor C: Mid-Level (Makai Falls)
SCD has one siren in the Pupukea area that may be affected by this route.

Corridor D: Mauka Falls
No comments

Corridor E: Mauka Route
SCD has one siren in the Pupukea area that may be affected by this route.

In Corridors A, C and E our concerns are that the electromagnetic field generated by the transmission lines may interfere with normal operation of the siren. Should this concern be verified at a later date, the impacted sirens would have to be resited and relocated in the vicinity of its present location to insure that the alerting capability coverage is not compromised. The cost of the siren relocation project should be treated as support for siren infrastructure, as in the permitting process for new developments and be coordinated with the Office of State Planning. The cost is to be borne by the applicant/requestor.

Our SCD planners and technicians are available to discuss this further if there is a requirement. Please have your staff call Mr. Mel Nishihara of my staff at 734-2161.

Enc.

c: Mr. Ken Morikami
Hawaiian Electric Company, Inc.

Mr. Chester Koga
R. M. Towill Corporation

Office of Environmental Quality Control

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

June 23, 1993

Mr. Roy C. Price, Sr. Vice Director
Office of the Director of Civil Defense
Department of Defense
3949 Diamond Head Road
Honolulu, Hawaii 96816-4495

Dear Mr. Price:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project. As noted in the DEIS, we are proposing a modified alignment 'D' as our preferred alignment. We do not anticipate any impact to State Civil Defense facilities along this route. Should we find ourselves in conflict, we will coordinate mitigation efforts with your office.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken Morikami
Project Manager

KM:CTK

Comp

University of Hawaii at Manoa

Environmental Center
A Unit of Water Resources Research Center
Crawford 317 • 2550 Campus Road • Honolulu, Hawaii 96822
Telephone: (808) 956-7361

May 7, 1993
RE:0625

Ms. Dana Teramoto
Department of Land Utilization
City and County of Honolulu
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Dear Ms. Teramoto:

Draft Environmental Impact Statement
Waialua-Kuilima 46 KV Subtransmission Line
North Shore, Oahu

The proposed project involves running a second 46 KV subtransmission line approximately 14 miles long from the existing Waialua Substation to the existing Kuilima Substation. The purpose of the new subtransmission line is: 1) to maintain reliable electrical service to the North Shore of Oahu by correcting low voltage conditions, and to provide an alternative subtransmission line that can provide service in the event of a failure on the existing 46 KV line; and 2) to provide additional transmission capacity to meet the growing demands of existing customers and to accommodate projected load growth along the North Shore.

Our review of the Draft Environmental Impact Statement (EIS) was prepared with the assistance of Michael Hadfield, Zoology/Pacific Biomedical Research Center; Kazutoshi Najita, Electrical Engineering; Paul Weaver, Electrical Engineering; and Elizabeth Gordon, Environmental Center.

General Comments

Generally, our reviewers have found the Draft EIS adequate in its discussion of anticipated environmental impacts and proposed mitigative measures. We offer the following comments in augmentation of information provided in the Draft EIS:

Flora and Fauna (Section 3.2.6.)

Ordinarily, achatinellids (tree snails) are not expected to inhabit the elevations and exposures discussed in this document (i.e., less than 600 feet in a northern facing terrain). However, reports from the Heritage Program suggest the occurrence of some interesting native vegetation in the

area which should be surveyed for snails. The section on fauna (page 3-17) suggests that installation and maintenance of the proposed transmission line will not have any impact on snails. However, we note that if any of the vegetation within the alignment is inhabited by achatinellids, they will be disturbed by the project.

Electric and Magnetic Fields (Section 3.3.3)

Our reviewers concur that the proposed alignment for the new 46 KV subtransmission line is preferable due to its location away from populated areas as much as possible. Particularly at this time, when there is no conclusive evidence whether exposure to power-frequency electric and magnetic fields presents human health risks, a conservative approach is prudent. There may be some concern where the new line crosses the northern border of the Boy Scouts and Girl Scouts camps. The scouts go on minimally supervised adventure and survival assignments, usually at night, in the wooded areas. The possibility of avoidance of the powerline area by the scouts should be discussed with the Aloha Council.

Thank you for the opportunity to review the Draft EIS. We hope that our comments will be helpful in the preparation of the final document. We would appreciate receiving two copies of the Final EIS for our records.

Sincerely,

John T. Harrison
Environmental Coordinator

cc: OEQC
Hawaiian Electric Company Inc.
R.M. Towill Corporation
Roger Fujioka
Michael Hadfield
Kazutoshi Najita
Paul Weaver
Elizabeth Gordon

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840 0001

June 23, 1993

Mr. John T. Harrison, Environmental Coordinator
Environmental Center
University of Hawaii
Crawford 317
2550 Campus Road
Honolulu, Hawaii 96822

Dear Mr. Harrison:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project. In response to your comments and concerns we would like to respond as follows:

1. Flora and Fauna. We will undertake an inventory survey of the final alignment to ascertain if there are tree snails present. The findings of this survey will be transmitted to your office for review. If tree snails are found, mitigation measures will be proposed.

2. Electric and Magnetic Fields. The proposed alignment has been discussed with the Boy Scouts and a copy of the DEIS was sent to the Girl Scouts. The final alignment will be chosen so as to minimally impact their activities. As you note, there currently is no conclusive scientific evidence which suggests a direct correlation between exposure to electric and magnetic fields and harmful health effects. With this in mind, Hawaiian Electric Company has adopted a policy of prudent avoidance where feasible.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken Morikami
Project Manager

KM:CTK

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

REX D. JOHNSON
DIRECTOR

DEPUTY DIRECTORS
JOYCE T. OMINE
AL PANG
JEANNE K. SCHULTZ
CALVIN M. TSUDA

IN REPLY REFER TO:
STP 8.5153

April 16, 1993

'93 APR 20 PM 4 50

Mr. Dana Teramoto
Department of Land Utilization
City and County of Honolulu
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Dear Mr. Teramoto:

Subject: Draft Environmental Impact Statement
Waialua-Kuilima 46KV Subtransmission Line

The preferred route for the 46KV transmission line crosses both our existing Kamehameha Highway and new Haleiwa Bypass Highway, which is currently under construction. Plans for the crossings must be closely coordinated with and approved by our Highways Division.

To avoid cutting relatively new highway pavement, we strongly recommend the transmission lines cross the Haleiwa Bypass Highway under the Helemano Stream Viaduct since HECO proposes that these lines proceed underground in this area. Paving in the vicinity of the viaduct has been scheduled for sometime in mid May 1993.

Thank you for the opportunity to provide comments.

Sincerely,

Rex D. Johnson
Director of Transportation

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840 0001

June 23, 1993

Mr. Rex D. Johnson, Director
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Johnson:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project. As we move into the design phase of this project we will be coordinating our efforts with your Department.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken Morikami
Project Manager

KM:CTK

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
Room 104, Old Federal Building
335 Merchant Street
Honolulu, Hawaii 96813
Telephone 587-3822

ESTHER UEDA
EXECUTIVE OFFICER

March 24, 1993

Ms. Dana Teramoto
Department of Land Utilization
City & County of Honolulu
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Dear Ms. Teramoto:

Subject: Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46 kv Subtransmission Line Project

We have reviewed the DEIS for the subject Waialua-Kuilima 46kv subtransmission line project, and confirm that the proposed alignment (alternate D) of the subtransmission line, as depicted on Figure 4-1, crosses the State Land Use Urban, Agricultural, and Conservation Districts at various points in its alignment.

We note that the proposed alignment will cross the Conservation District at Anahulu Stream as well as at Waimea Stream.

We have no other comments to offer at this time. We appreciate the opportunity to comment on this matter.

If you have any questions, please feel free to call me or Bert Saruwatari of our office at 587-3822.

Sincerely,

ESTHER UEDA
Executive Officer

EU:th

cc: Ken Morikami, HECO
Chester Koga, R.M. Towill

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840 0

June 23, 1993

Ms. Esther Ueda, Executive Officer
State Land Use Commission
Room 104, Old Federal Building
335 Merchant Street
Honolulu, Hawaii 96813

Dear Ms. Ueda:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken Morikami
Project Manager

KM:CTK

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

June 23, 1993

Mr. Gordon Matsuoka, State Public
Works Engineer
Department of Accounting and General Services
P.O. Box 119
Honolulu, Hawaii 96810

Dear Mr. Matsuoka:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken Morikami
Project Manager

KM:CTK

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MAY 13 1993

Department of Land Utilization
City and County of Honolulu
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Attention: Dana Teramoto

Gentlemen:

Subject: Waialua-Kuilima 46 kV Subtransmission Line
Waialua-Kuilima, Oahu
Draft Environmental Impact Statement

Thank you for the opportunity to review the subject document. We have no comments to offer.

If there are any questions, please have your staff contact Mr. Ralph Yukumoto of the Planning Branch at 586-0488.

Very truly yours,

Gordon Matsuoka

GORDON MATSUOKA
State Public Works Engineer

RY:jk
cc: Hawaiian Electric Company, Inc.
R. H. Towill Corporation
OEQC

JOHN WAIHEE
GOVERNOR

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

CHARLES T. TOGUCHI
SUPERINTENDENT

'93 APR 14 PM 1 21

UTILIZATION

OFFICE OF THE SUPERINTENDENT

April 1, 1993

Ms. Dana Teramoto
Department of Land Utilization
City and County of Honolulu
650 S. King Street, 7th Floor
Honolulu, Hawaii 96813

Dear Ms. Teramoto:

SUBJECT: Draft Environmental Impact Statement
Waialua-Kuilima 46 KV Subtransmission Line

We have reviewed the subject DEIS and have no objection to the preferred route of Alignment D for the subtransmission line. The preferred route will have no impact on Sunset Beach Elementary School.

Thank you for the opportunity to comment.

Sincerely,

Charles T. Toguchi
Superintendent

CTT:hy

cc: A. Suga
J. Sosa

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840 0001

June 23, 1993

Mr. Charles T. Toguchi, Superintendent
Department of Education
P.O. Box 2360
Honolulu, Hawaii 96804

Dear Mr. Toguchi:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken Morikami
Project Manager

KM:CTK

POLICE DEPARTMENT

CITY AND COUNTY OF HONOLULU

801 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96813 - AREA CODE (808) 529-3111

FRANK F. FASI
MAYOR

MICHAEL S. NAKAMURA
CHIEF

HAROLD ?. KAWASAKI
DEPUTY CHIEF

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OUR REFERENCE BS-LK

April 15, 1993

TO: DONALD A. CLEGG, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

ATTENTION: DANA TERAMOTO, ENVIRONMENTAL AFFAIRS BRANCH

FROM: MICHAEL S. NAKAMURA, CHIEF OF POLICE
HONOLULU POLICE DEPARTMENT

SUBJECT: WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE
PORTIONS OF 5:7:1 & 2, 5:8:1 & 2, 5:9:5 & 6,
6:1:2, 5-7, 6:2:7-10, 6:4:1 AND 6:6:18

This is in response to the draft Environmental Impact Statement for the Waialua-Kuilima 46 KV Subtransmission Line Project, March 1993.

We note that air quality, noise, and traffic impacts during construction will be mitigated. We have no other comments on the project at this time.

Thank you for the opportunity to review this document.

MICHAEL S. NAKAMURA
Chief of Police

By Eugene Uemura
EUGENE UEMURA
Assistant Chief of Police

cc: OEQC
Hawaiian Electric Company, Inc.
R. M. Towill Corporation

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840 00(

June 23, 1993

Chief Michael S. Nakamura
Honolulu Police Department
801 South Beretania Street
Honolulu, Hawaii 96813

Dear Chief Nakamura:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami
Ken Morikami
Project Manager

KM:CTK

An HEI Company

DEPARTMENT OF PARKS AND RECREATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

REC'D APR 5 1993

April 1, 1993

TO: DONALD A. CLEGG, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

ATTN: DANA TERAMOTO

FROM: WALTER M. OZAWA, DIRECTOR

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
WAIALUA-KUILIMA 46KV SUBTRANSMISSION LINE
WAIALUA AND KOOLAULOA, OAHU, HAWAII
TAX MAP KEY PORTIONS OF 5-7-1 & 2; 5-8-1 & 2;
5-9-5 & 6; 6-1-2, 5-7; 6-2-7:10; 6-4-1 AND 6-6-18

We have reviewed the DEIS for the proposed subject project and have no comment to offer at this time.

Thank you for the opportunity to review the project.

Should you have any questions, please contact Lester Lai of our Advance Planning Branch at extension 4696.

For WALTER M. OZAWA, Director

WMO:ei

cc: Ken Morikami, Hawaiian Electric Company, Inc.
Chester Koga, R. M. Towill Corporation

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu HI 96840 00

June 23, 1993

Mr. Walter M. Ozawa, Director
Department of Parks and Recreation
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Ozawa:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken Morikami
Project Manager

KH:CTK

DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813 • (808) 523-4432

FRANK F. FASI
MAYOR

DONALD A. CLEGG
DIRECTOR

LORETTA K.C. CHEE
DEPUTY DIRECTOR

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April 16, 1993

Mr. Chester Koga
R. M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817

Dear Mr. Koga:

Draft Environmental Impact Statement (DEIS) For
Waialua-Kuilima 46kV Subtransmission Line

We have reviewed the DEIS for the above project. Per your telephone conversation with our staff, we understand that a modified Corridor D scheme has been chosen from three alternate corridors. We have the following concerns pertaining to the Corridor D proposal:

1. Wildlife

Page 3-12 of the DEIS states, "The proposed subtransmission line alignment is not located near the habitats of any species whose status are monitored by the Federal and/or State government." What is the distance between the endangered birds' habitats and the proposed 46kV line? The Final EIS should include a location map of these areas.

2. Archaeological Resources

Page 1-5 of the DEIS states that portions of the line crossing archaeological areas will be surveyed. Which archaeological sites would be affected by the proposed corridor route? A map showing the proposed 46kV line and the archaeological site affected should be included in the Final EIS.

3. Visual Concerns

A view plane analysis should be completed for portions of the proposed alignment which will be visible from Kamehameha Highway. Profiles and elevation drawings showing the proposed 46kV lines as seen from Kamehameha Highway should be provided.

Special Management Area Use Permit (SMP)

The Final EIS should indicate the location of the modified corridor route and include a location map showing the Special Management Area (SMA) line. What portion of the kV line will be within the SMA?

Thank you for the opportunity to comment. If you have any questions, please contact Dana Teramoto of our staff at 523-4648.

Very truly yours,

Donald Clegg

DONALD A. CLEGG
Director of Land Utilization

DAC:ak

deis46kv.djt

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

June 23, 1993

Mr. Donald A. Clegg, Director
Department of Land Utilization
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Dear Mr. Clegg:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project. We have prepared responses to your comments of April 16, 1993 below.

1. Wildlife. The proposed alignment will not have any impact on habitats of species regulated by the State or Federal governments. The closest regulated area is the James Campbell Wildlife Refuge which is located along the coastline. The approximate distance between the Punamano section of this refuge and the Kuilima substation is approximately one mile.

2. Archaeological Resource. The sites in question are found in the valleys (Anahulu, in particular) below the subtransmission line. We do not feel that these areas will be impacted. Maps of the areas that have high potential for historic resources are found in the appendix. Construction activities will be monitored to ensure that if cultural remains are discovered, the findings will be transmitted to the State Historic Preservation Office.

3. Visual Concerns. We will include a view plane analysis for portions of the proposed alignment which will be visible from Kamehameha Highway.

4. Special Management Area (SMA). We will include a map that shows the relationship of the proposed subtransmission line to the SMA boundary. There are currently two sections of the line, near the Haleiwa substation and the Kuilima substation, where the line will be within the SMA boundaries.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken Morikami
Project Manager

KM:CTK

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET 5TH FLOOR
HONOLULU HAWAII 96813
PHONE (808) 523-4427 • FAX (808) 527-5498

FRANK F. FASI
MAYOR

E. JAMES TURSE
DIRECTOR

GAIL M. KAITO
DEPUTY DIRECTOR

REC'D MAY 3 1993

April 29, 1993

MEMORANDUM

TO: DONALD A. CLEGG, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: E. JAMES TURSE, DIRECTOR

SUBJECT: WAIALUA-KUILIMA 46KV SUBTRANSMISSION LINE PROJECT
DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
WAIALUA AND KOOLAULOA, OAHU
TAX MAP KEY: PORTIONS OF 5-7-1 & 2; 5-8-1 & 2; 5-9-5 & 6; 6-1-2,5-7; 6-2-7-10; 6-4-1 AND 6-6-18

We have no comments to offer on the Draft Environmental Impact Statement for the Waialua-Kuilima 46kv Subtransmission Line Project.

Should you have any questions, please contact Jason Ching of our Planning and Analysis Division at 523-4368.

Thank you for the opportunity to comment.

for Gail Kaito
E. JAMES TURSE
Director

cc: Office of Environmental Quality Control
Hawaiian Electric Company, Inc.
R. M. Towill Corporation

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

June 23, 1993

Mr. E. James Turse, Director
Department of Housing and Community Development
650 South King Street, 5th Floor
Honolulu, Hawaii 96813

Dear Mr. Turse:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami
Ken Morikami
Project Manager

KM:CTK

An HEI Company

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

COPY

April 26, 1993

TO: DONALD A. CLEGG, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

ATTN: DANA TERAMOTO

FROM: KAZU HAYASHIDA, MANAGER ~~AND CHIEF~~ ENGINEER
BOARD OF WATER SUPPLY

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) FOR HAWAIIAN ELECTRIC COMPANY'S (HECO) PROPOSED WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE, WAIALUA AND KOOLAULOA, TMK: PORTIONS OF 5-7-1, 2; 5-8-1, 2; 5-9-5, 6; 6-1-2, 5 TO 7; 6-2-7 TO 10; 6-4-1; 6-6-18

Thank you for the opportunity to review and comment on the proposed electric subtransmission line project.

Our concerns on the potential conflict of the project with our water system facilities are adequately addressed by the document.

If you have any questions, please contact Roy Doi at 527-5235.

cc: Hawaiian Electric Company, Inc.
✓R. M. Towill Corporation

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu HI 96840 0001

June 23, 1993

Mr. Kazu Hayashida, Manager
and Chief Engineer
Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96813

Dear Mr. Hayashida:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken Morikami
Project Manager

KM:CTK

DEPARTMENT OF TRANSPORTATION SERVICES

CITY AND COUNTY OF HONOLULU

HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

JOSEPH M. MAGALDI, JR.
DIRECTOR

AMAR SAPPAL
DEPUTY DIRECTOR

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April 21, 1993

MEMORANDUM

TO: DONALD A. CLEGG, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: JOSEPH M. MAGALDI, JR., DIRECTOR

SUBJECT: WAIALUA-KUILIMA 46KV SUBTRANSMISSION LINE
DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
TMK: PORTIONS OF 5-7-1 AND 2; 5-8-1 AND 2;
5-9-5 AND 6; 6-1-2, 5-7; 6-2-7-10; 6-4-1; 6-6-18

This is in response to the DEIS submitted to us for review on March 23, 1993 by the Office of Environmental Quality Control.

Based on our review, we have no objections to the proposed project at this time. Construction plans for all work within the City's street right-of-way should be submitted to our department for review. A traffic control plan showing temporary detours for pedestrians and vehicles should be included in these plans once a preferred alternative has been chosen.

Should you have any questions, please contact Lance Watanabe of my staff at local 4199.

JOSEPH M. MAGALDI, JR.

cc: Hawaiian Electric Company, Inc.
Office of Environmental Quality Control
R. M. Towill Corporation

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840 00

June 23, 1993

Mr. Joseph M. Magaldi, Jr., Director
Department of Transportation Services
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Magaldi:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project. At the present time, we have not yet begun the design phase of our project, therefore, we cannot provide the construction plans and traffic control plans to you. However, once they have been completed, they will be transmitted to your office for review.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken Morikami
Project Manager

KM:CTK

PLANNING DEPARTMENT
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU HAWAII 96813

FRANK F. FASI
MAYOR

ROBIN FOSTER
CHIEF PLANNING OFFICER

ROLAND D. LIBBY, JR.
DEPUTY CHIEF PLANNING OFFICER

MM 3/93-800

May 7, 1993

'93 MAY 7 PM 4 29
DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

MEMORANDUM

TO: DONALD A. CLEGG, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: ROLAND D. LIBBY, JR., ACTING CHIEF PLANNING OFFICER
PLANNING DEPARTMENT

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR HAWAIIAN ELECTRIC COMPANY (HECO) PROPOSED WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE

We have reviewed the subject Draft EIS for Hawaiian Electric Company's proposed Waialua-Kuilima 46kV Subtransmission Line and have the following comments to offer:

1. The Final EIS should include a more in-depth, field archaeological study for the preferred transmission line corridor as recommended in the Archaeological Report Appendix A.

2. The Draft EIS states that the proposed line will be routed along boundaries and fringes of the Boy Scouts Camp and the Girl Scouts Camp (pp 1-3 and 1-4). The Final EIS should include a map which shows in relative detail the proposed line in relationship to these areas.

3. The Draft EIS (page 3-4) indicates that construction activities should not impact on the Boys and Girls Scout Camp areas. The Final EIS should be expanded to include a discussion of other than construction related impacts, such as electrical and magnetic fields, etc.

4. The EIS should elaborate on the existing and growing electrical demands of customers referenced under the No Action Alternative on page 1-8.

5. The EIS should assess visual impacts of the different alternatives using photo overlays or similar illustrations. Public views of importance are identified in the Development Plan (DP) Special Provisions for the North Shore. The makai alternatives would impact severely on coastal views in the area. The mauka alternatives have a lesser impact. The Planning Department is currently processing an amendment to the North Shore DP Special Provisions which would identify additional coastal views to be protected (see attached).

Thank you for the opportunity to comment. Should you have any questions, please contact Mel Murakami of our staff at 527-6020.

ROLAND D. LIBBY, JR.
Acting Chief Planning Officer

RDL:ft

Attach.

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

June 23, 1993

Mr. Roland Libby, Jr., Deputy Director
Department of General Planning
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Libby:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project. We would like to offer the following responses to your inquiries:

1. Archaeological Study. As part of the design process we will be undertaking an inventory of cultural resources along the final alignment. This inventory will take place after the line is designed in order to precisely locate the location of poles and anchors. The finding of this inventory will be forwarded to the Historic Preservation Division of the Department of Land and Natural Resources.

2. Boy / Girl Scouts. We will include maps indicating the proposed alignment in relationship to the Boy and Girl Scout facilities in the final EIS.

3. Electric and Magnetic Fields. As you may be aware, the electrical and magnetic field strengths of transmission line reduces fairly dramatically with distance. We propose to locate the line along the makai boundary of the Boy and Girl Scout camps, thereby, reducing field strengths at the Scout facilities to negligible levels.

4. Electrical Demand. The function of this new subtransmission line as stated in the draft EIS is twofold: 1) to maintain reliable service by correcting existing low voltage conditions and providing a backup system, and 2) to provide additional transmission capacity. The predicted loads for the North Shore region were calculated using the following methods: 1) reviewing the "Central Oahu/North Shore Regional Plan" developed by the Central Oahu/North Shore Task Force which identifies residential, resort, commercial, industrial, and agricultural uses; 2) deriving load density factors from existing loads in the North Shore area and applying these load density factors to the expected land use; and 3) adding the expected loads from actual

service requests received for a particular development. A load flow analysis was then used to determine the optimum solution to low voltage and overload problems under various line outage conditions.

5. Visual Impacts. We will include a view plane analysis for portions of the proposed alignment which will be visible from Kamehameha Highway. Thank you for the information relating to the 1993 Development Plan amendments.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken Morikami
Project Manager

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ENV 93-75

March 25, 1993

MEMORANDUM

TO: MR. DONALD A. CLEGG, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

ATTENTION: DANA TERAMOTO

FROM: C. MICHAEL STREET, DIRECTOR AND CHIEF ENGINEER

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
WAIALUA-KUILIMA 46 kV SUBTRANSMISSION LINE
TMK:VARIOUS

We have reviewed the subject DEIS and have the following comments:

Construction plans should be submitted for our review to ensure that there are no conflicts between the proposed subtransmission line alignment and City utility lines such as sewer and storm drains.

Should you have any questions, please contact Mr. Alex Ho at x4150.

C. Michael Street
C. MICHAEL STREET
Director and Chief Engineer

cc: HECO (Ken Morikami)
R.M. Towill Corporation (Chester Koga)

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840 00

June 23, 1993

Mr. C. Michael Street, Director
Department of Public Works
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Street:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project. At the present time, we have not yet begun the design phase of our project and, therefore, cannot provide the construction plans to you. However, once they have been completed, they will be transmitted to your office for review to ensure that there are no conflicts between our subtransmission line and the City's utility lines.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami
Ken Morikami
Project Manager

KM:CTK

S. E. LUCKY COLE — PLANNING CONSULTANT
59-229C Ke Nui Road
Haleiwa, HI 96712
(808) 638-7389; (800) 678-5263
(808) 638-8736 FAX

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DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

May 6, 1993

Donald Clegg, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street, 7th floor
Honolulu, Hawaii 96813

Subject: Hawaiian Electric Transmission Line through Sunset Beach

Dear Don:

<u>I support the proposed mauka route for the transmission line.</u> As you know I was the President of the Sunset Beach Community Association (SBCA) in 1991 and 1992. During my term Hawaiian Electric Company (HECO) met with the SBCA and the executive committee on numerous occasions. There were substantial concerns expressed by the residents over the routes under consideration, especially the coastal route and the connecting link along Pupukea Road for the mauka routes. HECO listened to the residents and came back with a creative Mauka alignment with an alternative method of providing redundant service to Sunset Beach.

I'm sure there will be negotiations required for this new alignment as it impacts several major landowners, but it is much simpler than the prior alternatives which impacted several thousand coastal and Pupukea residents. I think HECO and Ken Morikami, the Project Manager, should be commended for listening to the residents and developing a creative alternative.

If you or your staff have any questions, I can be reached at 637-3507 during the day.

Sincerely,

Schuyler E. "Lucky" Cole

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

June 23, 1993

Mr. S. E. Lucky Cole
Planning Consultant
59-229C Ke Nui Road
Haleiwa, Hawaii 96712

Dear Mr. Cole:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken Morikami
Project Manager

KM:CTK

An HEI Company

GROUP 70
INTERNATIONAL

3 May 1993

Mr. Ken Morikami
Project Manager
Hawaiian Electric Company, Inc.
820 Ward Avenue
Honolulu, HI 96814

Re: **Draft Environmental Impact Statement**
Waialua-Kuilima 46 kV Subtransmission Line Project

Dear Mr. Morikami:

Obayashi Hawaii Corporation is providing comments on the Draft EIS for the North Shore, Oahu 46 kV line project. As you are aware, Obayashi is planning to develop the Lihi Lani Ranch on 1,144 acres of land in Pupukea. Our comments address concerns about the selected route for the new subtransmission line, as it relates to the Lihi Lani project and the surrounding community.

Of the various alternatives considered by HECO for this facility routing, the selected Mauka route would have a relatively minor effect on Lihi Lani. Areas planned for hiking and riding trails, horse ranch, campground and conservation park would be adjacent to the proposed routing. The State of Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife has encouraged Obayashi to ultimately provide a fire break clearing in the forest along the mauka boundary. It is possible that Obayashi could grant an easement through this clearing to accommodate the new 46 kV line.

Thank you for this opportunity to present our comments on the Draft EIS for your new transmission facility. We would like to remain in close contact during the planning process for this facility, and look forward to meeting with you and your consultant in the future. Please contact me or Jeff Overton at Group 70 if you have any questions or require further information.

Sincerely,

OBAYASHI HAWAII CORPORATION

Craig Yamagishi (ue)
Craig M. Yamagishi
Lihi Lani Project Coordinator

cc OEQC, Brian Choy
R. M. Towill, Chester Koga
Group 70, Jeff Overton

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

June 23, 1993

Mr. Craig M. Yamagishi, Project Coordinator
c/o Group 70 International
924 Bethel Street
Honolulu, Hawaii 96813

Dear Mr. Yamagishi:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project. As noted in the DEIS, our plans are to route the proposed subtransmission line along the mauka edge of the Lihi Lani development.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami
Ken Morikami
Project Manager

KM:CTK

Comp FAX

The Hawai'i — Lā'ieikawai Association, Inc.
P.O. Box 720, Ka'a'awa, Hawai'i 96730 • Phone (808) 237-7015/(808) 237-7339 • Fax (808) 237-8962

May 7, 1993

'93 MAY 10 AM 12 57
DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

Ms. Dana Teramoto
Department of Land Utilization
650 South King Street
Honolulu, Hawai'i 96813

Dear Ms. Teramoto

re: Draft EIS for Waialua-Kuilima 46 KV Subtransmission line project

We incorporate herein by reference all of the questions and comments made by Hawai'i's Thousand Friends (HTF) in their April 22, 1993 letter addressed to you on this subject. We request complete replies to all of the comments and questions made by HTF (letter of April 22, 1993 attached).

In addition we wish to point out that the archaeological section (pp 3-24) is meager and incomplete. We put you on notice that the "if the applicants find any iwi of Hawaiians all you have to do is dig 'em up and bury them someplace else" philosophy is so culturally insensitive and abhorrent that it is unacceptable to us.

Furthermore, the section on "electric and magnetic fields" is incomplete and misleading in my view. It is "misleading and incomplete" because it appears not to have drawn on the most recent information published in professional sources. Failure to make such disclosures, may, inter alia, leave the applicant wide open to lawsuits.

Lastly, part of the alleged reason for the need for "additional transmission capacity [is] to meet the growing demands of existing customers and to accommodate projected load growth along O'ahu's North Shore" (emphasis added) (pp. 3-29, 3.3.5). Please have the applicants provide evidence of what they call "growing demands". Who has demanded what and what can you produce in the way of evidence substantiating these alleged "demands".

With respect to "projected load growth along O'ahu's North Shore": What specifically in the way of projected load growth are the applicants talking about? Please itemize with specificity what they claim constitutes projected load growth. In addition, in their calculations of projected load growth are the applicants taking into account the closure of Waialua Sugar and developments that the three principal landowners in the area - Bishop Estate, Castle and Cooke and Mokuleia Land Company - have in mind? Have the applicants had any discussions or correspondence with these landowners or their agents or other prospective developers and/or their agents concerning their "projected load growth needs"? If so, please provide such evidentiary material in substantiation of

the claim of "demands" related to "projected load growth". Has the applicant discussed with Castle and Cooke or their agents matters related to the prospective closure of Waialua Sugar? If so, please provide details.

Sincerely yours

J. M. Anthony, Ph.D.

Encl.

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

June 23, 1993

Mr. J.M. Anthony, Ph.D.
The Hawaii - Laieikawai Association, Inc.
P.O. Box 720
Kaaawa, Hawaii 96730

Dear Dr. Anthony:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project. We would like to offer the following responses to your comments:

1. Hawaii Thousand Friends. We have included our response to Hawaii Thousand Friends for your reference.

2. Archaeological Resources. Once the alignment has been finalized we will undertake a detailed archaeological study to validate our initial findings. As part of the construction plans for this project, provisions will be made to notify the State Historic Preservation Division in the event that cultural remains are discovered.

3. Electric and Magnetic Fields. We believe that the information we have presented represent a fair assessment of the current state of knowledge. Based on findings presently available, there currently is no conclusive scientific evidence which suggests a direct correlation between electric and magnetic field exposure to adverse human health. With this in mind, Hawaiian Electric Company has adopted a policy of prudent avoidance where feasible. The State Department of Health has taken a similar position as evidenced by its policy on EMF.

4. Purpose and Need for the Proposed Action, pg. 1-2. The projected load growth cited in the DEIS includes actual service requests for the expansion at Kuilima, Lihi Lani, and new residential units. Also, the predicted loads for the North Shore region were calculated by deriving load density factors from exiting loads in the North Shore area and applying these load density factors to the expected land use as identified in such studies as the "Central Oahu/North Shore Regional Plan".

The closure of Waialua Sugar has been discussed with the land owner and operator. We are not in a position to predict their future.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken Morikami
Project Manager

KM:CTK

HAWAII'S THOUSAND FRIENDS

Ke aloha o ko kākou ʻāina, ʻO ia ka mana kū paʻa. Pānoanoa ka ʻāina, Mānoanoa ka poʻe.
The Love of our land, is the power for us to stand fast. Rare is the land, many are the people.

DATE: 5/4/93

TO: Department of Land Utilization
650 South King Street
Honolulu, Hawaii 96813
Attn: Dana Teramoto:

FROM: Donna Wong

RE: Draft EIS for Waialua-Kuilima 46KV Subtransmission Line Project

Pg. 1-2 1.2 PURPOSE AND NEED FOR THE PROPOSED ACTION
What is the "projected load growth" anticipated along the corridor that the 46KV line is anticipated to support?

Pg. 1-3 1.5.1 Existing Uses and Proposed Development
What are the expected impacts that will affect sugar cane field operations?

Pg. 1-4 1.5.2 Topography
Will equipment and maintenance access roads have to be built to get to remote areas? If so where, how many and what are the impacts?

Pg. 1-6 1.5.7 Electric and Magnetic Fields (EMF)
This section only refers to the "closest occupied residences" and it appears that no consideration has been given to current, projected or proposed land use designation and/or zoning changes that would place residential development closer to the lines.

Pg. 1-7 1.5.9 Traffic
We are concerned with traffic congestion at Weed Circle. This area presents a particular problem because work can not be scheduled on week ends because of the around-the-island week end traffic. We suggest that traffic solutions be worked out with the local residents.

Pg. 1-14 1.8.2 Department of Health
Is Section 401 water Quality Certification needed for potential impacts to streams? If so identification of streams and impacts is essential? Under POTENTIAL PERMITS AND APPROVALS the Water Commission was not listed. Why?

Pg. 1-15 1.8.3 Department of Public Works
For what portions of the construction are de-watering permits needed and it doesn't appear that the effects of "de-watering" have been determined and evaluated?

Pg. 2-6 2.5.1 Overhead Sections
How many "access road(s)" need to be constructed for surveying and what will happen to these cleared areas once survey work is completed? There is serious concern that vehicles entering the pristine areas will introduce new flora species thus impacting the native ecosystem. The DEIS does not address this issue and the impacts and solutions need to be fully assessed?

Pg. 2-8 2.5.3 Quality Control
Where will "excess material", dirt, asphalt, rocks etc. be discarded? How many tons are anticipated to be removed in total and from remote areas specifically? Will dirt or any other substance be brought into the pristine areas?

Pg. 2-9 2.6 PROJECT SCHEDULE
The completion time of 12 months is ambitious given all required permits needed plus weather adversity and unforeseen conditions. A more realistic time table would be 18-24 months.

Figures 3-2
3-3 The maps neglect to show the current Land Use Designations and county zoning.

Pg. 3-4 Impacts and Mitigation Measures
At this time Lihi Lani has withdrawn their request as described in this Draft EIS but a future proposal could impact the present "buffer zone". Also extreme caution should be taken with regard to the health and safety from lines and EMF's for the Boy Scouts and Girl Scouts Camps. If there is a potential health risk our children are the last ones we want to be exposed.

Pg. 3-6 It would be helpful to have a map showing the various soil types so that construction activity relationship to slopes, construction activity, rainfall etc. can be considered. Since several of the soil types are conducive to medium to rapid runoff and moderate to severe erosion these areas will require more extensive and comprehensive erosion control plans.

305 Hahani St., Suite 282 • Kailua, HI 96734 • (808) 262-0682

Pg. 3-8 rRK Rock Land does not identify the runoff or erosion hazard.

Pg. 3-9 Impacts and Mitigation Measures
Please identify the location of the "fill sites".

Pg. 3-10 3:2.4 Hydrology and Drainage
Impacts and Mitigation Measures
We strongly disagree with the conclusion that "No adverse impacts are anticipated on surface water or groundwater resources...." since access and surveying roads must be cut as well as grading and grubbing will disturb the soil. It is probable that temporary or permanent bridges over streams and natural drainage areas will be necessary and these activities will impact stream flow, course and water quality. Siltation can be a major problem from rain and wind will transport barren soil into streams.

It is to simplistic to say "There should be no discharges into surface waters nor any violations..." because it is impossible to evaluate all conditions prior to work beginning at a site. As stated above the impacts of "discharges into surface water" must be anticipated and evaluated.

Pg. 3-12 3.2.6 Flora and Fauna
We are concerned that the impacts to the native, endangered and tall trees because impacts are only discussed in the context of "immediate alignment" and there is no discussion of access roads, moving of heavy equipment etc.. It is presumptuous to say that "because clearing and tree trimming" will be within the right-of-way that there will be no impact to native plants and large trees. The final EIS must identify the route for access roads, survey roads, areas needed for heavy equipment movement as well as define the boundaries of the right-of-way and identify the flora within these areas and present bypass and/or mitigation plans.

Pg. 3-17 Fauna
Is monitoring habitat sites by Federal and/or State government the only consideration given in reaching the conclusion of significant impact? This statement is to simplistic because the fact that an area has not been monitored thus native species do not exist is false.

In order to ensure that cutting of access roads, movement of heavy equipment, soil removal and importation does not negatively impact flora and fauna these access routes must be predetermined, and evaluated for all possible impacts. All impacts can not be considered just to pertain to the right-of-way areas.

Pg. 3-18 Impacts and Mitigation Measures
The conclusion "...potential resident birds and migratory birds that may use the area are not expected to be significantly impacted by the subtransmission line" is premature because the DEIS has not explored the flight pattern of area and migratory birds.

Pg. 3-21 3.2.9 Air Quality
What besides "adequate" dust control measures will be used during construction?

3.2.10 Noise and Vibration
Impacts and Mitigation Measures
In order to limit irritation from constant construction noise we suggest that set hours be established such as work can not begin before 7:00 am and must end by 5:00 pm. on weekdays and at 9:00 am and to 4:00 pm on weekends.

Pg. 3-24 Impacts and Mitigation Measures
How can the conclusion be reached that "No short or long-term impacts are expected..." given prior to a complete and thorough archaeological survey is conducted along all impacted areas such as access and survey roads, etc..

What is meant by "care will be taken that the placement of the infrastructure avoids impact on any sites in the project area"? What is a "surface survey"?

Will an archeologist/anthropologist accompany the construction crew during field work in the pristine areas?

Pg. 3-28 3.3.3 Electric and Magnetic Fields
Impacts and Mitigation Measures
We support and appreciate the precautions taken by HECO to "design power lines to minimize electric and magnetic fields...", and "...avoiding highly populated areas, optimizing conductor configurations, and locating conductors as high above ground as possible...".

Pg. 3-29 3.3.4 Recreational Facilities
Impacts and Mitigation Measures
What is the projected closure time for Waimea Valley?

Pg. 3-29 3.3.5 Population Characteristics
Impacts and Mitigation Measures

Since one of the functions of this subtransmission line is "to provide additional transmission capacity to meet the growing demands of existing customers and to accommodate projected load growth along Oahu's North Shore" we believe that the demographics of that projected growth need to be included in the final EIS.

Pg. 4-4 4.2.3 Section 226-12 Objectives and Policies for the Physical Environment - Scenic, Natural Beauty, and Historic Resources

While care has been given to protect view planes we do not feel that the same attention has been given to the protection of potential "historic resources."

Pg. 4-7 4.5 CITY AND COUNTY OF HONOLULU GENERAL PLAN

The Distribution of Residential Population shows that the North Shore is only slated to grow by .2% up to the year 2010. Because of this desired population constraint we feel that it is important that the final EIS address the carrying capacity of the new 46KV line. Will the line accommodate a population greater than the General Plan desired population distribution?

While the installation of underground utility lines is in Objective D, and HECO is restrained from putting in overhead lines in the Haleiwa Special District, where construction work may be more intense, we do not feel that this is just cause for a rate increase.

Pg. 4-9 4.10 SPECIAL MANAGEMENT AREA

What is meant by "That permit application has been supported in part by this EIS"?

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

June 23, 1993

Ms. Donna Wong
Hawaii's Thousand Friends
305 Hahani Street, Suite 282
Kailua, Hawaii 96734

Dear Ms. Wong:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project. We would like to offer the following responses to your inquiries:

1. Purpose and Need for the Proposed Action, pg. 1-2. The projected load growth cited in the DEIS includes the expansion of Kuilima, Lihi Lani, new residential units, and increased usage from existing customers.

2. Existing Uses and Proposed Development, pg. 1-3. The proposed subtransmission line will minimally impact sugar operations. Impact will occur where the subtransmission line is located over cane fields. In these areas, the cane will need to be cleared prior to burning. HECO will work with the proper tenants to compensate for any cane damage.

3. Topography, pg. 1-4. As currently proposed the subtransmission line may require upgrade of existing or creation of new access roads. Where there are no access roads, construction material will be taken to or removed from the site by helicopter.

4. Electric and Magnetic Fields, pg. 1-6. The siting of the proposed alignment considered both existing and potential developments along the alignment. Taking the more mauka alignment limited the possibility of near term impacts on proposed developments.

5. Traffic, pg. 1-7. We are aware of the traffic problems at Weed Circle and Kamehameha Highway and will be limiting our work to off peak periods as specified by the State Department of Transportation.

6. Department of Health, pg. 1-14. The list of permits identified were for the purpose of identifying all potential permitting requirements. The actual permits sought will be determined by the final alignment that is selected. We have taken the approach of avoidance where possible in order not to trigger a

particular permit. By mitigating impacts in the planning phases we hope to avoid impacts in the design and construction phases. We did not include the Commission on Water Resources because we did not anticipate impacts to streams or gulches. However, should we find that stream disturbance is necessary, we will consult with the Commission on Water Resources.

7. Department of Public Works, pg. 1-15. Dewatering may be required in the underground sections in Haleiwa where trenches will be dug for the duct lines. Because the water removed will be ground water, we do not anticipate any impacts. We will consult with the Department of Health to ascertain the need for a NPDES permit.

8. Overhead Sections, pg. 2-6. Access to the location of the proposed polelines will be via existing cane haul roads, military access roads, and service roads previously constructed. In those locations where the structure sites are some distance away from the main access road, spur roads may be constructed for vehicular access. The trees and vegetation in the areas where the polelines will be sited are predominantly introduced species.

9. Quality Control, pg. 2-8. Less than three cubic yards of soil will be excavated during pole hole excavation operations. All excavated material will be spread next to the installed pole. No new dirt will be brought to the pole sites.

10. Project Schedule, pg. 2-9. The project schedule developed for this project is based on previous experience. The construction time of 12 months assumes that the design has been completed and all permits and approvals received.

11. Figure 3-2 and 3-3. The State land use designations and zoning are shown in Section 4.

12. Impacts and Mitigation Measures (p. 3-6). The proposed alignment will be along the mauka edge of the Lihi Lani development thereby allowing the developer to maximize the use of his property. The proposed alignment will also be located along the edge of the Boy Scout and Girl Scout facilities and will provide sufficient distance to mitigate the impact of electric and magnetic field affects from the proposed subtransmission line.

13. Pg. 3-6. We will consider the need for developing a detailed soils map for the area. Where there is a potential for soil erosion, we will develop an erosion control plan.

14. Pg. 3-8. The rRK Rock Land classification does not have a single erosion factor. This "soil type" occurs from low elevation to very high elevation, and occurs in level to steep terrain. Based on this finding, the erosion factor would vary according to location and topography.

15. Pg. 3-9. Excess excavated material will be disposed at an approved fill site, such as the Kawailoa transfer station.

16. Hydrology and Drainage, pg. 3-10. As stated earlier, access to the area will be via existing roads. New spur roads may be constructed to allow the installation of the polelines. These spur roads will be constructed in such a manner so as not to impact streams or natural drainage areas. However, should we find that stream disturbance is necessary, we will consult with the Commission on Water Resource Management.

17. Flora and Fauna, pg. 3-12. The proposed alignment has been examined for the presence of native endangered plant species and none were found. When the final alignment is set a detailed survey of each structure site and new spur road will be conducted to inventory the plant species that may be affected. As stated earlier, we will attempt to mitigate where possible through avoidance.

18. Fauna, pg. 3-17. The monitoring by Federal or State agencies is related to a particular specie being listed on the rare, threatened or endangered specie list. This it not to suggest that only species monitored by the State or Federal governments are given consideration. Once the alignment is finalized, a detailed survey will be conducted to evaluate the potential impacts.

19. Impact and Mitigation, pg. 3-18. We will re-word this section to indicate that flight patterns were not evaluated.

20. Air Quality, pg. 3-21. Adequate dust control measure will mainly include watering to keep the dust under control.

Noise and Vibration. Construction duration on a given day will be limited depending on location. In residential areas, construction will be limited by the provision of the State noise code. Where construction noise exceeds the noise code, then a variance will be required or a different work method will be employed to reduce construction noise to an acceptable level, particularly during the evening hours and on weekends.

21. Impacts and Mitigation, pg. 3-24. Once the alignment has been finalized we will undertake another inventory to validate our initial findings. As part of the construction plans for this project, provisions will be made to notify the State Historic Preservation Office in the event that cultural remains are discovered. A surface survey is a study of above ground conditions.

22. Electric and Magnetic Fields, pg. 3-28. One of the factors used to determine the selection of the route and the proposed

design of the system was Hawaiian Electric's commitment to minimize electric and magnetic fields where possible.

23. Recreational Facilities, pg. 3-29. The closure of Waimea Valley, mainly the upper reaches of the valley and not the Waimea Falls Park, will be for approximately five days. This closure is for the protection of hikers during the construction period.

24. Population Characteristic, pg. 3-29. We will include additional information regarding the projected population for this district.

25. Section 226-12, pg. 4-4. See comment No. 21 above.

26. City and County General Plan, pg. 4-7. The function of this new subtransmission line as stated in the draft EIS is twofold: 1) to maintain reliable service by correcting existing low voltage conditions and providing a backup system, and 2) to provide additional transmission capacity. The predicted loads for the North Shore region were calculated using the following methods: 1) reviewing the "Central Oahu/North Shore Regional Plan" developed by the Central Oahu/North Shore Task Force which identifies residential, resort, commercial, industrial, and agricultural areas; 2) deriving load density factors from existing loads in the North Shore area and applying these load density factors to the expected land use; and 3) adding the expected loads from actual service requests received for a particular development. A load flow analysis was then used to determine the optimum solution to low voltage and overload problems under various line outage conditions.

Inclusion of undergrounding costs in the rate base is reasonable if done for engineering or operating reasons, or if mandated by City or State regulations.

27. Special Management Area, pg. 4-9. The statement refers to the need of an environmental evaluation as part of the permit application. This EIS will be submitted as part of our permit application with the City and County.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken Morikami
Project Manager

KM:CTK

Martin A. Woll
SUITE 2500, PACIFIC TOWER
1001 BISHOP STREET
HONOLULU, HAWAII 96813

7 May, 1993

Ms. Dana Teramoto
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, HI 96813

Re: Draft Environmental Impact Statement (EIS) for Proposed
HECO 46kV Waialua - Kuilima Transmission Line

Dear Ms. Teramoto:

I wish to register my opposition to the above-cited transmission line project as currently planned, on the basis that the environmental impact report is incomplete.

The proposed line has the potential to cause significant radio-frequency interference (RFI) both along its route and in surrounding areas, which include my personal residence on Kanalani Place near the top of Pupukea Road. I spoke with Mr. Ken Morikami, project manager at Hawaiian Electric Co. (HECO), on 25 March about my concerns. He acknowledged that the environmental impact report did not address the issue of RFI and agreed to send me a copy of the relevant portions of the EIS on an earlier, similar project. I also requested detail concerning the hardware configuration for the line supports to be used in the current project, and Mr. Morikami said he would try to get that information to me as well. I have learned that the requested items are just now being sent to me, however, making it impossible for me to read and evaluate them by today's comment deadline. At this point, therefore, I have no evidence that the RFI issue has been adequately addressed.

While I support the need for more reliable electrical service in our area, the RFI which could be caused by the proposed line would have severe negative consequences for me. I am a federally licensed amateur radio operator active on the medium-frequency and high-frequency bands allocated to the amateur radio service. My current residence has multiple antenna towers and is advantageously located for long-distance communication. This installation is unique in the state and, due to zoning changes since its approval and construction, could not be duplicated anywhere on

Oahu. Even a moderate level of radio-frequency noise from the proposed lines could render reception of distant signals impossible, impairing my investment and the enjoyment and use of my property substantially.

The causes of RFI are numerous and include inadequate design of the transmission system, inappropriate hardware selection, improper installation and inadequate maintenance, among others. These factors should all be addressed prior to approval of the project. Further consideration should be given to underground installation of the line, which tends to reduce the interference potential considerably; the reduction in otherwise-needed maintenance would likely help mitigate the additional installation cost as well.

I will be pleased to discuss the foregoing issues further with representatives of your agency or of HECO, and I look forward to the opportunity to review any supplements or amendments to the project plan or to the EIS which address my concern. My home telephone is 638-7720; office is 531-3666. Mail can be sent either to my letterhead address or to my home address: 59-768 Kanalani Place, Haleiwa, HI 96712.

Very truly yours,

Mark A. Woll

Martin A. Woll

cc: Mr. Ken Morikami, Project Manager, HECO
✓Mr. Chester Koga, R.M. Towill Corp.
Hon. Rene Mansho, City Council

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840 0001

June 23, 1993

Mr. Martin A. Woll
Suite 2500, Pacific Tower
1001 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Woll:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project. Again, I apologize for not getting the information requested to you sooner. We trust that the information provided by our office on May 7, 1993 adequately addressed your concerns. At the present time we are planning to shift the alignment in a mauka direction so as to avoid the Pupukea area. This will greatly increase the distance between the line and your antenna towers. Nevertheless, we will include a section on radio and television interference in the Final EIS.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken Morikami
Project Manager

KM:CTK

THE ESTATE OF JAMES CAMPBELL

April 12, 1993

Ms. Dana Teramoto
Department of Land Utilization
650 S. King Street
Honolulu, HI 96813

Dear Ms. Teramoto:

Re: Waialua-Kuilima 46 Kv Subtransmission Line Project

We have reviewed the DEIS and wish to offer the following comments.

We have had discussions with HECo and have expressed to them our preference for placing the line underground along Kamehameha Highway or for using the mauka most route, alignment "E". The proposed alignment, as depicted in Figure 2-1, would do irreparable visual damage to the Kawela Bay/Turtle Bay area by virtue of the line's prominent location at the edge of the bluff where the line crosses the Estate's property. We have expressed our willingness to discuss easements to implement alignment "D" as a compromise which is both possible and more cost effective than the proposed alignment which combines alignment "D" with alignment "B".

Thank you for the opportunity to comment.

Very truly yours,

Henry Eng

Henry Eng, AICP
Manager, Land Planning

cc: OEQC
HECo
R.M. Towill

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu HI 96840 00

June 23, 1993

Mr. Henry Eng, AICP
Manager, Land Planning
The Estate of James Campbell
Suite 500
828 Fort Street Mall
Honolulu, Hawaii 96813

Dear Mr. Eng:

SUBJECT: Draft Environmental Impact Statement for the Waialua-Kuilima 46 kV Subtransmission Line Project, North Shore, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waialua-Kuilima 46kV Subtransmission Line Project. The preferred alignment presented in the DEIS is at present the best alternative taking all data factors into consideration.

The combination of alignment 'D' with alignment 'B' was based on a response by your tenant, the United States Army, who expressed strong opposition to both alignments 'D' and 'E' due to their use of the Kahuku Army Training Area. We believe that the current "combined" route will meet the Army's needs as well as have limited visual impact upon Turtle Bay, in that, it will be set back from the bluffs overlooking Kamehameha Highway. As we have indicated in our meetings, we will continue to work with your organization to site the proposed 46kV subtransmission line in a location which is mutually agreeable to both Campbell Estate and HECO.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken Morikami

Ken Morikami
Project Manager

KM:CTK

An HEI Company

APPENDIX A

ARCHAEOLOGICAL STUDY

Waialua to Kahuku Power Line

by

Michael Pfeffer, B.A.
and
Hallett H. Hammatt, Ph.D.

prepared for

R. M. Towill

Cultural Surveys Hawai'i
February 1992

Abstract

Historical research was undertaken for R.M. Towill Corporation on a tract of land on the North Shore of O'ahu. The project area stretches from the town of Waialua to an area near Kahuku and rises from the coast to an elevation of 1,300 feet in the Kawailoa Forest Reserve. Six proposed transmission line corridors (designated A through F) run from Waialua to an existing sub-station inland from Kuilima Point. Research documented five specific areas of archaeological concern that could be impacted by the proposed corridors: 1) the coast of Waiale'e *ahupua'a*; 2) the Pupukea/Paumalu Homestead lands; 3) Waimea Valley; 4) Anahulu Valley; and 5) the area in and around Waialua and Haleiwa.

Within the five areas of concern, Cultural Surveys Hawaii has documented the presense of a variety of Hawaiian sites, Land Commission Awards, and cultural resources that require special consideration. Both the primary and secondary impacts of a transmission line corridor on these sites and cultural resources should be considered. More in depth study and field survey is recommended when a specific transmission line corridor is chosen.

Acknowledgements

We wish to thank Dr. Tom Dye at the State Historic Preservation Office for his assistance in helping to compile information on the study area and Waialua Sugar Company for the use of their field maps.

Thanks to the people who helped proofread this report, in particular Julie Borra, David Schideler, and Vicki Creed.

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List of Figures

Introduction

In January of 1992 Cultural Surveys Hawaii undertook research for R. M. Towill Corporation with the aim of identifying the known archaeological sites and historic cultural resources, in an area of land stretching from the town of Haleiwa to the town of Kahuku on the North shore of the island of O'ahu (fig. 1-2). Cultural Surveys Hawaii was asked specifically to research an area to be impacted by six proposed transmission line corridors (fig.3). These corridors (designated A through F) run from north to south through the *ahupua'a* of Paalaa Kai, Paalaa Uka, Kawailoa, Waimea, Pupukea, Paumalu, Kaunala, Waiale'e, Pahipahialua, 'Opana, and Hanakaoe (including Punalau, Kawela, and Ulupehupehu).

The corridors are each approximately 1,500 feet wide and cover essentially all of the land from the coast (Corridor A) to an elevation of approximately 1,300 feet in the Kawailoa Forest Reserve (Corridor F), and extend from the present town of Waialua to an existing sub-station inland from Kuilima Point. At this time no new sub-stations are scheduled to be constructed.

The scope of work undertaken by Cultural Surveys Hawaii includes: 1) research into known documentary resources on traditional Hawaiian usage in the study area; 2) a review of previous archaeological research done in the study area; 3) a search of O'ahu tax maps and historical records at the State Historic Preservation Office to identify and research Land Grant Awards within the study area; 4) a review of USGS and sugar company maps to pinpoint areas of previous sugar cane and/or pineapple production: 5) a preliminary review of historic

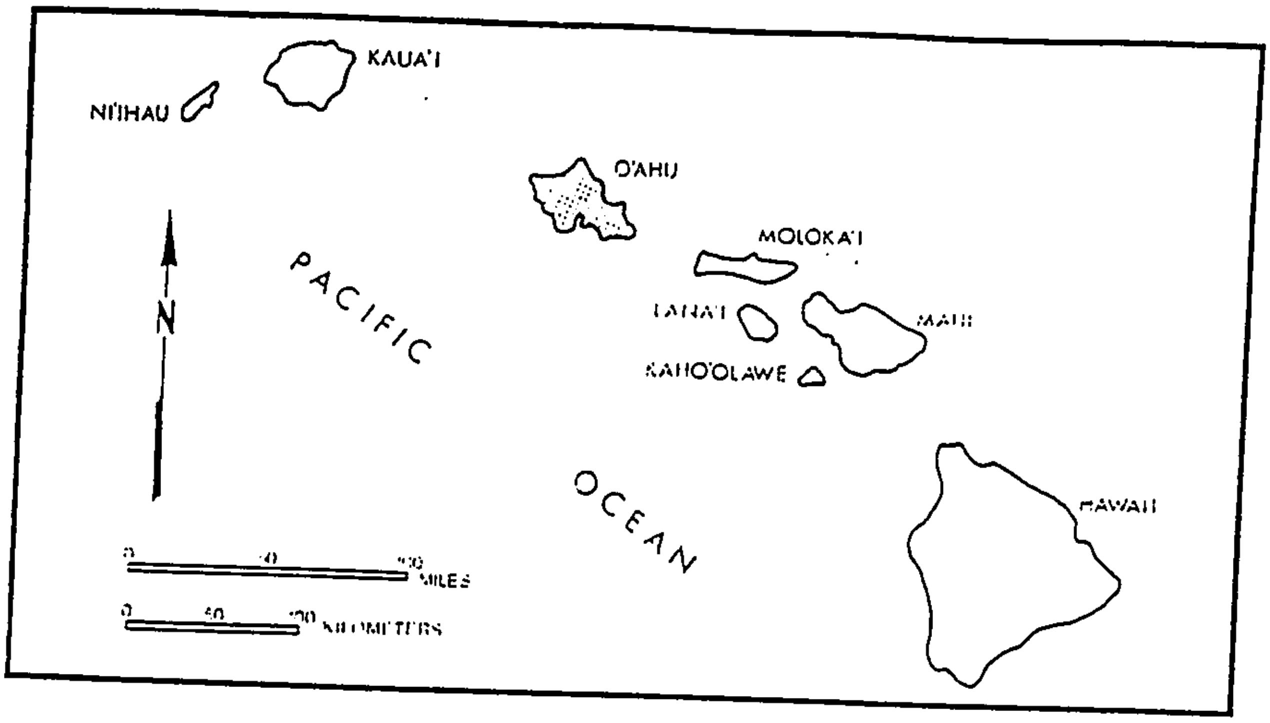

Fig. 1 State of Hawai'i

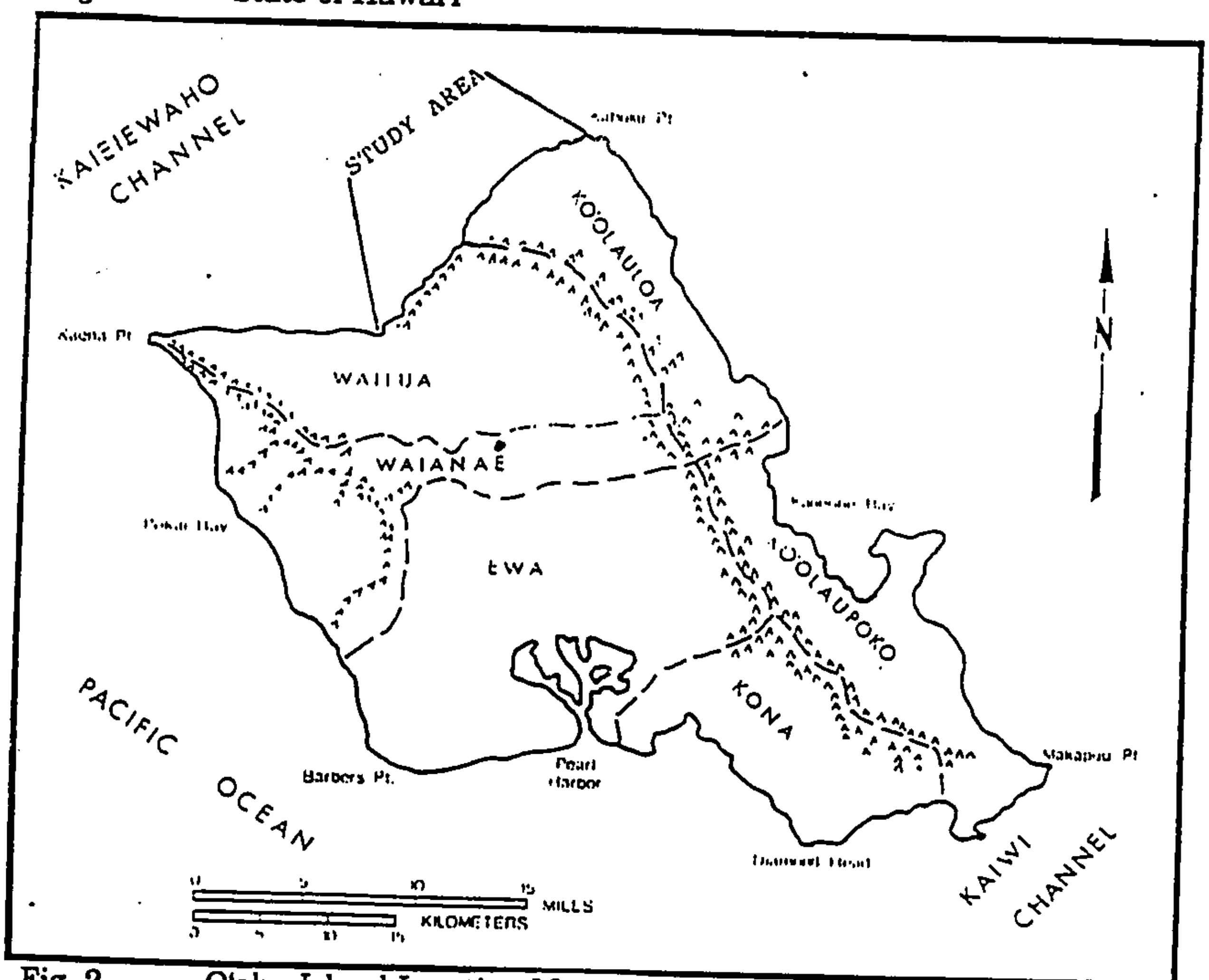

Fig. 2 O'ahu Island Location Map

cultural resources in the study area; and 6) a formulation of recommendations based on the results of this research.

These studies have resulted in the preparation of several maps locating: 1) most of the presently registered (at the State Historic Preservation Office) archaeological sites; 2) the main concentrations of Land Commission Awards; 3) the areas of intensive sugar cane production in the past; and 4) the areas of major archaeological and cultural significance within the study area that may be adversely impacted by the proposed corridors.

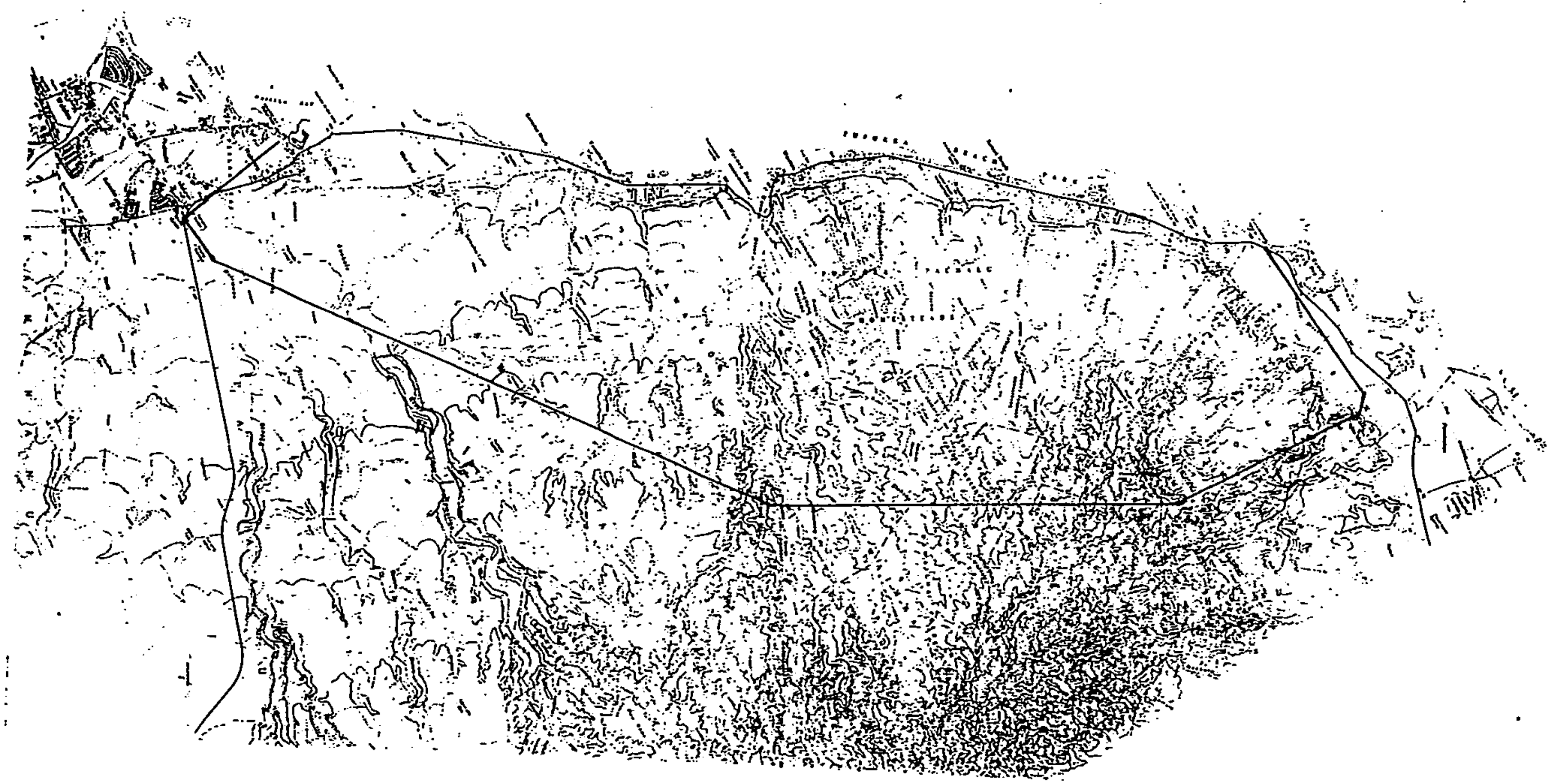

Fig. 3 USGS 7.5 Minute Map of Waialua and Kahuku Quads of Project Area (Outlined)

Documentary and Previous Archaeology Study

Due to the size of the study area, an in depth review of the known historic information on the area was not possible at this time. However, a brief history of the area from prehistoric to early historic times is presented here. The following material is presented from south to north along the North Shore of O'ahu from Kahuku to Waialua.

The study area is comprised of parts of two districts, Waialua and Koolauloa. Within these district portions there are eleven major *ahupua'a* (listed above). Cultural Surveys Hawaii has outlined five major areas of archaeological and cultural concern in regards to the six proposed corridors. These five areas are: 1) the coastal area of Waiale'e *ahupua'a* ; 2) the Pupukea/Paumalu Homestead area; 3) Waimea Valley; 4) Anahulu Valley; and 5) the area in and around the towns of Waialua and Haleiwa. In addition to this, the rest of the study area will be examined and subsidiary areas of interest will be noted. All five areas and most known sites are shown on the overall map of the study area. (fig. 4, back pocket).

Registered State Sites within the Study Area

The State Historic Preservation Office compiled a list of all of the known registered sites within the study area (appendix A). The 142 designated state sites listed in the study area range from large *heiau*, to legendary God stones, caves, burials of all types, various house sites, shrines, and petroglyph fields.

In the five zones that are impacted by the corridors, an attempt was made to place the known state sites on the overall area map. However, due to the number of sites and a lack of available placement maps, not all of the sites could be accurately placed at this time.

The sites are listed in appendix A in numerical order by state site number. There is a brief description of each site, as well as a tax map number, and most importantly, a code of the site's archaeological and cultural significance. The codes are explained at the end of the appendix.

Land Commission Awards in the Study Area

One important indication of land utilization and population during the historic period comes from lists of Land Commission Awards given out during settlement of lands after the Great *Mahele in the mid-1800s*. These awards are listed for all of the *ahupua'a* on each island in the state. By looking up the *ahupua'a* in the two districts of Waialua and Koolauloa, a fairly accurate picture can be drawn of land use in those areas at that time. This helps indicate where people were living during those times, and also indicates where people may have been living during prehistoric times as well. Only nine of the *ahupua'a* in the study area were listed as having any Land Commission Awards awarded at that time. These nine *ahupua'a* are listed as containing 241 individual Land Commission Awards other than those given to the king as crown lands. This list of awards is not complete, but it does help to indicate the areas of dense settlement and/or agriculture within the study area. Of the nine *ahupua'a*, three contained 10 or less awards, three contained between 10 and 20 awards, one had

33 awards, one had 64, and one had 79 awards. The first area of concern in the study area, Waiale'e, contained 33 awards. The second area, the Pupukea/Paumalu lands had a combined total of 27 awards. The third area, Waimea, had only 16 awards. The final two areas of concern, Anahulu Valley and the Waialua/Haleiwa area are both located in the *ahupua'a* of Kawailoa and Paalaa, containing 79 and 64 awards respectively. From this data it is clear that only certain parts of the study area were intensively farmed or lived on during the early historic period. The LCAs in each *ahupua'a* are usually grouped around river valleys, the coast, or up in mountain regions. The clusters of LCAs in each *ahupua'a* closely correspond to the five major zones of archaeological concern. The five zones of archaeological concern are the major areas of settlement during the early historic period, and possibly in prehistoric times as well.

Historic Background

As listed in the 1832 missionary census, the population of the island of O'ahu at that time was 29,745. The population of the two major districts in the study area are given as 2,640 for Waialua, and 2,891 for Koolauloa. The combined population of the two districts in 1832 was 5,537 persons (Schmitt, 1973). This was 18.6 percent of the total population of O'ahu, and indicates that the study area may have contained a sizable portion of the islands' population in the prehistoric period. The impact of foreign diseases and demographic shifts to more urban areas in the years immediately following contact, are two of the reasons commonly given for the decline in population on the North Shore of O'ahu and in other areas of the state as well. These premises are backed up with information from the 1836 census. In 1836 there was a decrease in the population of approximately 8.5 percent in Waialua and 7.2 percent in Koolauloa. Comparing this to the decrease of 6.5 percent for the whole island during those four years indicates that there was a shift from rural to urban during this time (Schmitt, 1973, p. 23, 38). The relatively greater rate of population decline of the northern half of the island during the mid-1800s suggests that this area may have contained a larger percentage of the residents of O'ahu in earlier times.

Koolauloa

Evidence of a sudden drop in population and other major changes that occurred immediately following contact, can be seen in the description summarized for various *ahupua'a* within the study area by E.S. Craighill and Elizabeth Handy:

> This blunt northern tip of Oahu [Kahuku area], whose name means 'The hillock,' is now the seat of the Kahuku Plantation Company's offices, town, and mill, and for many years has been planted in sugar cane... McAllister (1933, p. 153) remarked in his survey that it did not seem possible that this "rather desolate, wind-swept" plain could ever have supported much life, agricultural or human, before the era of industrial machinery and organization. Yet one of his informants "remembers the time when trees now found only in the mountains" covered it. And in Captain Cook's time it was reported that "nothing can exceed the verdure of the hills, the variety of wood and lawn, and the rich cultivated valleys which the whole face of the country [on this northern end] displayed" (Cook, 1784, vol. 3. p. 115).
>
> In 1833 Hall (1839) observed at Kahuku that "much taro land now lies waste because the diminished population of the district does not require its cultivation."

From these descriptions it is obvious that major environmental, agricultural, and demographic changes occurred on O'ahu in the years immediately following contact. While Kahuku lies just outside the terminus of the proposed transmission corridors, a description of the affects of contact on the native population there is indicative of the changes wrought on the populations of the *ahupua'a* located within the project boundaries. From the early reports of Cook, Vancouver, and later McAllister, it seems that Kahuku once supported a larger Hawaiian population. Changes in economy and the presence of Western diseases, caused a rapid decline in the population and the amount of tilled land in and around the study area.

The Handys go on to discuss the various other *ahupua'a* within the study area:

> Rounding the northern tip past Kahuku onto the 'sunset coast,' the next sizable wet-taro area is the deep valley of Waimea. Before reaching Waimea the intervening stream beds, shown on the map as Hanaka'oe, Pahipahialua, and Kaunala, had not sufficient flatlands for taro cultivation under the old system. Two exceptions to non-cultivation in this region were to be found. One was in 'Opana (The-squeezing) adjoining Hanaka'oe, where there was formerly a small spring-watered terrace area named Ka-wela (The-heat), which is also the name of the bay below. The other was in Waiale'e, next before Kaunala, where there were another small group of terraces anciently named Kane-ali'i. In 'Opana the legend is told that the gods Kane and Kanaloa struck spring water from a rock known as Wai-kane, to give life to this hitherto waterless region around Kawela Bay.
>
> Two other *ahupua'a* situated between Kaunala and Waimea, namely Paumalu and Pupukea, are not of a topography to support wet-taro culture of the ancient type. High-level uplands are now given over to pineapple. The narrow seaward plain had no water. According to Kama'aina informants, the gulches or streams in these two localities never were terraced or planted.

Between Waiale'e and Waimea Bay the only other major area of Hawaiian occupation during early historic times appears to have been in the areas now known as Ehukai and Sunset Beach (zone 5, sec. 9). This area is in the *ahupua'a* of Paumalu and Pupukea and lies near the coast. It is surprising to find such a dense concentration of LCAs in an area that, according to Handy and Handy, could not support much agriculture. McAllister does not list any sites in this area from his work in 1933, but a recent survey by PHRI (draft report, 1991) has discovered some 60 sites in the mountains above the shoreline area.

This description of the other *ahupua'a* in the Koolauloa portion of the study area indicates that, other than Waiale'e and the Pupukea/Paumalu area, the only other major area of intensive Hawaiian occupation and/or agriculture was in Waimea Valley.

Waiale'e

The shoreline region of Waiale'e *ahupua'a* is the first major zone of concern primarily because it had a densely populated coastal region at the time of the Great Mahele. As can be seen on the modern tax map of the area (zone 5, sec. 8, plat. 01) there is a very dense section of Land Commission Awards along the coast. There are approximately 40 individual awards within this *ahupua'a* in the area between Kamehameha Highway and the coast (see fig. 5). These awards are oriented *mauka/makai* and the majority were probably used as agricultural fields. Due to the number of awards it is impossible to list all of the information on each award, but several examples can effectively summarize their general nature:

1) LCA 2672 given to Aie December 31, 1847;

> To the Land Commissioners, Greetings: I, Aie, hereby state my claim for land and *kula* at Kuapa. There are three *lo'i*, and also the edge of a watercourse. The boundaries are: North, Keokea, east, Mahoe's, west, Keliiwaiwaiole's, south, the *ko'ele.*

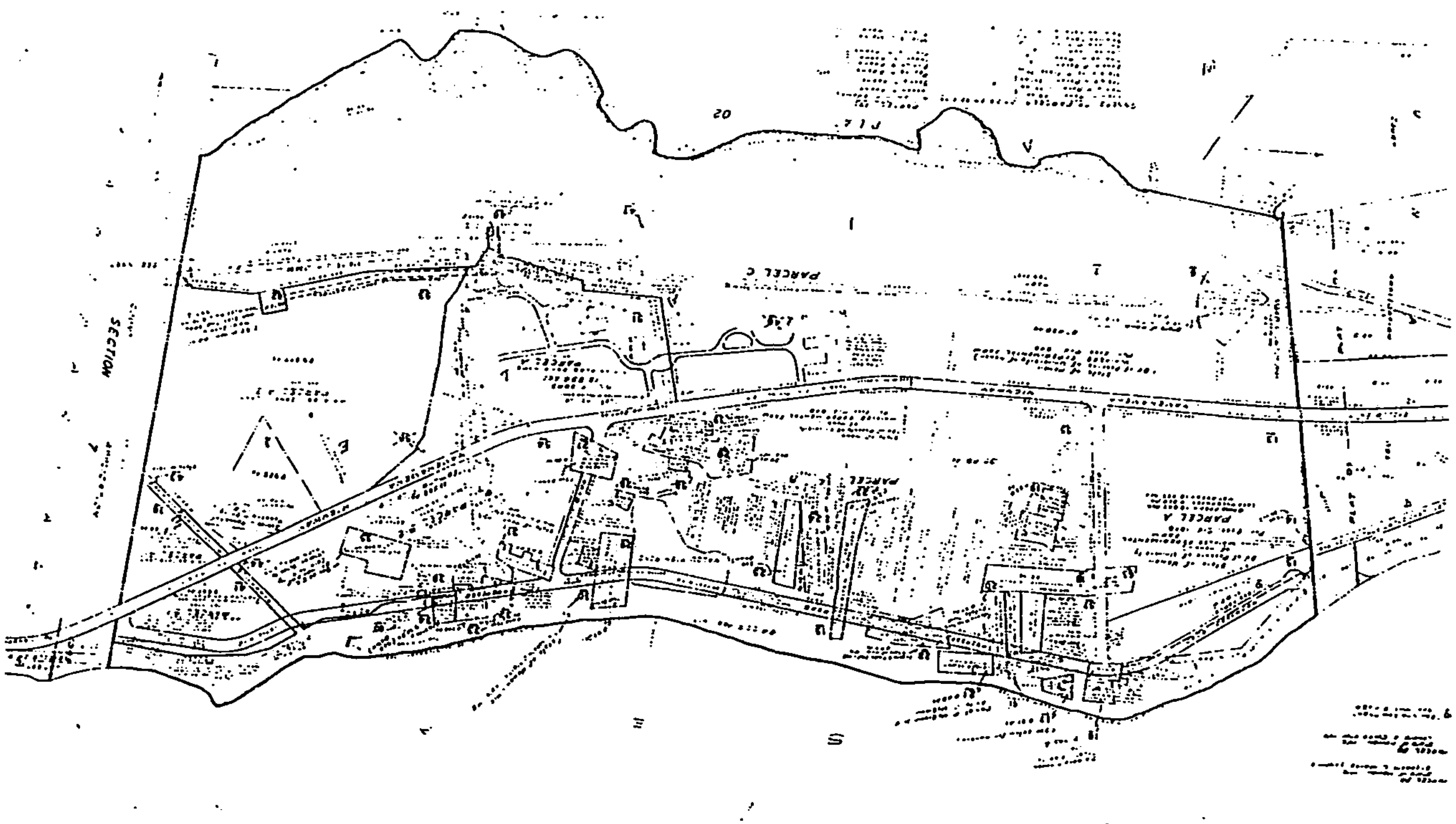

Fig. 5 Waiale'e *ahupua'a* (zone 5, sec. 8, plat. 1)

2. I have one *lo'i* at Hapunaaiiki.
3. I have one lo'i at Kapunaiki.
4. There is also a *lo'i* at Kalou, however it is a share of a *lo'i*.
5. This *lo'i* of mine is at Kauakahiloko. These 4 *lo'i* of mine are scattered, therefore their boundaries are not described. Also, the *kula* is at Paipaialua (Pahipahialua). *Pili* and *koa* grow there. My occupation of these places has been from Haalilio until the present. My houselot is also claimed by me.

2) LCA 2776 given to Mahoe on December 31, 1847:

To the Land Commissioners, Respectful Greetings: I, Mahoe. hereby state my claim for land at Kuaimalolo. There are three *lo'i*, bounded on the north by Kalou, on the east by Nua's (land), on the south by a *lo'i* ko'ele, on the west by Aie's (land). At Kawela I have a claim for one *lo'i*, bounded on the north by Kaunaki's (land), on the east by Mumuku's (land), on the south by Kaopu's (land), on the west by Muli's (land). At Kahuku I have one *lo'i*, bounded on the north and the east by Kekua, on the south by Puahiki, on the west by Kawaaloa. At Pahipahialua is a garden of banana, *wauke*, and sugar cane and three *koa* canoe trees. Three *koa* canoe trees are 'at Kaunala (and) a *noni* garden. My house claim is at Pahipahialua.

3) LCA 2720 given to Pooolulu January 4, 1847:

To the Land Commissioners, respectful greetings: I, Poooluku, hereby state my claim for land at Waiale'e. The name of my *mo'o* is Kamooiki. There are three and a half *lo'i*, bounded on the north by a sea (fishery) on the east by Kuheleloa's land, on the south by kula land, on the west by Keliikui's land. At Kaunala I have a garden of *wauke*, *noni*, *alani* (orange?), sugarcane and banana. At Pahipahialua is a cultivated upland. My houselot is at Waiale'e, bounded on the north by a sea, on the east by Waihinalo's lot, on the south by Kahuku's (land), on the west by *kula* land. My interest was established from the time of Kamehameha I.

From these three native claims it can be seen that, without a good map of all of the Land Commission Awards of a given area, it would be next to impossible to establish the actual locations of any of these parcels of land. Fortunately, these testimonials can be used with old state tax maps of the area (fig. 5). By combining these two sources of information it is possible to formulate an idea of how the land looked and what it was utilized for during the early historic period and possibly prehistoric times as well. These three examples indicate that the land near the coast at Waiale'e, and in other parts of the study area, was utilized for house and small farming plots. Each family owned several plots of land that were used to grow different necessities. The land at Waiale'e seems to have been used for growing staple crops, while plots in Pahipahialua were used as a source of *koa* trees for use as canoes. The pattern seems to be that in areas with the necessary requirements for cultivation (a steady water supply, arable land, etc..), small plots of land were owned and farmed by individuals. These individuals also owned small parcels of land in other areas (the mountains or other valleys) where they grew crops that required different conditions than were available close to their main plots.

Many of the LCA holders at Waiale'e also owned a small plot in Pahipahialua, or some other part of the study area. Mahoe (LCA 2776), for example, owned land not only in Waiale'e, but somewhere in Pahipahialua and Kahuku as well. Due to the complexity of trying to figure out where each LCA holder had each of his plots of land, or *lo'i*, it is only possible at this time to concentrate on the areas of dense LCA concentration such as Waiale'e.

In Waiale'e *ahupua'a* only one site is recorded by McAllister in his 1933 survey. This site (50-80-01-257) is described as follows:

> Fishpond known as Kalou, sea side of the Waiale'e Industrial School. Said to have been in its best condition when Kaluhi was konohiki of this district. There was formerly a 'Kane stone' in the immediate vicinity. This is also the place where Kahuku is attached to Waiale'e (McAllister, 1933, p. 147).

This site is an enclosed, spring-fed fishpond near the coast and is located on the map as being in the center of Waiale'e's coastline. Just how Kahuku is supposed to attach to Waiale'e at that spot is unclear and may refer to some legend that forms a mythical tie between the *ahupua'a* . The fishpond was held by the chief, or *konohiki* of the area in prehistoric times, and was part of King Kamehameha III's royal lands during his reign.

Pupukea/Paumalu Area

Just south of Waimea Bay is the second zone of concern, an area known as the Pupukea/Paumalu homestead lands (fig. 6). This area is in the process of being developed for housing and recreation (golf courses) for Obayashi Hawaii Corporation. As part of these development plans, archaeologists were called in to survey and excavate the new development area. This area comprises some 1,300 acres of land located in the mountains above the shoreline area of Pupukea Beach Park. PHRI, a local archaeology company, was asked to conduct the research for the Obayashi

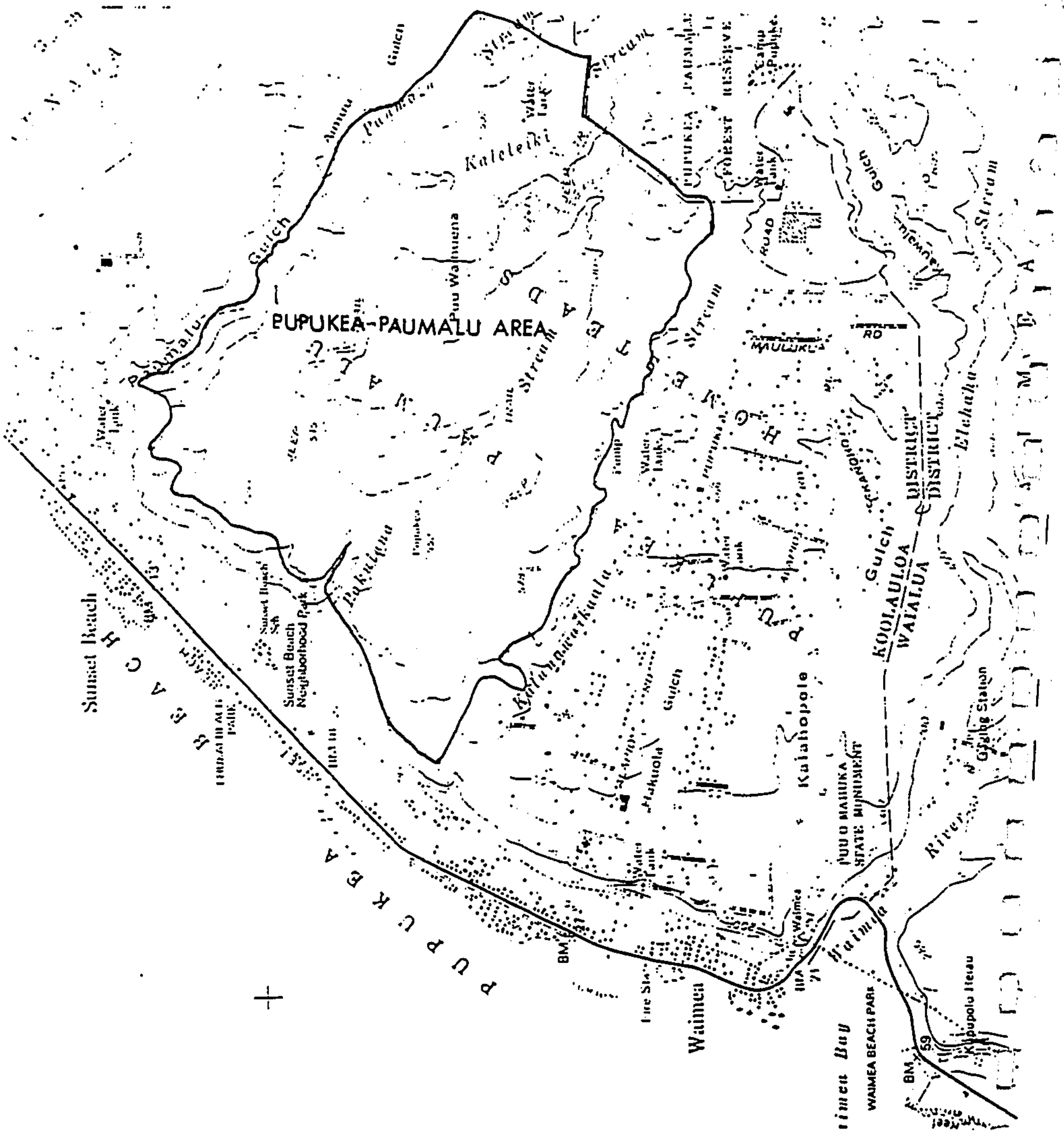

Fig. 6 Pupukea/Paumalu Homestead Lands (Shaded)

Hawaii Corporation in 1988 and a draft report was made available in 1991.

This report documents some 60 known sites, containing 112 separate features. Of these sites, 28 are clearly prehistoric or historic Hawaiian sites. These include rock shelters, caves, cave burials, petroglyphs, and various agricultural and habitation features. Of these sites, 23 are recommended for further evaluation and/or excavation, but only seven are recommended for preservation. The seven sites all contain human burials, petroglyphs, or some other cultural significance that recommends them for preservation. While most of the sites documented by the PHRI study will be destroyed by the coming development, some will be preserved and must be considered before any further work can be done in that area (Mayberry, and Haun, 1988, pp. 56, 73-76, in Draft for Obayashi Corp, 1991).

The state site numbers within the Pupukea/Paumalu project area are numbered as follows: 50-80-01-03822 through 50-80-01-03873 and 50-80-01-03971 through 50-80-01-03976. These sites can all found in the shaded area of figure 6 of the Pupukea/Paumalu area.

Waimea

The third area of Hawaiian occupation in both prehistoric and historic times was Waimea Valley (fig. 7). Much of Waimea *ahupua'a* is now part of Waimea Falls Park, a privately owned park within Waimea Valley. Located at the juncture of the Koolauloa and Waialua districts, Waimea was, until 1886, in Koolauloa, but is now considered to be part of

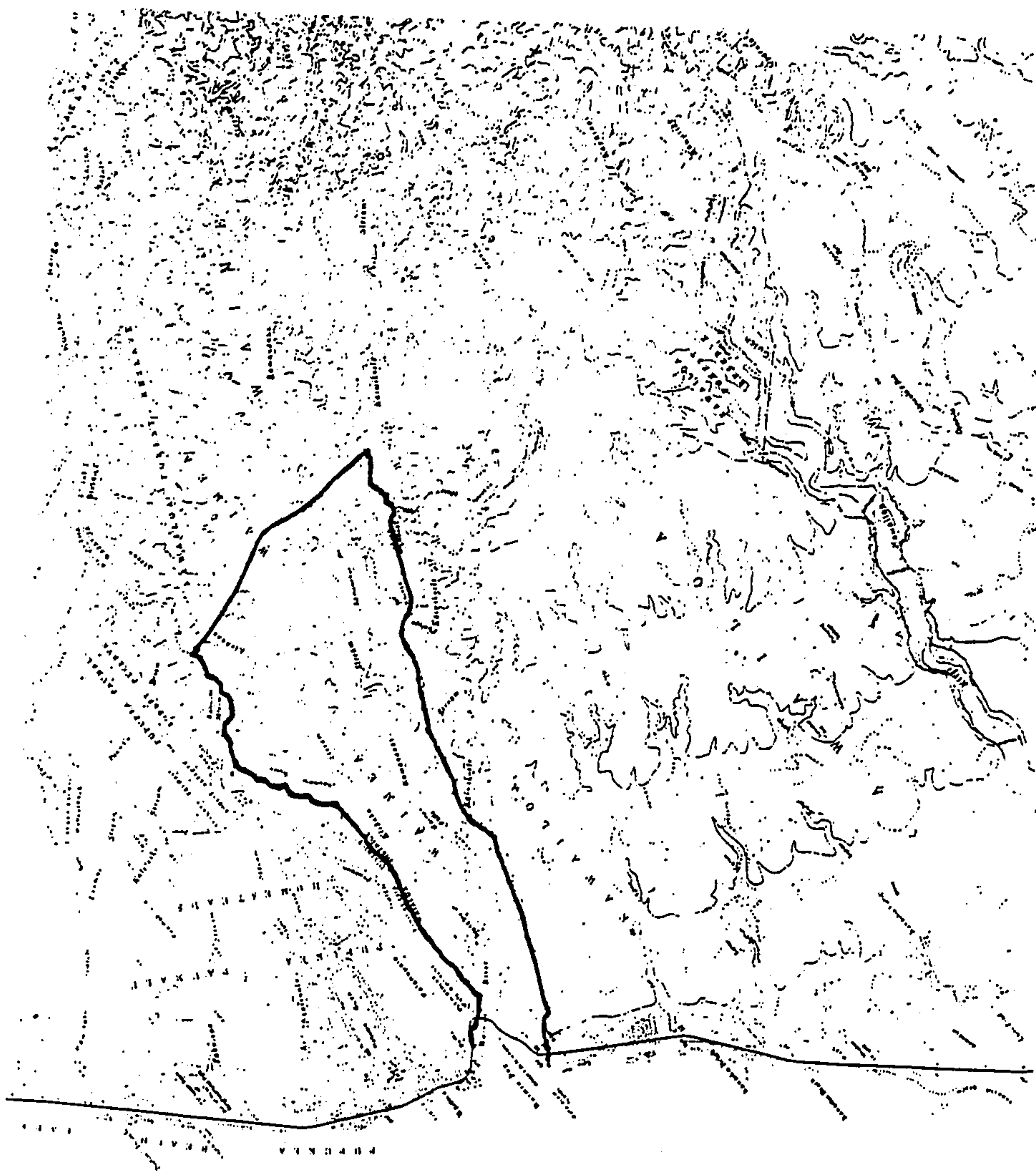

Fig. 7 Waimea Valley

the district of Waialua (Handy and Handy, p.463).

As shown by Handy and Handy, Waimea was a very rich valley that was intensively utilized in both historic and pre-historic times:

> The "Index of Claims Awarded by the Land Commission," published in 1881, gives the land names of thirteen *kuleana* 2(land portions) in Waimea. A few of these were probably beach sites, and some others were on the elevated tableland west of the stream, about one mile inland.
>
> The level land in the lower valley was in *lo'i* on both sides of the stream prior to the great flood of 1894. The name Waimea, meaning "Reddish water," suggests that flooding was characteristic. It is evident that the low level land along the west side of the stream for a distance of from one-half to one mile inland was once in *lo'i*, but there are no evidences of there having been *lo'i* on the broad elevated land area already mentioned.
>
> Above Waihi falls the canyon is narrow and steep and filled with tumbled boulders for about one mile, then it broadens somewhat. Here on the east bank is a narrow strip of old *lo'i*. According to *kama'aina* informants there were many such scattered patches above the falls in the broadening valley along the stream bed. House sites are still marked by old breadfruit trees on the ridge. All of these sites are named. The largest *lo'i*, however, was below the falls by a grove of monkeypod trees. Known as Ka'ili'ili, the area was situated on land elevated above the stream bed and irrigated by means of an *'auwai* still to be seen along the base of the *pali*. Farther upstream, but down in the gulch, was another large continuous area known as Honc'awa and Ka'ula. Throughout the valley in olden days there was a great abundance of every kind of cultivation, including taro, sweet potato, sugar cane, banana, breadfruit, coffee, and *'awa*..
>
> This area had an upland hinterland where many semiwild and wild food plants must have flourished. There were certainly many localities where *wauke* and *olona* were abundant. . . A fishing shrine (McAllister, 1933, p. 147) on top of a

> bluff east of the bay is evidence that there was deep sea fishing. . . On the opposite side of the bay was another fishing shrine. The largest *heiau* on Oahu was located on a ridge north of the bay: its presence is evidence that Waimea was a community of great importance and that it was the seat of a high *ali'i.*

It is evident from this brief account that Waimea must have been a verdant and culturally important valley in prehistoric times. The presence of agricultural terraces, *koa* (fishing shrines), burial caves and plots, house sites, and *heiau*, along with the known L.C.A.s given out to Hawaiians following the great Mahele, indicate that Waimea contains a higher density of archaeological sites than do the valleys immediately surrounding it.

This premise is further supported by several reports on Waimea that have been written over the last twenty years, including one written by Anne Takemoto in 1974 for the Bishop Museum. Takemoto's report documents the legendary origins of Waimea as well as its early history in both prehistoric and historic times. To briefly summarize: Waimea has always been a very verdant valley, containing rich agricultural terraces, a large stream/river, many wild and semi-wild food plants, and a sheltered (in the summer) bay for anchorage and fishing. The presence of fishing shrines, coupled with known legends, indicates that the waters off of Waimea held an abundance of fish (Takemoto, 1974).

McAllister (1933) quotes informants who offer stories about the abundance of fish to be had in the waters in and around Waimea Bay.

Several fishing shrines (*koa*) are mentioned by McAllister (including sites 244 and 245) as being placed at the mouth of both sides of the bay (McAllister, 1933, p. 127-129).

In addition to the fishing shrines at the mouth of the bay, there are several burial caves in the cliffs along either side of the valley. Near Pu'u o Mahuka *heiau* (50-80-01-249) there are several burials located in small caves in the cliff face. Unfortunately all of these caves seem to have been heavily disturbed and little remains of the burials themselves.

Pu'u o Mahuka *heiau* is located on the ridge on the north side of the valley and is considered to be the largest *heiau* on O'ahu. Registered as a National Historic Landmark it is composed of two major segments. One segment measures 281 feet long by 127 feet wide, while the other is 186 feet wide by 168 feet long (Takemoto, 1974, p. 2). Religious activities at this *heiau* were almost certainly connected with the *kahuna* at Waimea Bay.

In 1792 an incident occurred at Waimea Bay that has since become known as the "Daedalus Incident." The Daedalus, a British ship, anchored at Waimea Bay in 1792 to refill its water casks and to take on whatever provisions could be traded for with the native population of the valley. However, in an event that has never been fully explained, a group of Hawaiians attacked and killed three of the landing party and carried off their bodies. It is thought that the murdered seamen from the Daedalus were first brought to P'u o Mahuka before being taken to a safer place farther from the ship's guns (Mitchell, 1986, pp. 41-42).

Directly across the valley there is another *heiau* called Kupopolo, (site 50-80-01-241) located on the ridge top to the south of the river at the mouth of the bay (Takemoto, 1974, p. 2). Both this *heiau* and Pu'u o Mahuka were probably important religious centers for Waimea Valley in ancient times. One of McAllister's informants says that Waimea, Waialua, and Hakipu'u were all given to the *kahuna* from very ancient times up to the time of Kamehameha the Great (McAllister, 1933, p. 126). After Kamehameha the Great had taken over the island of O'ahu he gave Waimea Valley to his head religious leader (*kahuna nui*), Hewahewa. It seems to have been a common practice for the reigning chief or king to give these lands to his head *kahuna*. As the home for the head *kahuna* of the king, Waimea was considered a sacred place of great importance to the ancient Hawaiians.

From the brief summary given above it is obvious that Waimea Valley was an important place in the history of the Hawaiian people. Any attempt to put a transmission line through Waimea will necessitate a more in depth look at the archaeology and history of the valley. At this time it is sufficient to note that the valley contains an abundance of both prehistoric, and historic archaeology that would be impacted visually, and possibly physically, by the placement of a transmission line corridor through the valley.

Waialua District

From Waimea, one proceeds into the district of Waialua containing the remaining *ahupua'a* of the study area. After Waimea, there are several river valleys that water the broad plains between Waimea and Waialua. Little archaeological work has been done in this area and much of it has been planted in sugar cane and pineapple for the last hundred years or so. The wholesale planting of sugar cane and pineapple has destroyed any archaeological sites that may have been found in those areas, and so altered the landscape that it is difficult to reconstruct the original topography. However, there are several valleys in this area that have never been intensively planted in sugar cane, or explored archaeologically, and these may contain a rich record of early occupation.

Along the coast in this area McAllister does list a number of sites in his 1933 survey. There are a number of sites situated at the mouths of small river valleys that indicate that there may be more extensive remains further up the valleys. Most of these coastal sites are located in areas that have been heavily developed and many of the sites may have been lost or destroyed.

Anahulu Valley

One notable exception to the general lack of archaeological research in the project area occurs in the fourth area of concern, the Anahulu River Valley (figs. 8 and 9).

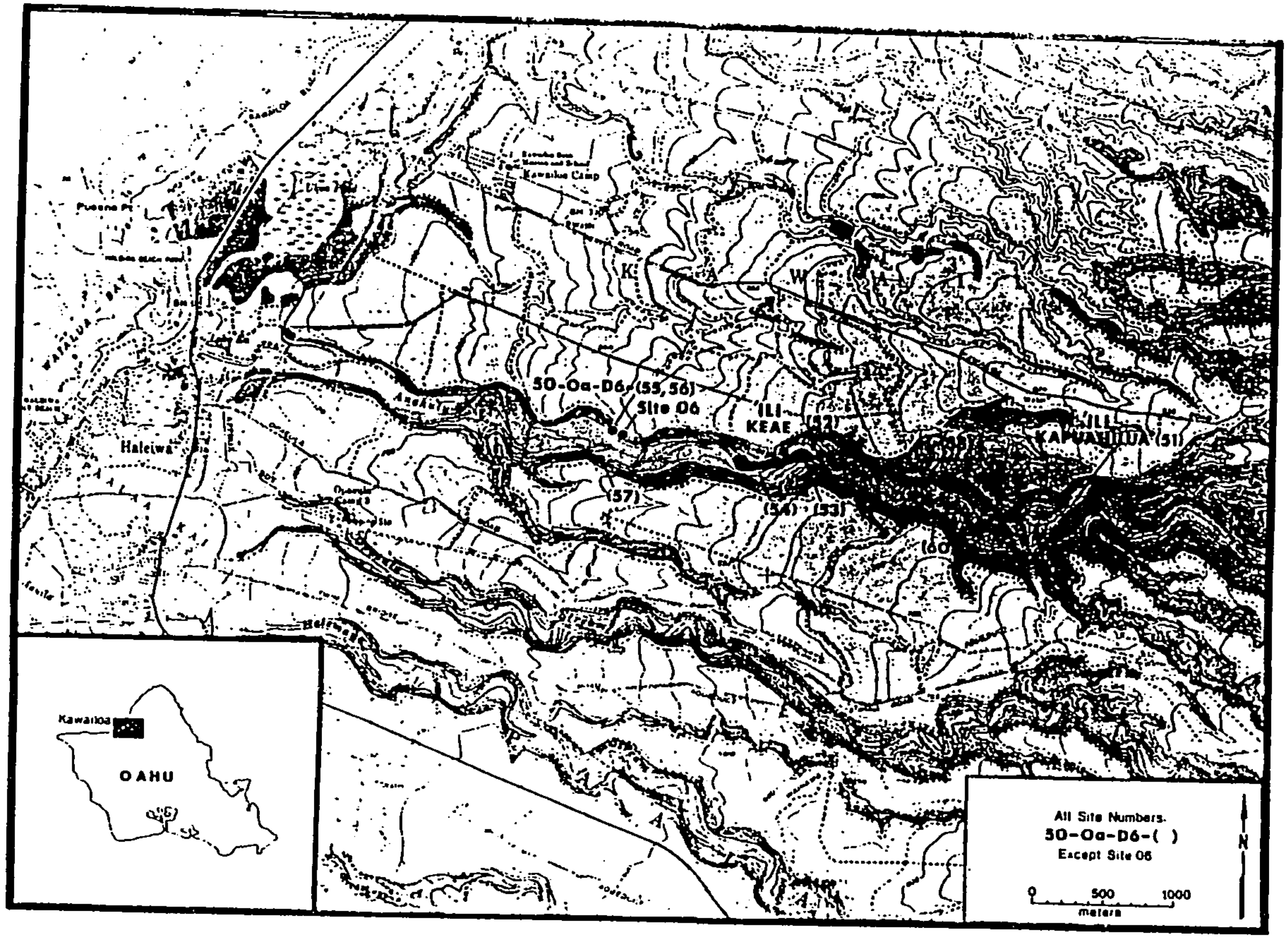

Fig. 8 Study Areas and Major Sites in the Anahulu Valley, after Kirch 1979.

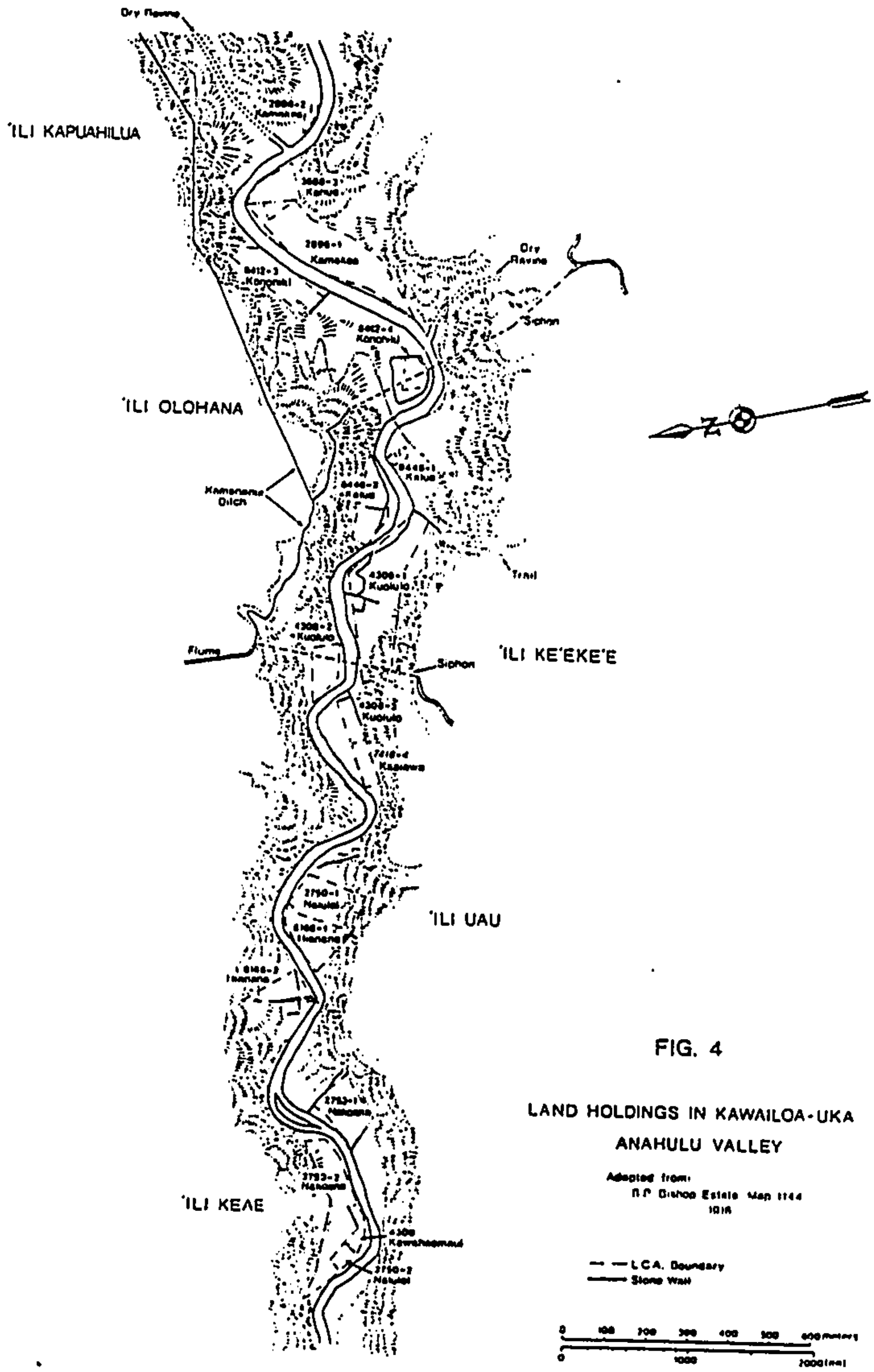

Fig. 9 Land Holdings in Kawailoa-Uka Anahulu Valley, after Kirch 1979.

The Anahulu River lies near the boundary between Kawailoa and Paalaa Kai *ahupua'a*, and is within the *ahupua'a* of Kawailoa. even though it forms one of the dividing boundaries with Paalaa Kai. It flows from high up in the Kawailoa Forest Reserve and empties into Waialua Bay. Unlike most of the river valleys in the study area, Anahulu has been partially researched, surveyed, and excavated by professional archaeologists.

The first major interest in the Anahulu Valley occurred in the early 1970s when Marshall Sahlins decided to look at the valley's archaeology as part of a much larger project about the historical anthropology of the late pre-historic to early historic period in Hawaiian history. From 1971 to 1973 the history of occupation in the Anahulu Valley was heavily researched for the Sahlins project. In 1974 it was decided that archaeological work in the valley would help to illuminate and/or reinforce the previous research on the valley's history (Kirch, 1974, p. 1). The results of two seasons of field testing and survey from 1974 to 1976 were published in a 1979 work by Kirch that is available at the State Historic Preservation Office. A brief synthesis of the work is detailed below and the sites and LCAs found by Kirch are noted on figure 8.

In 1974 Pat Kirch was asked by Marshall Sahlins to undertake an extensive survey and test excavation of the Anahulu Valley of Waialua, O'ahu. However, due to monetary and time constraints, the original scope of the project had to be toned down and consequently only a portion of the valley was fully surveyed and excavated.

In both prehistoric and historic times there were several zones of production from the coast up to the hinter lands in the upper reaches of the valley: on the coast there were fishponds and other maritime resources; a broad plain used for taro, melon, and sweet potato cultivation, along with small pastures for farm animals; irrigated taro pondfields in the valley bottom; hillside cultivation (*kula*) for a variety of crops and trees; and small planted areas on up the valley and in its many tributraries. These different areas were divided up amongst many families who owned plots in different areas to allow access to diverse resources (Kirch, 1979, p. 2).

Two major areas were surveyed and excavated in the valley, Kapuahilua *'ili* and Keae *'ili*. Kapuahilua lies further up the valley than Keae and was the residence site of Kamakea. Kamakea was probably the *konohiki* of the upper valley and a man of some importance. The lower study area, Keae, has known kinship ties between two of the three *kuleana* owners. Several other sites including a rock shelter were excavated in the hopes of providing a clear stratigraphic sample of the occupation of the valley. In addition to this, the ponded field systems in the two areas were also mapped and excavated (Kirch, 1979, p. 3).

The Kapuahilua study area consists of a fairly extensive terraced area located in the upper reaches of the valley on one side of the river. There are a series of house platforms, taro pondfields, and various walls, enclosures, and other artifices of human manufacture. In addition, there were two Land Commission Awards given out for the Kapuahilua area; LCA 3688-B Apana 3, to Kahue; LCA 2896 Apana 1 to Kamakea. There were also two sections designated in the land records as LCA 8412 Apana's 3 and 4 given to the *konohiki* of the valley. Several excavations were undertaken at Kapuahilua: one in Kamakea's house sites, 50-Oa-D6-51; and another in the irrigation system, 50-Oa-D6-58 and 50-Oa-D6-60 (Kirch, 1979, p. 10-12).

Much further downstream past three other *'ili*, is *'ili* Keae. Within Keae there were three LCA claims: LCA 2753 *Apana's* 1 and 2 to Nakoana, LCA 4309 Apana 1 to Kawahaomaui, and LCA 2750 to Nalulei. The excavations at Keae were carried out at a number of sites including 50-Oa-D6-52 through 50-Oa-D6-57 and a rock shelter designated as site 06 (Kirch, 1979, p. 25-26).

Both areas of excavation yielded a quantity of information and helped Kirch and Sahlins formulate a sequence for the occupation of the mid-Anahulu Valley. The outline has several limitations: the first being that only a small portion of the valley was fully surveyed and excavated; and second the historical sequence relies almost entirely on one rock shelter for its stratigraphic data (Kirch, 1979, p. 51).

It appears that in the late prehistoric period, the valley was used as a resource area and was exploited periodically by the local coastal-dwelling community. Rock shelters and temporary camps were the most common type of shelter during this period. Although small garden plots may have been utilized from time to time, the emphasis seems to have been on foraging and collecting small game and different plant materials (Kirch, 1979, p. 51-51). The absence of any evidence of permanent habitation or agricultural features in the valley in prehistoric times is striking and suggests that the sudden rise of the Anahulu pondfield system may have been due to changes in the aristocratic control of the Waialua area during that time period.

This pattern of sporadic use continues up into the late prehistoric period, but is replaced by a more permanent settlement pattern in the early historic period. House platforms, walled enclosures, grave sites, and the irrigated pondfield systems were all late additions during the valley's history (Kirch, 1979, pp. 51-52).

The increase of agricultural production and permanent habitation sites in Anahulu Valley and Waialua in the early historic period, may have occurred as a response to the stationing of Kamehameha I's forces in the Waialua area in 1796 and 1804. The forces were stationed there in preparation for Kamehameha I's assault on Kaua'i in his attempt to unify the islands under his control (Kuykandall, R., 1967, p. 46-49).

The entire length of the Anahulu Valley is lined on both sides of the river with small Land Commission Awards in areas with arable land. LCAs run down the entire length of the river to the mouth of the valley at

Waialua Bay.

Due to time and monetary constraints placed on the Anahulu project, Kirch was unable to survey the whole valley. Based on areas that were surveyed and the number of recorded LCAs on the tax maps, it is likely that many archaeological sites remain to be found and recorded in the Anahulu Valley. An in depth paper on the findings from Anahulu and other areas is due out in the immediate future by Sahlins and will provide an invaluable look at both Anahulu in particular and the North Shore in general.

Waialua/Haleiwa

The fifth area of concern in the project area is the area in and around the towns of Waialua and Haleiwa. This entire area is of archaeological interest not only for its many prehistoric and early historic Hawaiian sites, but for the wealth of early plantation sites that abound in the area. The largest concentration of McAllister sites on the North Shore can be found in the area around Waialua Bay. This area has also been the base of the Waialua Sugar Company's operations for the last hundred years and contains a large number of historic sites from this period.

A report by Robert Hommon in 1982 details all of the known sites found by McAllister in the Waialua area and lists those that could no longer be found, or were destroyed, with those that are still extant (fig. 10). Of the twenty six McAllister sites examined by Hommon in the Waialua area, only seven could still be located and virtually all of these were centered around the area known as Ukoa pond near the coast (all McAllister sites are listed in figure 3 and annotated destroyed or extant). The rest of these sites could no longer be located on the surface, or had been reported destroyed, although remnants of the sites may be buried under modern construction and land modification (Hommon, 1982, p. 4-6, map).

In a separate study conducted by CHINIAGO Inc. in 1979 for the Kamehameha Highway realignment, a number of sites were found and recorded. Site 1439, a historic deposit; 1440, a wall remnant; 1441, an old church; site 1442, a historic building, and two McAllister sites; 229 (Kawaipuolo Spring), and site 236, Ukoa Pond. In addition to this, the old Emerson Homestead (located in Haleiwa) was researched and examined (CHINIAGO Inc., 1979, p. 3-4). It is unclear whether any of the sites were impacted by the highway readjustment. Any new work in the area would necessitate further study of the Waialua/Haleiwa area for existing sites.

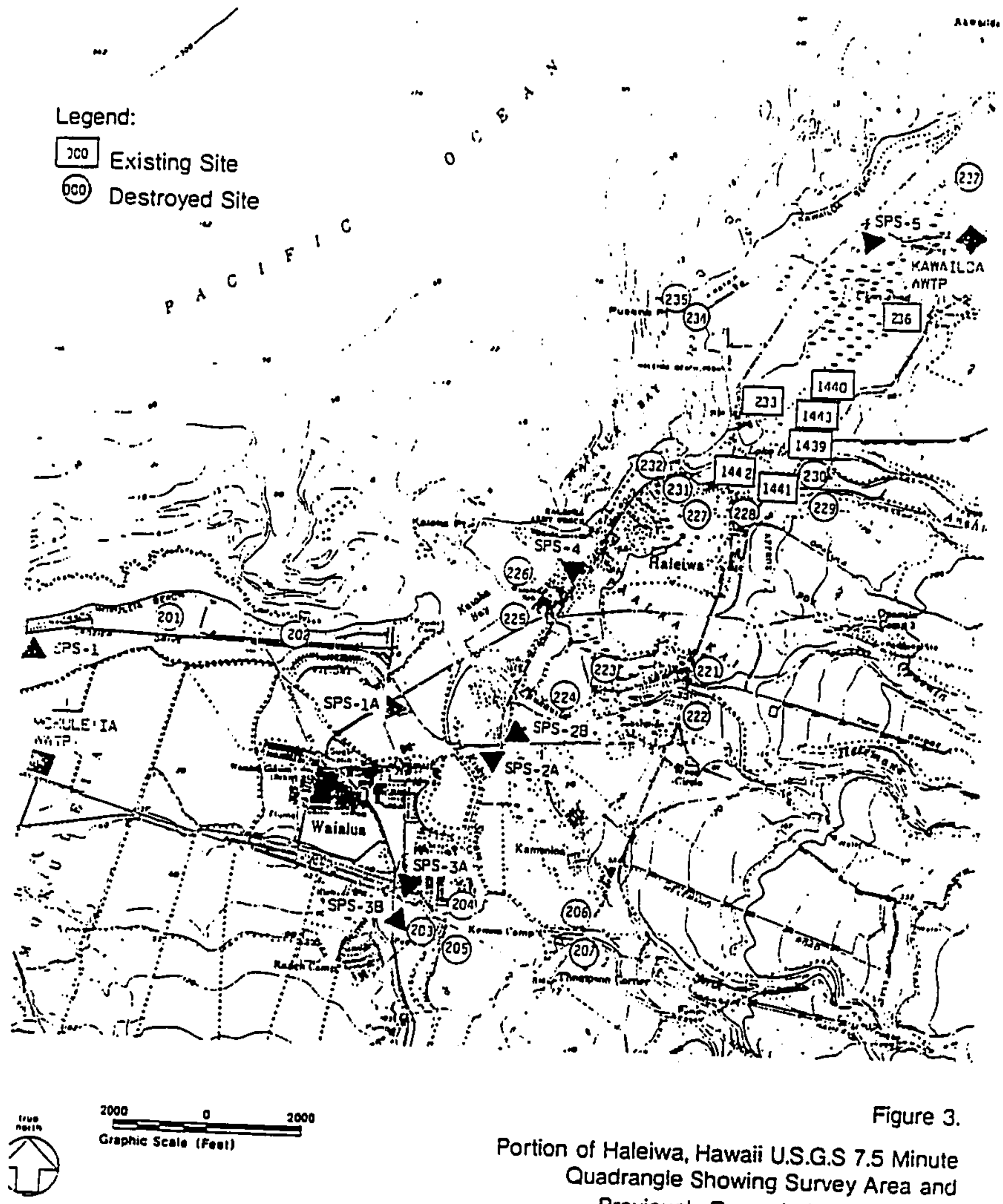

Figure 3.
Portion of Haleiwa, Hawaii U.S.G.S 7.5 Minute Quadrangle Showing Survey Area and Previously Recorded Historic Sites

Fig. 10 **1982 Map of Known McAllister Sites by R. Hommon**

General concerns within the study area

Cultural Resource Management of Sites

One area of concern that should be considered is what sort of impact the transmission line corridor will have on sites that have been recognized by the Hawaii Register and/or the National Register of Historic Sites. There are only twelve such sites in the vicinity of the study area: five in Kahuku; one in Waiale'e; two in Waimea; and four in Waialua.

Kahuku area

Of the five sites in the Kahuku area only two are actually on the National Register. These two sites are 50-80-02-1038 and 50-80-02-2501. The first site (1038) is known as the Kahuku Habitation Area and consists of exposed cultural deposits in a sand dune. This site lies outside of the present project boundary and will probably not be impacted by any of the transmission corridors. Site 2501 is located in Hanakaoe *ahupua'a* and consists of a burial platform. This site may be impacted by Corridor A and should be considered for both physical and visual impact.

The other three sites in the Kahuku area are only eligible for inclusion as Nationally Registered sites. Site 50-80-02-2399 lies in and around Kawela Bay and is just outside of Corridor A, but should also be considered for visual and/or physical impact. Site 50-80-02-2911 is located outside of the project area and no impact is likely. The last site in the area, 50-80-02-2912 is also outside of the project area and no impact is foreseen.

Waimea Area

The second area to contain a Registered site is in Waiale'e. Site 50-80-01-257, Kalou Fishpond, is listed on the Hawaii Register of sites, but not on the National Register. This site would be impacted by Corridor A and it is recommended that both physical and visual impact be considered for this site.

Waimea contains two sites registered as both State and National sites. The two large *heiau* at the mouth of Waimea Bay are both registered sites. Both 50-80-01-249, known as Puu o Mahuka *heiau* , and 50-80-01-241, Kupopolo *heiau*, were discussed in the section on Waimea. These two sites would be impacted directly by Corridor A, and to a lesser degree, by any corridor passing through the State Park (Corridors B, C, and D) and therefore should be considered for physical and/or visual impact from all four corridors.

Waialua Area

There are four sites in the Waialua area that are listed on the Register. Site 50-80-04-1334, the Waialua Courthouse, is on the Hawaii Register of sites as is Pohaku Lanai, site 50-80-04-226. Site 50-80-04-1348, Waialua School, is also on the Hawaii Register of sites, and the National Register. Kawailoa Ryusenji Temple, site 50-80-04-1337, is on the National Register as well. All four of these sites should be considered as special areas of concern and may be impacted by all six corridors.

All of the sites in these three areas have been recognized for their importance by the State of Hawaii and in some cases the National Register for their archaeological, cultural, and other significance to the people of Hawaii and the world. It is important therefore, to carefully consider the impact that the transmission line corridors could have on any and all of these sites.

Archaeological Projects in the Study Area

There have been a number of other archaeological surveys, excavations, and studies in various parts of the study area over the last twenty years. As has already been mentioned, Anahulu has been studied by Sahlins and Kirch, and Waimea Valley has been heavily studied by both the State, and by various Bishop Museum projects. The Pupukea/Paumalu area has also recently been examined by PHRI (1988, in print 1991). In addition, the Waialua area was looked at by Hommon (1982), and by CHINIAGO inc. (1979). Most of these studies have been carried out in areas near the coast where the majority of new construction work has occurred. However, there have been several reports completed in the Kahuku area for various wind farms and military installations. Information from these reports will be helpful in determining what kind of archaeological remains are present in the upper regions of the project area where little work has been done.

Two reports on the Kahuku Wind Farm project were undertaken by Barry Nakamura and Bertell Davis. These reports are similar in scope to the present project in that both deal with background searches of the study area to determine the impact of both the Wind Farm site and its accompanying transmission line corridor. A series of wind-generator pads were constructed in the *ahupua'a* of Punalau, Ulupehupehu, Hanaka'oe, Kawela, ʻOpana, Pahipahialua, and Waialeʻe. A total of eight sites were noted by the project. These sites are all located up in the mountains in fairly innaccessible areas. Most of the sites are located on ridge tops, the most likely area for transmission line towers. These sites indicate that further research should be done on the ridge tops of the areas chosen for the transmission line route. These sites are shown with the accompanying wind generator pads in figure 11 (Davis, 1981, p. 5).

Major Agricultural Activity in the Study Area

There have been two major agricultural crops grown on the North Shore of Oʻahu over the last hundred years; sugar cane and pineapple. While pineapple was grown in several parts of the study are, notably in the mountains above Kahuku, it was sugar cane that had the most profound effect on the study area.

There were two major sugar cane companies that operated in the study area; Kahuku Sugar Company, and the Waialua Sugar Company (formerly the Waialua Agricultural Company). The two companies utilized most of the land in the project area, planting vast fields of sugar cane, modifying the landscape, building rail roads and roads, and importing large numbers of foreign laborers to work the fields. These factors have had a major impact on the archaeology of the area.

First, the modification of the landscape to suite the purpose of sugar cane planting has greatly altered the topography of the land; leveling hillsides, filling in swales and small valleys, and creating large relatively flat fields for planting (fig. 12). This, coupled with years of plowing and

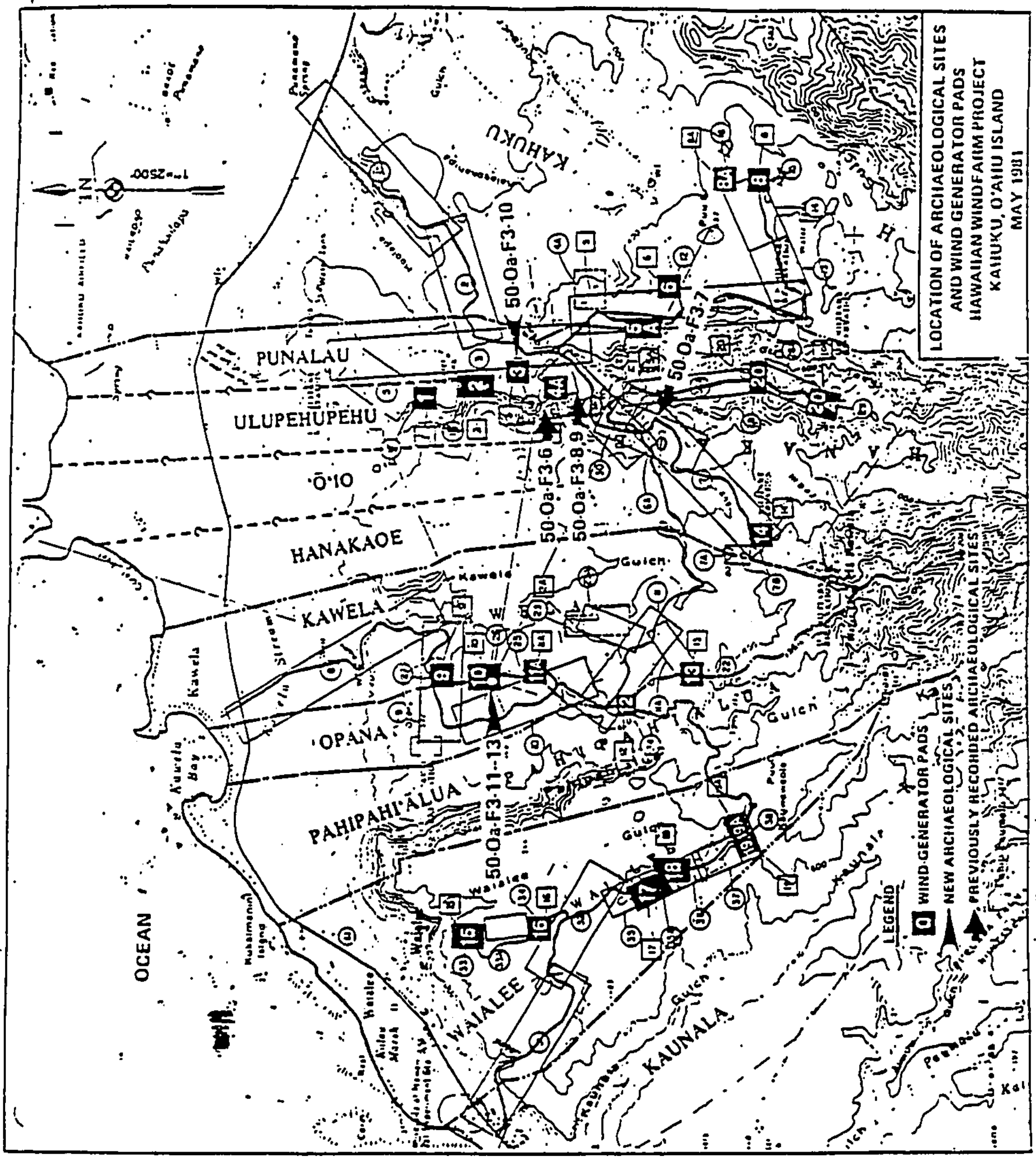

Fig. 11 1981 Kahuku Wind Farm Map by B. Davis

Fig. 12 Waialua Sugar Company Field Map

tilling, has destroyed any sites that may once have existed in the vast fields that dominate the landscape of the study area.

Second, the sugar companies have had a major effect on the study area's historic archaeology. By importing large numbers of foreign workers (mostly Chinese, Filipino, and Japanese) to work the fields, they created plantation communities around the processing mills. They also constructed an elaborate system of roads and field camps throughout the fields and some remnants of these old camps such as Kawailoa Camp may remain. Little archaeological work has been done on the old plantation homes and field camps in this area. Many such plantation related sites may be located within the project area and should be investigated if impacted by the transmission line corridors.

The overall effect of the sugar cane companies in the study area is twofold: 1) the agricultural techniques employed destroyed much of the study area's archaeological sites; and 2) the plantation home sites offer archaeologists an invaluable look at the lifestyle of early workers in turn-of-the-century Hawaiian history.

Summary

The historical research and archaeological investigations carried out by Cultural Surveys Hawaii indicate that there is a great deal of archaeology present in the study area. In areas that have been preserved from large scale agriculture (sugar cane and pineapple production) and/or urban development there is a high probability of finding Hawaiian sites. The coastal area contains the highest density of sites, while the upper reaches of the forest reserve contain fewer known sites.

From these investigations it is apparent that there are five major areas of archaeological concern with respect to the present project that should be considered before a transmission route is chosen:

1) An area of dense Land Commission Awards in the coastal region of Waiale‘e *ahupua‘a*.

2) The area of the Pupukea/Paumalu development in the hills above Pupukea Beach Park.

3) The valley of Waimea, that is both a private park and a Special Management Area.

4) The Anahulu river valley running through Kawailoa *ahupua‘a* from the mountains to Waialua Bay.

5) The area in and around the towns of Waialua and Haleiwa. This includes the lower Anahulu Valley, Ukoa pond, and the coastal areas in and around Waialua Bay.

These five geographic areas contain a rich record of Hawaiian activity and represent the most concentrated areas of Hawaiian site density and/or land usage in the study area. All five of these areas impact one or more of the proposed transmission line corridors in some way.

The following is a breakdown of each corridor and how it impacts each area of archaeological concern:

Corridor A:

Corridor A is approximately 1,500 feet wide, 60,000 feet long, and runs along the coast from sea level to an elevation of 400 feet in places. This corridor has the most impact on the known archaeology in the study area. It will impact, at least visually, most of the extant sites recorded by McAllister in his 1933 survey and will have an impact on all five of the major areas of archaeological concern within the project's boundaries. Corridor A runs through the town of Waialua and Haleiwa, impacting sites in that area, as well as Ukoa pond and the lower Anahulu Valley; the corridor cuts across the mouth of Waimea Bay and impacts all of the coastal sites in that area, including Puu o Mahuka and other important sites; it cuts through the Pupukea/Paumalu Homestead area; it then cuts directly through the coastal area of Waiale'e *ahupua'a*, running near most or all of the Land Commission Awards in the area before turning inland to its terminus at the Kuilima sub-station.

Corridor B:

Corridor B is approximately 1,500 feet wide, 60,000 feet long, and is the straightest corridor of the six. It runs directly from Waialua to the Kuilima sub-station at an average elevation of 400 to 600 feet. This corridor runs through four of the areas of concern, Waialua, Anahulu, Waimea, and the Pupukea/Paumalu area. The major impact from corridor B will be on the lower Anahulu Valley and on Waimea Valley.

Corridor B cuts across the lower section of Anahulu Valley through an area that has not been fully researched archaeologically. Therefore care should be taken to determine the impact Corridor B will have on that part of Anahulu Valley.

The greatest impact from Corridor B occurs in Waimea Valley. The corridor cuts through the lower half of the valley and will have a visual impact on much of the archaeology in the valley. There are a number of sites located in that part of the valley that would be impacted by the corridor. As a private park, Waimea is viewed by a large number of visitors every year. Therefore any transmission line cutting through the park will have an impact on the integrity of the park as an example of an ancient Hawaiian site area.

Corridor B also cuts through the Pupukea/Paumalu area and may have an impact on the sites that have been discovered in that area. It is not known at this time which, if any of the known sites in that area will be preserved, but care should be taken that development in this corridor has no adverse impact on the areas that contain human burials.

Corridor C:

Corridor C is also 1,500 feet wide and is 60,000 feet long. This corridor starts out of Waialua with Corridors D, E, and F. It then drops down and intersects Corridor B at Waimea and continues to the terminus at Kuilima slightly makai of Corridor B. Corridor C has about the same impact on the areas of concern as Corridor B except that it cuts through the Anahulu Valley at a higher elevation. It is recommended that the same care be taken with consideration to the areas of concern at Waialua, Anahulu, Waimea, and Pupukea/Paumalu.

Corridors D and E:

Corridors D and E run at a much higher elevation than the first three. The two corridors are of similar width, but are somewhat longer due to various turns that each makes to avoid known areas of concern. Both corridors have an impact on the Waialua area, on the mid-Anahulu Valley area, and on the upper reaches of Waimea valley. The major archaeological concerns for the two corridors are in Anahulu Valley and Waimea Valley.

Corridors D and E cut through the same part of Anahulu Valley as Corridor C and have a minimal impact on the known sites of the valley. However, as was stated in the Anahulu section, the valley has never been completely surveyed and probably contains many more sites than are shown on the map. Therefore, any proposed areas for physical impact in Anahulu Valley should be surveyed in advance of actual siting of powerline infrastructure.

Corridors D and E then continue across Kawailoa *ahupua'a* until they reach Waimea Valley. At this point both corridors cut across the valley at a higher elevation than the previous three.

Corridor D cuts through the valley just above Waimea Falls (one of the main attractions at the park) missing much of the lower valley's archaeological sites, but may impact some sites in the upper valley and may visually impact the beauty of the valley. This visual impact must be considered as a concern to the integrity of the valley as both a private park and an archaeological preserve.

Corridor E dissects Waimea Valley at a much higher altitude than Corridor D. It crosses the upper reaches of the valley and will have little impact on any of the known archaeology in the lower reaches of the valley. However, further research is recommended for the valley if Corridor E is chosen as the transmission line route.

Both corridors D and E then continue south until they reach the terminus at Kuilima. While there are not many sites known in this area, further archaeological study will be necessary should Corridors B, C, D, or E be chosen.

Corridor F:

Corridor F runs at the highest elevation in the study area at an average elevation of 1,000 feet. This corridor has the least impact on any of the known areas of concern. It does affect the Waialua area, and cuts across Anahulu Valley, but has little effect on any of the other known areas.

The only major area of concern is at the point where Corridor F cuts through Anahulu Valley. It cuts through the Keae *'iki* portion of the valley and would impact the sites in that area. Should Corridor F be chosen further research and survey should be undertaken to determine what impact development would have on Anahulu Valley.

Corridor F then continues along much higher than any of the other corridors. There are few if any sites known in the upper reaches of the mountains, however, if Corridor F is chosen, research and survey must be conducted along its route to determine whether or not there are sites along the Corridor F's course that have not yet been discovered.

Recommendations

Based on the research conducted by Cultural Surveys Hawaii at this time, the following recommendations and considerations concerning the proposed transmission lines are offered:

1) At this time five major zones of archaeological concern have been outlined by this report; Waiale'e, Pupukea/Paumalu, Waimea, Anahulu, and the Waialua/Haleiwa area.

2) Full consideration should be given the choosing of the transmission line alignment so as to avoid known archaeological sites listed or shown on the overall map.

3) Where the corridor must cross known sites and/or areas of concern, particular care should be taken that the placement of the infrastructure avoids impact to sites in the project area. The State Historic Preservation Office will minimally require archaeological surface survey in areas with known sites. An additional concern of the State Historic Preservation Office is site remnants in existing sugar cane fields: surface inspection of the transmission line corridor where it passes through cane fields will address this concern.

4) The State Historic Preservation Office will probably require surface survey of areas that have never been surveyed before to determine the presence or absence of sites: surface survey of the transmission line corridor where it passes through unknown areas will address this concern.

5) Planners should be aware of the presence of State and Nationally Registered sites in the study area, that will require further study and/or

recommendations for both physical and visual impact, should the transmission line corridor impact any of these sites.

6) Waimea Valley is of special concern because it is a private park that is viewed by many people each year. The State Historic Preservation Office will probably require further work in Waimea Valley to determine the impact that a transmission line corridor will have on the valley as both an archaeological preserve and as a state park.

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Appendix A: State Sites Within the Project Area

State site #: 50-80-01-00241
Site name: KUPOPOLO HEIAU 241
Site description: A TWO-TERRACE ROCK PAVED STRUCTURE, LARGE & IMPRES- SIVE, MEASURES 35 X 85M;LEGENDARY MATERIAL AVAILABLE, ASSOCIATED W/KAOPULUPULU A WELL-KNOWN PRIEST; PREHISTORIC
HRHP date: 7/24/78
NRHP date: 6/04/73
Period: 1
Significance criteria: DE
TMK: 1-6-1-05:016

State site #: 50-80-01-00242
Site name: KANEAUKAI STONE 242
Site description: LEGENDARY STONE SAID TO BE A GOD.

Period: 1
Significance criteria: E
TMK: 1-6-1-02:001

State site #: 50-80-01-00243
Site name: SACRED STONE KAAHAKII 243
Site description: FORMED OLD DIVISION BETWEEN WAIALUA & KOOLAULOA. SEAS IDE OF ROAD, SW OF WAIMEA BAY. NOT LOCATED IN 1981 SU RVEY BY WELCH.
Period: 1
Significance criteria: E
TMK: 1-6-1-01:001

State site #: 50-80-01-00244
Site name: KEAHUO O HAPUU COMPLEX 244
Site description: CONSISTS OF 3 SITES(244,1193,1194)INCLUDING A FISHING SHRINE,A CAVE SHELTER,& A WING WALL;ALL IN GOOD CON- DITION;MIDDEN FOUND IN CAVE SHELTER;HISTORICAL & LEGENDARY MATERIAL ASSOCIATED TO KO'A;PREHISTORIC
Period: 1
Significance criteria: CDE
TMK: 1-6-1-01:026

State site #: 50-80-01-00245
Site name: PALIPILO KO'A 245
Site description: FISHING SHRINE ON TOP OF PALIPILO BLUFF.

Period: 1
Significance criteria: DE
TMK: 1-6-1-02:001

State site #: 50-80-01-00246
Site name: WAIMEA GULCH BURIALS 246
Site description: ON SOUTH SIDE, IN NUMEROUS CAVES AND ROCK SHELTERS. ARTIFACTS IN SOME (1933).

Period: 1
Significance criteria: CDE
TMK: 1-6-1-02:000

State site #: 50-80-01-00247
Site name: WAIMEA HABITATION/AGRICULTURAL COMPLEX 247
Site description: AGRICULTURAL TERRACES ON BOTH SIDES OF WAIMEA RIVER. REMAINS OF HOUSE SITES.

Period: 1
Significance criteria: E
TMK: 1-6-1-02:002

State site #: 50-80-01-00248
Site name: KUHALE KO'A 248
Site description: A SMALL FISHING SHRINE ON NORTH SIDE OF INLET.

Period: 1
Significance criteria: E
TMK: 1-5-9-05:004

State site #: 50-80-01-00249
Site name: PUU O MAHUKA HEIAU 249
Site description: THE LARGEST HEIAU IN HAWAII,MEASURES 120' X 540',CONSISTS OF 3 ADJACENT ENCLOSURES,W/ STRUCTURES SUCH AS TERRACES,PLATFORMS,& WALLS IN THE INTERIOR;PROBABLY CONSTUCTED IN LATE 1700'S;A LUAKINI CLASS HEIAU;
HRHP date: 1/29/81
NRHP date: 9/08/83
Period: 1
Significance criteria: CDE
TMK: 1-5-9-05:068

State site #: 50-80-01-00256
Site name: WASHINGTON STONE (KAHIKILANI) 256
Site description: A NATURAL OUTCROP ASSOCIATED TO A LEGEND ABOUT KAHIKILANI,A YOUTH FROM HAWAII;AN HVB SIGN NOW POINTS TO THE DIRECTION OF THE STONE ON THE HILL.

Period: 1
Significance criteria: E
TMK: 1-5-9-06:000

State site #: 50-80-01-00257
Site name: KALOU FISHPOND 257
Site description: AN INLAND FISHPOND FED BY A SPRING & DRAINED ON THE MAKAI END;HAS BEEN ALTERED W/ADDITION OF PIPELINE & A SQUARE AREA CAPPED W/CONCRETE.

HRHP date: 1/30/81
Period: 1
Significance criteria: CDE
TMK: 1-5-8-01:055

State site #: 50-80-01-00508
Site name: WAIALUA BURIALS 508
Site description: CONSISTS OF 4 SMALL,MODIFIED,SHELTER CAVES W/ASSOCIA- TED FEATURES(TERRACES,ENCLOSURE,MOUND,WALLS);HUMAN BONES INSIDE CAVES;CAVES PARTIALLY DISTURBED

Period: 1
Significance criteria: E
TMK: 1-6-1-05:016

State site #: 50-80-01-01004
Site name: KAUNALA PLATFORM 1004
Site description: A PROBABLE HOUSE PLATFORM MEASURING 2.5 X 2.0M; ISOLATED STRUCTURE;NO ASSOCIATED MIDDEN OR ARTIFACTS; IN GOOD CONDITION

Period: 1
Significance criteria: CDE
TMK: 1-5-8-02:001

State site #: 50-80-01-01195
Site name: KE AHU O HAPUU COMPLEX 1195
Site description: INCLUDES AN UPRIGHT MARKING THE FORMER BOUNDARY BETWE EN WAIALUA & KO'OLAULOA; A HEIAU OR KO'A; A WATER HOL E; A FISH LOOKOUT POINT AND A RAILROAD BED.

Period: 1
Significance criteria: E
TMK: 1-6-1-13:001

State site #: 50-80-01-02502
Site name: WAIMEA RELIGIOUS PLATFORM 2502
Site description: A TWO-LEVEL PLATFROM;WALLS OF CORAL & BASALT;INTERIOR IS DIRT-FILLED;NO ARTIFACTS OR MIDDEN FOUND. MAYBE ASSOCIATED WITH PUU O MAHUKA.

Period: 1
Significance criteria: CDE
TMK: 1-5-9-05:000

State site #: 50-80-01-03724
Site name: HALEIWA BURIALS 3724
Site description: TWO HISTORIC ERA BURIALS INTERRED HAWAIIAN STYLE (PIT BURIALS) WITH HISTORIC ERA BEADS, CHARCOAL, FISH BONE AND BUTTONS. PA REPORT:19-20 YR OLD 5'7" POLYNESIAN M ALE;40-50 YR OLD 5'6" POLYNESIAN FEMALE.

Period: 2
TMK: 1-6-1-11:020

State site #: 50-80-01-03736
Site name: WAIMEA BEACH PARK HABITATION SITE 3736
Site description: LOCATED ON THE WEST BANK WHERE WAIMEA STREAM MEETS TH E BAY.BOTH PREHISTORIC AND HISTORIC CULTURAL LAYERS A ND ARTIFACTS

Period: 1
Significance criteria: DE
TMK: 1-6-1-01:003

State site #: 50-80-01-03822
Site name: SUNSET BEACH MODIFIED OUTCROP
Site description: A NATURAL BASALT OUTCROP MODIFIED WITH A LINEAR ALIGN MENT OF MED-SIZED BASALT BOULDERS. C. 10.0 X 42.0M LO NG RUNS PARALLEL TO A GENTLE SLOPE. BULLDOZER CUT.

Period: 1
TMK: 1-5-9-06:024

State site #: 50-80-01-03823
Site name: PUPUKEA U-SHAPED EARTHEN BERM 3823
Site description: LARGE, FLAT-TOPPED, 42.0 X 60.0 X 7.0M AT BASE, 2.5 WIDE X 1.75M HIGH. PROBABLY RR SIDING FOR EARLY 20TH CENTURY SUGARCANE INDUSTRY. CAIRN 1.0 X 0.5M 20M S OF 3823.

Period: 4
Significance criteria: C
TMK: 1-5-9-06:024

State site #: 50-80-01-03824
Site name: SUNSET BEACH AGRICULTURAL TERRACES 3824
Site description: IN THE MIDDLE OF A MODERATELY STEEP TALUS BELOW SHEER BASALT COASTAL CLIFFS. OVERALL SITE SIZE: 15.0 X 3.6 X 1.3M HIGH. WALL 0.25 X 15M, OF STACKED BVASALT COB BLES & BOULDERS 5-7 COURSES. PLATFORM AREA IS SOIL-

Period: 1
Significance criteria: CDE
TMK: 1-5-9-06:024

State site #: 50-80-01-03825
Site name: SUNSET BEACH CAIRN 3825
Site description: A COLLAPSED PILE OF BASALT BOULDERS 0.5M HIGH, AREA 3M SQUARE.MAY HAVE BEEN AN EARLY HISTORIC OR PREHISTO RIC TRAIL OR PROPERTY MARKER.

Period: 1
Significance criteria: E
TMK: 1-5-9-06:024

State site #: 50-80-01-03826
Site name: SUNSET BEACH AGRICULTURAL/HABITATION SITE 3826
Site description: 13 FEATURES TOTAL: FE G IS 5 BOULDERS WITH PETROGLYPH S; WALLS & TERRACES.

Period: 1
Significance criteria: CDE
TMK: 1-5-9-06:024

State site #: 50-80-01-03827
Site name: SUNSET BEACH MODERN WELL 3827
Site description: A SM PARTIALLY STONE-LINED WELL DUG INTO LIMESTONE BE DROCK AND FILLED-IN. 2.0M DIAM X 0.8M DEEP. MODERN P IPES EXTEND NE TOWARD A CONCRETE 2 CHAMBERED FOUNDATI ON:3.2 X 4.5 X0.2M. FILLED WITH MUD.
Period: 4
TMK: 1-5-9-06:024

State site #: 50-80-01-03828
Site name: PAKULENA IRRIGATION DITCH 3828
Site description: C.1900-1925 IRRIGATION DITCH PROBABLY DELIVERED WATER FROM PAKULENA STREAM TO FIELDS LOCATED TO THE N. RUNS C.223M SW-NE; 2.3M WIDE X 25-50CM DEEP; EXCAVATION RE VEALED HAND-DUG INTO SANDSTONE BEDROCK.
Period: 3
TMK: 1-5-9-06:024

State site #: 50-80-01-03829
Site name: SUNSET BEACH AGRICULTURAL LINEAR MOUND 3829
Site description: OF BASALT COBBLES & COBBLES 10.0 X 1.5M. SITUATED PAR ALLEL TO THE SLOPE; MAY HAVE FUNCTIONED AS A WATER DI VERSION DEVICE.

Period: 1
Significance criteria: E
TMK: 1-5-9-06:024

State site #: 50-80-01-03830
Site name: SUNSET BEACH IRRIGATION DITCH 3830
Site description: 180M LONG, ROUGHLY PARALLELS SITE 3828. MAY HAVE BEEN ASSOCIATED WITH NEARBY SUGARCANE ACTIVITIES C.1900- 1925.

Period: 4
Significance criteria: E
TMK: 1-5-9-06:024

State site #: 50-80-01-03831
Site name: SUNSET BEACH ROCKSHELTER 3831
Site description: A NATURAL ROCKSHELTER 5.5 X 3.0 X 1.3M AND A WALL. FLOOR LITTERED WITH DEGITAGE AND ANGULAR FRACTURED PI ECES OF VOLCANIC GLASS.MAY HAVE BEEN A QUARRY OR TEMP HABITATION.

Period: 1
Significance criteria: DE
TMK: 1-5-9-06:024

State site #: 50-80-01-03832
Site name: SUNSET BEACH ROCKSHELTERS 3832
Site description: 2 SM NATURAL ROCKSHELTERS: (A) 7.0 X 2.5 X 1.6M HIGH. NO ARTIFACTS OBSERVED. FLOOR MAY CONTAIN BURIED CULTU RAL DEPOSITS;(B) 4.0 X 1.8 X 1.6M.ON THE FLOOR WERE A CORAL ABRADER, A POLISHED BASALT COBBLE FRAG,CHARC
Period: 2
Significance criteria: E
TMK: 1-5-9-06:024

State site #: 50-80-01-03833
Site name: KALUNAWAIKAALA WWII BUNKER 3833
Site description: ATOP STEEP CLIFFS, 19.0 X 7.0M IN AREA, 3-TIERED, CON STRUCTED OF REINFORCED CONCRETE. HIGHEST TIER STANDS 4.25M ABOVE THE BASE OF THE LOWEST TIER. MAINTAINED BY MR. CLAUDE ORTIZ.
Period: 4
TMK: 1-5-9-06:001

State site #: 50-80-01-03834
Site name: PUPUKEA RETAINING WALL 3834
Site description: ON THE PLATEAU BETWEEN PAKULENA & KALUNAWAIKAALA GULC HS, A SLOPING WALL OF ROUGH BASALT ROCKS, MEASURES 2. 5 X 1.8M, AT THE HEAD OF A SMALL DRAINAGE. PROBABLY AN AG TERRACE C.1900-1950.
Period: 4
TMK: 1-5-9-05:038

State site #: 50-80-01-03835
Site name: PAUMALU WWII COASTAL DEFENSE SITE 3835
Site description: 450'ABOVE SEA LEVEL AT THE CREST OF SHEER BASALT CLIF FS; AREA 45.0 X 80.0M;BISECTED BY DIRT ROAD.(A)2-TIER ED BUNKER OF REINFORCED CONCRETE;(B) A TANGLED MASS O F CORRUGATED STEEL;(C)A CIRCULAR CONCRETE & STEEL
Period: 4
TMK: 1-5-9-06:024

State site #: 50-80-01-03836
Site name: PAUMALU AGRICULTURAL COMPLEX 3836
Site description: ON THE PLATEAU BETWEEN PAUMALU & PAKULENA GULCHES, 9 FEATURES IN AREA 50.0 X 100.0M:A SM CONCRETE BASIN,A CONCRETE CHIMNEY,3 BROKEN CONCRETE SLABS,AN EARTHEN TERRACE,AN ALIGNMENT OF BASALT ROCKS,A LOOSELY STACKE
Period: 4
TMK: 1-5-9-06:024

State site #: 50-80-01-03837
Site name: PAUMALU RETAINING WALL 3837
Site description: 2 SPATIALLY DISCRETE RETAINING WALLS THOUGHT TO HAVE COMPRISED MARGINS OF THE SAME ROADBED ON THE SAME LG PLATEAU. FE A IS A CURVED RETAINING WALL OF WATERWORN BASALT COBBLES & BOULDERS 9.5 X0.85 X 1.0M. FE B IS
Period: 4
TMK: 1-5-9-06:024

State site #: 50-80-01-03838
Site name: PAKULENA GULCH ROCKSHELTER 3838
Site description: A SM ROCKSHELTER CONTAINING A SEMICIRCULAR WALL AND A POSSIBLE TERRACE WALL AT THE BOTTOM OF THE GULCH AT T HE BASE OF A BASALT CLIFF.MEASURES 3.0 X 1.0 X 0.95M. WALL 1.0 X 0.25 X 0.20M MAY HAVE ENCLOSED A STORAG
Period: 1
Significance criteria: E
TMK: 1-5-9-05:038

State site #: 50-80-01-03839
Site name: PAKULENA GULCH AGRICULTURAL COMPLEX 3839
Site description: AT MOUTH OF PAKULENA GULCH,EXTENDS OVER MUCH OF TALUS CONSISTS OF UNKNOWN NO. OF AGRICULTURAL TERRACES & AT LEAST 6 WALLS. MAY HAVE BEEN ASSOCIATED WITH OCCUPATI ON AT SITE T-13/3826.
Period: 1
Significance criteria: E
TMK: 1-5-9-06:069

State site #: 50-80-01-03840
Site name: PAKULENA RETAINING WALLS 3840
Site description: 3 SPATIALLY DISCRETE WALLS FROM NEAR MOUTH OF GULCH & UPSTREAM FOR 180.0M.MOST RUN PARALLEL AND IMMEDIATELY ADJACENT TO PAKULENA STREAM. OF ROUGH & WATERWORN BAS ALT ROCKS & SM BOULDERS,STACK & CORE-FILLED WITH R
Period: 3
TMK: 1-5-9-06:069

State site #: 50-80-01-03841
Site name: PAKULENA GULCH ROAD COMPLEX 3841
Site description: 4 SPATIALLY DISCRETE WALLS: RETAIN ROCK & SOIL,PART O F A ROAD SYSTEM WHICH SERVICED THE AGRICULTURAL PLATE AUS BORDERING BOTH SIDES OF PAKULENA GULCH.

Period: 4
TMK: 1-5-9-06:024

State site #: 50-80-01-03842
Site name: SUNSET BEACH CAVE BURIAL 3842
Site description: LOCATED IN THE MIDDLE OF A MODERATELY STEEP TALUS. 7.75 X 3.0 X 0.80M. 2 HUMAN BURIALS,REMAINS OF A BURI AL CANOE. 2 SM WALLS BUILT BY GARY MCCURDY TO PROTECT SITE.ALSO 3 WELL PRESERVED WOOD FRAGS FROM A BURIAL
Period: 1
Significance criteria: DE
TMK: 1-5-9-06:024

State site #: 50-80-01-03843
Site name: KALUNAWAIKAALA RETAINING WALL 3843
Site description: IN EXISTENCE SINCE AT LEAST THE 1920S, A LINEAR RETAI NING WALL OF WATERWORN BASALT COBBLES & SM BOULDERS 4.0 X 0.65 X 1.0M RETAINS A TERRACEA OF LOAMY SOIL AP PROX 40M SQ.
Period: 4
TMK: 1-5-9-26:024

State site #: 50-80-01-03844
Site name: KALUNAWAIKAALA STREAM RETAINING WALL COMPLEX 3844
Site description: 3 RETAINING WALLS & A COBBLE PAVEMENT-LOW WATER CROSS ING. FE A: A FREE STANDING DOUBLE-STACKED WALL OF WAT ERWORN BASALT COBBLES & SM BOULDERS ONCE A RETAINING WALL FOR A ROADBED;FE B:LOW WATER CROSSING PAVEMENT
Period: 3
TMK: 1-5-9-05:038

State site #: 50-80-01-03845
Site name: KALUNAWAIKAALA STREAM PUMPHOUSE 3845
Site description: A SM RECTANGULAR CONCRETE & WOOD STRUCTURE WITH A TIN ROOF 6.0 X 3.5 X 3.0M; WITHIN THE STRUCTURE IS A LAG CAST-IRON WATER PUMP. INFORMANT HITCH: BUILT OVER A 500' DEEP WELL DRILLED IN 1951.ABANDONED IN 1970 BE-
Period: 4
TMK: 1-5-9-05:038

State site #: 50-80-01-03846
Site name: PAUMALU MILITARY COMPLEX 3846
Site description: 3 CONCRETE & WOOD FEATURES: FE A:A WOOD & CONCRETE ST RUCTURE WITH A GABLED ROOF NOW VERY COLLAPSED;FE B:3 RECTANGULAR CONCRETE FOOTINGS PARALLEL TO EACH OTHER; FE C:A CONCRETE STAIRBLOCK OF 2 STEPS.
Period: 4
TMK: 1-5-9-05:038

State site #: 50-80-01-03847
Site name: KALUNAWAIKAALA GULCH DAM 3847
Site description: BUILT WITH WATERWORN BASALT BOULDERS,SPANS THE BOTTOM OF THE GULCH, 19.0 X 1.20 X 1.96M. ALLUVIUM HAS COLL ECTED ON THE UPSTREAM SIDE OF THE DAM.PROBABLY SERVED FOR FLOOD CONTROL & SOIL CONSERVATION.
Period: 4
TMK: 1-5-9-29:028

State site #: 50-80-01-03848
Site name: KALUNAWAIKAALA WWII BUNKER 3848
Site description: LOCATED STOP STEEP CLIFFS WHICH OVERLOOK THE OCEAN. 3.4 X 2.4 X 1.85M.

Period: 4
TMK: 1-5-9-05:038

State site #: 50-80-01-03849
Site name: PAKULENA MILITARY COMPLEX 3849
Site description: 2 TRENCHES: FE A:A CURVILLINEAR TRENCH 24.0 X 3.0 X 2 .0M,AT NE END,AN EARTHEN ROOF SUPPORTED BY TIN SHEETS AND IRONWOOD POSTS;FE B:7.0 X 2.0 X 2.0M,ROOFED AREA SIMILAR TO FE A 3.0M LONG.
Period: 4
TMK: 1-5-9-06:001

State site #: 50-80-01-03850
Site name: PUU WAIHUENA RETAINING WALL 3850
Site description: A SLIGHTLY CURVED RETAINING WALL OF WATERWORN BASALT 15.0 X 2.0 X 0.80M, 2-3 COURSES HIGH, ACTS AS A RETAI NER FOR A ROADBED IMMEDIATELY UPHILL.PROBABLY DATES C 1900-1920. MAY HAVE SERVICED AG AREAS OF NEARBY ARE
Period: 4
TMK: 1-5-9-06:024

State site #: 50-80-01-03851
Site name: PAUMALU BOTTLE & RUBBISH SCATTER 3851
Site description: A SM SCATTER OF BROKEN BOTTLES, EARTHENWARE, PEWTER, PORCELAIN, & METAL FRAGS IN AN ERODED FACE OF A BANK, 10.0 X 7.0M APPEAR TO DATE TO ABOUT THE TURN OF THE CENTURY.MAY BE ASSOCIATED WITH PLANTATION CULTIVATION
Period: 4
TMK: 1-5-9-06:024

State site #: 50-80-01-03852
Site name: PAUMALU AGRICULTURAL MOUNDS 3852
Site description: 2 MOUNDS OF LOOSELY STACKED WATERWORN BOULDERS & COBB LES ADJACENT TO EACH OTHER. FE A:LINEAR IN PLAN, 20.0 X 3.0 X1.5M; FE B:OVAL IN PLAN,5.0 X 3.0 X 1.0M. PROB ABLY AG CLEARING MOUNDS ASSOCIATED WITH EARTLY TO
Period: 4
TMK: 1-5-9-06:024

State site #: 50-80-01-03853
Site name: PAUMALU RETAINING WALLS 3853
Site description: SITUATED ON THE PLATEAU BETWEEN PAUMALU GULCH, KALELE IKI GULCH AND PUU WAIHUENA, 2 RETAINING WALLS OF WATE RWORN BASALT BOULDERS & COBBLES.FE A IS CURVILINEAR & RUNS ALONG THE DOWNSLOP EDGE OF A DIRT ROAD STILL
Period: 4
TMK: 1-5-9-06:007

State site #: 50-80-01-03854
Site name: PAUMALU ROAD COMPLEX 3854
Site description: 3 FE: A CONSISTS OF 6 SEGMENTS OF ROADBEDS, OF ROUGH WATERWORN BASALT COBBLES, RUN ADJACANT TO PAUMALU STR EAM & OVER THE NE BOUNDARY; B IS A DOUBLE-STACKED WAL L OF ROUGH, WATERWORN BASALT ROCKS; C -REMNANT OF A
Period: 2
TMK: 1-5-9-06:018

State site #: 50-80-01-03855
Site name: PAUMALU ENCLOSURE-WALL COMPLEX 3855
Site description: 2 FEATURES: A IS A RECTANGULAR ENCLOSURE PROBABLE ANI MAL PEN MEASURING 55M SQ. FE B IS A CORE-FILLED WALL WHICH ADJOINS THE N CORNER OF FE A, 80.0 X 1.0 X 2.0M MAY HAVE BEEN A FIELD OR PROPERTY BOUNDARY.
Period: 3
TMK: 1-5-9-06:024

State site #: 50-80-01-03856
Site name: PAUMALU RETAINING WALL 3856
Site description: ON THE LOWER SLOPES IMMEDIATELY SW OF PAUMALU GULCH. CONSISTS OF A SM RENMANT OF A STONE RETAINING WALL OF WATERWORN BASALT ROCKS, 5.0 X 2.5 X 1.0M. HEAVILY DI STURBED BY CATTLE. PROB RETAINING WALL FOR A ROADBE
Period: 4
TMK: 1-5-9-06:024

State site #: 50-80-01-03857
Site name: PAUMALU ROCKSHELTER 3857
Site description: ON THE STEEP S SLOPE OF PAUMALU GULCH AT THE BASE OF A SMALL CLIFF, 3.75 X 1.8 X 0.6M.FLOOR LITTERED WITH PIG REMAINS. NO CULTURAL REMAINS NOTED.TROWEL PROBE YIELDED CHARCOAL & GREASY LOOKING GREY SOIL.
Period: 1
TMK: 1-5-9-06:024

State site #: 50-80-01-03858
Site name: PAUMALU WALL 3858
Site description: SITUATED ON THE LOWEST SLOPES S OF PAUMALU GULCH, OF ROUGH WATERWORN BASALT ROCKS,RUBBLE CORE-FILLED,IN CORPORATES 3 NATURAL BEDROCK OUTCROPS & BOULDERS, 20.0 X 0.5 X 0.9M, DOWNHILL END ADJOINS T-56(3859).
Period: 0
TMK: 1-5-9-06:024

State site #: 50-80-01-03859
Site name: PAUMALU RETAINING WALL 3859
Site description: A WELL-PRESERVED FREE-STANDING RETAING WALL OF ROUGH WATERWORN BASALT COBBLES & SM BOULDERS, 220.0M LONG IN A NE DIRECTION, 1.0M HIGH X 0.6M WIDE, FACED SOMEW HAT, RETAINS A ROADBED.
Period: 3
TMK: 1-5-9-06:024

State site #: 50-80-01-03860
Site name: PAUMALU ENCLOSURE 3860
Site description: A ROUGHLY RECTANGULAR ENCLOSURE, AREA OF 2700M SQ, INCORPORATES BEDROCK OUTCROPS & VERY LG BOULDERS,BOTH SIDES ARE FACED WITH ROUGH WATERWORN BASALT ROCKS, RU BBLE CORE-FILLED,1.0 X 3.0-4.0 X50-55.0M.
Period: 3
TMK: 1-5-9-06:024

State site #: 50-80-01-03861
Site name: PAUMALU BRIDGE COMPLEX 3861
Site description: 3 STONE FEATURES: A IS A WALL, PARTIALLY EXPOSED AND CAPPED BY 0.6M OF ALLUVIUM, 5.5 X 0.6 X 0.8-1.8M. FE B IS A ROADBED RETAINING WALL OF WATERWRON BASALT ROC KS. FE C IS SIMILAR TO A,1.0 X0.8 X 0.2.
Period: 3
TMK: 1-5-9-06:024

State site #: 50-80-01-03862
Site name: PAUMALU RETAINING WALL 3862
Site description: AT THE BASE OF PAUMALU GULCH, DOWNSTREAM OF THE MOUTH OF KALELEIKI STREAM, OF WATERWORN BASALT COBBLES & SM BOULDERS,PARALLELS PAUMALU STREAM, DISCONTINUOUS,RETA IN A FLAT EARTHEN ROADBED.
Period: 3
TMK: 1-5-9-06:024

State site #: 50-80-01-03863
Site name: PAKULENA LINEAR MOUND 3863
Site description: ON THE PLATEAU BETWEEN PAK[illegible]A & PAUMALU GULCHES,PAR ALLES A DRAINAGE CHANNEL, 2[illegible] X 3.0 X 0.8M, OF LOOSE LY STACKED,UNFACED WATERWORN BASALT ROCKS.SOME OF THE ROCKS HAVE BULLDOZER BLADE SCARS ON THEM.
Period: 4
TMK: 1-5-9-06:024

State site #: 50-80-01-03864
Site name: KALUNAWAIKAALA ROCKSHELTER WITH WALL 3864
Site description: AT THE BASE OF SHEER BASALT CLIFFS, ON TOP OF A STEEP TALUS, A NATURAL ROCKSHELTER (A) & A ROCK WALL(B).FE A:4.0 X 3.0 X 1.1M;FLOOR LITTERED WITH MODERN TRASH, VOL GLASS DATES RANGE AD 1645-1689 & AD 1747-1767,TO
Period: 1
Significance criteria: E
TMK: 1-5-9-05:038

State site #: 50-80-01-03865
Site name: PUPUKEA ROCKSHELTER WITH WALL 3865
Site description: AT THE BASE OF SHEER BASALT CLIFFS, AT THE TOP OF A T ALUS; A SHORT WALL(A) & A NATURAL ROCKSHELTER (B):(A) WELL BUILT OF ROUGH BASALT ROCKS, 6.0 X 1.2 X 1.3M; (B) PARTLY BLOCK BY A BASALT BOULDER & BANYAN TREE
Period: 1
TMK: 1-5-9-05:038

State site #: 50-80-01-03866
Site name: KALUNAWAIKAALA STREAM ROCKSHELTER 3866
Site description: NEAR MOUTH OF STREAM, SHEER BASALT CLIFFS BELOW & ABO VE IT, A NATURAL ROCKSHELTER WITH 2 CHAMBERS SEPARATE D BY A NATURAL ROCK WALL;MODERN TRASH, BASALT PIECES WHICH MAY SUGGEST THE SHELTER FLOOR MAY CONTAIN CUL
Period: 1
Significance criteria: DE
TMK: 1-5-9-05:038

State site #: 50-80-01-03867
Site name: EHUKAI BEACH BURIAL CAVE 3867
Site description: A NATURAL ROCKSHELTER WHICH HAS COLLAPSED. THE ROOF F ALL HAS BLOCKED THE ONCE WIDE SHELTER ENTRANCE. E ENT RANCAE IS BLOCKED WITH BARBED WIRE. 8.0 X 9.5 X1.5M. WITHIN THE SHELTER WERE NUMEROUS HUMAN REMAINS.
Period: 1
Significance criteria: E
TMK: 1-5-9-05:038

State site #: 50-80-01-03868
Site name: SUNSET BEACH HEIAU 3868
Site description: IN THE CENTER OF A TALUS LOCATED BETWEEN BASALT CLIFF S & LOW LYING COASTAL AREAS; A TERRACE (A) RUNNING E- NE ADJOINING THE CORNER OF A RECTANGULAR ENCLOSURE(B) 12.0 X 16.0M IN AREA, OF WATERWORN BASALT BOULDERS
Period: 1
TMK: 1-5-9-05:069

State site #: 50-80-01-03869
Site name: SUNSET BEACH BURIAL/PETROGLYPH COMPLEX 3869
Site description: AT TOP OF A MOD STEEP TALUS INLAND OF SUNSET ELEM SCH AT BASE OF A BASALT CLIFF:2 PETROGLYPH GALLERIES(A)-1 ON AN UNEVEN BASALT CLIFF FACE,6+ SM ANTHROPORMORPHIC FIGURES & A LG FISH/SHARK;ANOTHER GRP-A DOG TRAD H
Period: 1
Significance criteria: DE
TMK: 1-5-9-06:024

State site #: 50-80-01-03870
Site name: KALUNAWAIKAALA ROCKSHELTER/WALL COMPLEX 3870
Site description: IN THE MIDDLE OF STEEP BASALT CLIFFS,ABOVE 64(3864),A ROCKSHELTER VOID OF CULTURAL MATERIAL;2 WALLS:(B)1.75 X 0.25 X 0.63M AT N END OF (A);(C)IN THE MIDDDLE OF (A) 1.25 X 0.4 X 0.5M,MAY BE FACED. B & C MAY HAVE
Period: 1
TMK: 1-5-9-05:038

State site #: 50-80-01-03871
Site name: EHUKAI ROCKSHELTER 3871
Site description: OVERLOOKS EHUKAI BEACH IN THE MIDDLE OF A SERIES OF STEEP BASALT CLIFFS,3.0 X7.0 X1.5M,HUMAN BONE ON FLR; TROWEL PROBE YIELDED CHARCOAL.
Period: 1
Significance criteria: DE
TMK: 1-5-9-05:038

State site #: 50-80-01-03872
Site name: EHUKAI ROCKSHELTERS 3872
Site description: 2 ROCKSHELTERS:(A)1.2 X 1.2 X 0.55M, (B) 5.0 X 2.5 X 1.4 M, TROWEL PROBES IN BOTH SUGGEST INTACT BURIED CU LTURAL MATERIALS.
Period: 1
TMK: 1-5-9-05:038

State site #: 50-80-01-03873
Site name: SUNSET BEACH WALL 3873
Site description: ON A TALUS NE OF SUNSET BCH ELEM SCH, 1.2 X 0.4 X 60. M, OF ROUGH WATERWORN BASALT ROCKS, HEAVILY AFFECTED BY CATTLE. PROBABLY A CATTLE WALL.

Period: 3
TMK: 1-5-9-05:069

State site #: 50-80-01-03955
Site name: KE IKI ROAD BURIAL 3955
Site description: MALE ADULT ON LEFT SIDE IN FLEXED POSITION. EARLIER INFANT BURIAL TO NW DISTURBED WHEN UPPER PIT DUG. INFANT'S BONES SCATTERED IN BURIAL FILL. ADULT'S HEAD IN N END.
Period: 1
Significance criteria: DE
TMK: 1-5-9-03:046

State site #: 50-80-01-03971
Site name: PAKULENA ROCKSHELTER COMPLEX 3971
Site description: IN A SHEER BASALT CLIFF, A SM ROCKSHELTER (B) & ASSOC IATED WALLS(A & C).(B):4.5 X 4.25 X 0.5M (A):1.5 X 0 .5 X 25.0M,(C) 1.0 X 0.5 X 0.4M, BOTH OF SINGLE-STACK ED ROUGH BASALT COBBLES.
Period: 1
TMK: 1-5-9-06:018

State site #: 50-80-01-03973
Site name: PAKULENA WALLED ROCKSHELTER 3973
Site description: SM,IN A NEARLY VERTICAL CLIFF FACE ON THE S SIDE OF PAKULEAN GULCH,ON A LEDGE 1.0-1.5 WIDE X 8.0 M LONG. SHELTERED AREA IS 3.5 X 1.00-1.25 X 1.5M.A CRUDELY CO NSTUCTED, SINGLE-STACKED WALL ENCLOSES THE SHELTER.
Period: 1
TMK: 1-5-9-05:038

State site #: 50-80-01-03974
Site name: PAKULENA CAVE 3974
Site description: ON THE STEEP SLOPES ON THE S SIDE OF PAKULENA GULCH, 3.5 X 4.0-4.5 X 0.75-1.5M,VOLCANIC GLASS FLAKES SCATT ERED AROUND 2 EXPOSURES OF SURFACE CHILL VOLCANIC GLA SS,EVIDENCE OF FLAKING/QUARRYING ACTIVITY, MIDDEN.
Period: 1
TMK: 1-5-9-05:038

State site #: 50-80-01-03975
Site name: PAKULENA CAVE 3975
Site description: A NARROW CAVE IN THE STEEP SLOPE ON THE S SIDE OF PAK ULENA GULCH, 2.0 X 0.5M, LEVEL FLOOR, SINGLE WATERWOR N CORAL COBBLE ON FLOOR.
Period: 1
TMK: 1-5-9-05:038

State site #: 50-80-01-03976
Site name: SUNSET BEACH BURIAL CAVE 3976
Site description: IN THE FACE OF A CLIFF, FRONTS A LEDGE 10.0 X1.0-3.0M HAS 2 OPENINGS SEPARATED BY A PILLAR OF ROCK,2.0-3.5 X 3.0-4.0 X 0.5-1.5M. FLR IS LITTERED WITH ROOF FALL, & HUMAN SKELETAL REMAINS. DISTURBED. NO HISTORICS.
Period: 1
Significance criteria: DE
TMK: 1-5-9-06:024

State site #: 50-80-01-04062
Site name: WAIMEA BAY CAVE BURIAL 4062
Site description: BONES FOUND ON A SLOPE NOT FAR FROM A CAVE WHERE INFO RMANT LIVED. COLLECTED AND STRUNG THEM INTO A NECKLAC E.TURNED INTO POLICE WHEN THEY GAVE HIM "BAD VIBES
Period: 1
Significance criteria: DE
TMK: 1-6-[illegible]02:000

State site #: 50-80-01-04098
Site name: KAUNALA BURIAL CAVE 4098
Site description: CAVE 2/3 WAYS UP A SLOPE. CAVE ENTRANCE FACING ALMOST DUE WEST TOWARDS SEA. ENTRANCE WALLED. SCATTERED SKEL ETAL REMAINS: SKULL, FEMURS, INNOMINATES, RIBS, PHALA NGES, LONG BONES. PIECE OF WOOD (CANOE/CASKET?) S
Period: 1
Significance criteria: DE
TMK: 1-5-8-05:001

State site #: 50-80-01-04150
Site name: MONET BURIAL & HEARTH 4150
Site description: SKELETAL REMAINS WERE UNCOVERED DURING EXCAVATION FOR HOUSE FOUNDATION. EXACT LOCATION NOT FOUND. REMAINS PROBABLY HAD BEEN IN SAND EXCAVATED FROM OTHER PLACES ON PROPERTY. HEARTH & CORAL SLAB ALIGNMENT UNEARTHED
Period: 1
Significance criteria: D
TMK: 1-5-9-03:029

State site #: 50-80-01-04193
Site name: KAUNALA GULCH WEST BURIAL CAVE
Site description: SITE DISCOVERED BY A RESIDENT IN OCT 1988; EXCAVATED & FOUND HUMAN REMAINS, REBURIED THEM. FRAGS OF PEARL SHELL, KUKUI NUT AND WOOD WERE FOUND SURROUNDING PIT. 2 STONE ADZES FOUND E OF PIT ALONG DRIPLINE OF CAVE
Period: 1
Significance criteria: DE
TMK: 1-5-8-05:001

State site #: 50-80-01-04229
Site name: PUPUKEA BEACH PARK BURIAL 4229
Site description: DISCOVERED SOON AFTER BIG SURF OF EARLY DECEMBER 1969 A FEW DAYS LATER DISCOVERED BURIAL HAD BEEN DISTURBED ; SKULL REMOVED, FOOT, HAND, JAW, TEETH & TAIL BONE SCATTERED AROUND BURIAL;FLEXED,66CM X 38CM PIT.
Period: 1
Significance criteria: DE
TMK: 1-5-9-04:032

State site #: 50-80-02-00258
Site name: KAPI OR PUNAULUA POND
Site description: A NATURAL POND ABOUT 25M IN DIAMETER;IN GOOD CONDITION;NO HUMAN MODIFICATION;LEGENDARY SIGNIFICANCE

Period: 1
TMK: 1-5-7-03:051

State site #: 50-80-02-00259
Site name: WAIKANE STONE 259
Site description: BESIDE STREAM BED ON MTN SIDE OF KEWALA BAY AT FOOT O F PALIS IN HANAKAOE;WHEN KANE STRUCK THE STONE WATER FLOWED FROM IT & CONTINUED TO FLOW UNTIL THE PLANTATI ON BUILT A PUMP JUST BELOW IT.
Period: 1
Significance criteria: E
TMK: 1-5-7-02:001

State site #: 50-80-02-00265
Site name: KAHOA STONES
Site description: TWO STONES IN THE WATER ABOUT 15M APART;NATURAL FEATURES;W/ASSOCIATED LEGEND

Period: 1
Significance criteria: E
TMK: 1-5-6-03:000

State site #: 50-80-02-00267
Site name: KALAIOKAHIPA RIDGE BURIAL CAVES 267
Site description: THE MANY CAVES WERE USED AS PLACES OF BURIAL BY THE OLD HAWAIIANS. KANE & KANALOA LIVED NEAR THE RIDGE WH EN KAHUKU PLAIN WAS STILL UNDER WATER.

Period: 1
Significance criteria: DE
TMK: 1-5-6-05:001

State site #: 50-80-02-00269
Site name: KAHUKU PLATFORM 269
Site description: A RECTANGULAR PLATFORM OF BEACH LIMESTONE COBBLES PLACED BOTH VERTICALLY & HORIZONTALLY;A SMOOTH CORAL ON ITS W EDGE;MEASURES 17 FT. LONG,9-10.5 FT. WIDE,& 3 FT. HIGH;IN GOOD CONDITION;PROBABLE KO'A
Period: 1
Significance criteria: CDE
TMK: 1-5-6-06:011

State site #: 50-80-02-00270
Site name: KEANA ROCK SHELTER 270
Site description: LOCATED IN A MOUNTAIN SIDE,HAS TWO-PILLAR SHAPED (NATURAL)STONES STANDING AT THE MOUTH;HUMAN BONES FOUND AT THE BASE;W/ASSOCIATED LEGEND
Period: 1
Significance criteria: DE
TMK: 1-5-6-06:019

State site #: 50-80-02-00275
Site name: WAIAPUKA POOL
Site description: A BRACKISH WATER POOL ABOUT 15 X 20M;NATURAL POND; LEGENDARY ASSOCIATION
Period: 1
TMK: 1-5-6-06:006

State site #: 50-80-02-01038
Site name: KAHUKU HABITATION AREA
Site description: EXPOSED SUBSURFACE CULTURAL DEPOSIT IN A SAND DUNE; CONTAINS HEAVY MIDDEN DEPOSIT;VERY LIKELY THERE ARE REMAINS OF PREHISTORIC OCCUPATION
NRHP date: 9/11/72
Period: 1
TMK: 1-5-6-03:010

State site #: 50-80-02-01043
Site name: KAWELA AGRICULTURAL TERRACES 1043
Site description: KAWELA GULCH

Period: 1
Significance criteria: CDE
TMK: 1-5-7-02:001

State site #: 50-80-02-02501
Site name: HANAKAOE BURIAL PLATFORM 2501
Site description: TRIANGULAR SHAPED STONE PLATFORM IN GOOD CONDITION; FILLED W/RUBBLE;USE AS BURIAL REASONABLY CERTAIN

NRHP date: 8/14/73
Period: 1
Significance criteria: DE
TMK: 1-5-7-02:003

State site #: 50-80-02-02801
Site name: MALAEKAHANA ARCHAEOLOGICAL COMPLEX
Site description: CONSISTS OF SURFACE (274) & SUBSURFACE(SAND DUNE) CULTURAL DEPOSITS;TEST EXCAVATED FROM 1977-1980; ABUNDANT MIDDEN & ARTIFACTS;VG DATES A.D. 1600-1700 BURIALS

Period: 1
Significance criteria: CDE
TMK: 1-5-6-01:004

State site #: 50-80-02-02899
Site name: KAWELA BAY SUBSURFACE CULTURAL DEPOSIT 2899
Site description: PREHISTORIC CULTURAL DEPOSIT UNCOVERED DURING SUB-SURFACE TESTING IN 9/84;LOCATED ALONG COAST OF KAWELA BAY;PROBABLE OCCUPATIONS & BURIAL AREA;C-14 DATE RANGE OF A.D. 1630-1950.

Period: 1
Significance criteria: CDE
TMK: 1-5-7-03:002

State site #: 50-80-02-02911
Site name: KAHUKU PT. CULTURAL DEPOSIT 2911
Site description: SUBSURFACE CULTURAL DEPOSIT IN A SAND DUNE AREA; TESTED IN 1977 & 1984, FOUND MIDDEN, ARTIFACTS (HISTORIC & INDIGENOUS) & HUMAN REMAINS; RADIOCARBON DATE 165 BC- 210 A.D. & 1655-1950
Period: 1
Significance criteria: CDE
TMK: 1-5-6-03:041

State site #: 50-80-02-02912
Site name: PUNAHOOLAPA MARSH 2912
Site description: ON THE COASTAL LOWLAND PLAIN OF KAHUKU; BEDROCK IS PAR T OF AN ANCIENT FRINGING CORAL REEF. A LARGE KIDNEY BEAN SHAPED TRACT. LONGER AXIS NW-SE. MARSH IS BISECT ED BY OLD ROADBED OF OAHU RAILWAY & LAND CO.
Period: 0
TMK: 1-5-6-03:040

State site #: 50-80-02-03735
Site name: WAIALE'E HABITATION SITE 3735
Site description: IN ERODING SAND BANK, CONTAINING ARTIFACTS, MIDDEN, CH ARCOAL AND INTACT HEARTHS AND OTHER PIT FEATURES

Period: 1
TMK: 1-5-8-01:015

State site #: 50-80-02-03765
Site name: PAHIPAHIALUA BEACH PARK BURIAL
Site description: POLICE REPORT ONLY

Period: 0
TMK: 1-5-7-05:000

State site #: 50-80-02-04066
Site name: MALAEKAHANA BAY HABITATION & BURIAL SITE 4066
Site description: HUMAN BURIAL, IMU & FIREPIT IN ERODING FACE OF SAND D UNE DISCOVERED IN APRIAL 1983 BY STATE PARK STAFF.CIR CA AD 1600. BURIAL FOUND APPROX 17M INLAND IN FEB 19 89 DURING EXCAVATION FOR A HOUSE FOUNDATION. CHARC
Period: 1
TMK: 1-5-6-01:027

State site #: 50-80-02-04111
Site name: KAHUKU DUNE BURIAL 4111
Site description: INDIVIDUAL BURIED IN A TIGHTLY FLEXED POSITION, FLEXE D ARMS BETWEEN THE LEGS, HANDS UNDER CHIN. ANTERIOR-POSTERIOR POSITION PARALLEL WITH SHORELINE. NO PIT OU TLINE, NO ARTIFACTS, NO CHARCOAL.
Period: 1
TMK: 1-5-6-02:009

State site #: 50-80-02-04190
Site name: MALAEKAHANA BAY BURIED CULTURAL DEPOSITS 4190
Site description: STORM EROSION EXPOSED A BURIAL, AN IMU AND AT LEAST 2 FIREPITS; CHILD'S BURIAL ADJACENT TO IMU; IMU HAD 2 BURNING PHASES, PREDATE THE BURIAL;MAY BE CONTEMPORAN EOUS W/PHASE I & II CA. A.D.1600.
Period: 1
Significance criteria: DE
TMK: 1-5-6-01:028

State site #: 50-80-02-09506
Site name: KEAAULU DITCH
Site description: STONE-FACED IRRIGATION DITCH;IN POOR CONDITION; PROBABLY HISTORICAL;DIMENSIONS NOT SPECIFIED

Period: 0
TMK: 1-5-6-07:003

State site #: 50-80-02-09507
Site name: OIO STREAM TERRACE
Site description: A POSSIBLE AGRICULTURAL TERRACE IN POOR CONDITION; DIMENSIONS NOT SPECIFIED;POSSIBLY PREHISTORIC

Period: 1
Significance criteria: E
TMK: 1-5-7-02:001

State site #: 50-80-02-09508
Site name: EAST OIO GULCH PLATFORM
Site description: A STEPPED STONE PLATFORM IN POOR CONDITION;DIMENSION & POSSIBLE FUNCTION NOT SPECIFIED;POSSIBLY PREHIS- TORIC

Period: 1
Significance criteria: CDE
TMK: 1-5-7-02:001

State site #: 50-80-02-09509
Site name: OIO GULCH COMPLEX 9509
Site description: CONSISTS OF AGRICULTURAL TERRACES IN OIO GULCH;IN POOR CONDITION;POSSIBLY PREHISTORIC

Period: 1
Significance criteria: E
TMK: 1-5-7-02:001

State site #: 50-80-02-09517
Site name: KANEALII AGRICULTURAL TERRACES 9517
Site description: IRRIGATED AGRICULTURAL TERRACE

Period: 1
Significance criteria: CDE
TMK: 1-5-8-02:002

State site #: 50-80-04-00205
Site name: POLOA GROVE BURIAL GROUND AKUA STONE 205
Site description: GROVE ONCE SACRED TO PELE, AREA APPROX 80 X 170'; TRI ANGULAR STONE ON EASTERN SIDE 1.7 X 0.6' THICK SURROU NDED BY 8 SMALL STONES; ALSO A BURIAL GROUND

Period: 1
Significance criteria: E
TMK: 1-6-6-27:001

State site #: 50-80-04-00206
Site name: KAHAKAHUNA HEIAU 206
Site description: LOCATED ON THE SEA SIDE OF THE ROAD AND NORTH OF THE OLD MILL SITE (1933) ON SLIGHTLY ELEVATED GROUND. BY 1933, THE STONES HAD BEEN REMOVED AND THE AREA USED F OR AGRICULTURE.
Period: 1
Significance criteria: CDE
TMK: 1-6-6-29:011

State site #: 50-80-04-00221
Site name: LAUKIAHA SPRING 221
Site description: IN 1933, NEAR WAIALUA SODA WORKS, INTO OPAEULA STREAM ON THE MOUNTAIN SIDE OF THE TWIN BRIDGES AT WAIALUA.

Period: 1
TMK: 1-6-2-06:011

State site #: 50-80-04-00222
Site name: KUMAILIA-UNU 222
Site description: AN AGRICULTURAL HEIAU ON THE SEA SIDE OF THE RAOD JUS T BEFORE THE TWIN BRIDGES IN GOING TOWARD WAIALUA. IN 1933, THERE WERE TRUCK GARDENS ON THE SITE.

Period: 1
Significance criteria: CDE
TMK: 1-6-6-18:019

State site #: 50-80-04-00223
Site name: HEKILI HEIAU 223
Site description: ON THE SEA OF THE TWIN BRIDGES AT WAIALUA.OCCUPIED BY BUDDHIST TEMPLE (1933). THRUM TOLD HEIAU WAS OF LUKIN I CLASS AND A PLACE OF REFUGE; NEARBY WAS KAOHE KO'A (ACCORDING TO HOOKALA).
Period: 1
Significance criteria: CDE
TMK: 1-6-6-17:010

State site #: 50-80-04-00224
Site name: PUNAKAI 224
Site description: HOUSE SITE OF KAHUNA PUUKANE; WHENEVER PUUKANE CHANGE D, POI WOULD OVERFLOW ANY VESSEL IN WHICH IT HAD BEEN PLACED; ALSO SITE OF KUKUIULA UNU (HEIAU).

Period: 1
Significance criteria: CDE
TMK: 1-6-6-16:008

State site #: 50-80-04-00225
Site name: KAPUKAPUAKEA HEIAU 225
Site description: EAST END OF KAIAKA BAY, ON SEA SIDE OF RR TRACK. ACCO RDING TO THRUM: A MEDIUM SIZED HEIAU OF TRADITIONAL M ENEHUNE CONSTRUCTION OF KAUILA WOOD; ASSOCIATED WITH LONOAKEAHU, LUUAU ITS KAHUNA.MAILIKUKAHI WAS CIRCUM
Period: 1
Significance criteria: CDE
TMK: 1-6-6-07:007

State site #: 50-80-04-00227
Site name: PUUPILO HEIAU 227
Site description: SEAWARD OF THE HALEIWA COURTHOUSE,PAALOA; SLIGHT ELEV ATION OF LAND WITH AN OLD COCONUT PALM ON THE SIDE (1933).

Period: 1
Significance criteria: CDE
TMK: 1-6-6-05:019

State site #: 50-80-04-00228
Site name: KEPUWAI HEIAU 228
Site description: CEMETARY BESIDES THE CHURCH IN WAIALUA MARKS THE SITE

Period: 1
Significance criteria: E
TMK: 1-6-2-05:004

State site #: 50-80-04-00229
Site name: KAWAIPUOLO SPRING
Site description: "THE-BUNDLED-WATER." WHEN STRANGERS PASSED HERE & ASK ED FOR WATER, IT WAS GIVEN TO THEM IN A TARO-LEAF CUP. (THRUM):SPRING DISAPPEARED;IT WAS FOUND NEAR KAENA PT & MENEHUNES CONVEYED WATER BACK IN TI & TARO LEAVE

Period: 1
TMK: 1-6-2-04:006

State site #: 50-80-04-00230
Site name: POO O MOO AND WAWAE O MOO ROCKS 230
Site description: ON EITHER SIDE OF THE ANAHULU STREAM ABOVE THE OLD HA LEIWA SEMINARY.GUARDIAN STONES FOR THE STREAM (CECI A KIM 1989).

Period: 1
TMK: 1-6-2-04:035

State site #: 50-80-04-00231
Site name: KAMANI HEIAU 231
Site description: LOCATION OF HALEIWA HOTEL; THRUM: "UNPAVED HEIAU OF L ARGE SIZE WITH LIME STONE WALLS, OF LUAKINI CLASS."

Period: 1
Significance criteria: CDE
TMK: 1-6-6-01:025

State site #: 50-80-04-00233
Site name: LOKOEA POND
Site description: A BRACKISH OR FRESH WATER,NATURAL INLAND POND;MODI- FIED IN RECENT YEARS W/THE CONSTRUCTION OF CONCRETE WALLS INSIDE & ALONG EDGES

Period: 1
TMK: 1-6-2-03:002

State site #: 50-80-04-00234
Site name: PUAENA POINT 234
Site description: ALSO KNOWN AS KAHAKAKAU KANAKA. AT THE DEATH OF ELANI WHO WAS GREATLY LOVED BY HIS PEOPLE,HIS BODY WAS PLAC ED ON THE ROCKS NEAR PUAENA POINT WHERE IT WAS ALLOWE D TO DECOMPOSE.
Period: 1
Significance criteria: E
TMK: 1-6-2-01:001

State site #: 50-80-04-00235
Site name: PUAENA POINT HEALING STONE 235
Site description: PARTIALLY COVERED BY SAND, CONTINUALLY WASHED BY THE SEA, AN OVAL STONE 2'HIGH X 4'LONG REPRESENTS PUAENA, A WOMAN WHO FOLLOWED PELE FROM TAHITI.SEAWEED WAS PLA CED ON THE STONE & ADDRESSED BEFORE TOUCHING THE IN
Period: 1
Significance criteria: E
TMK: 1-6-2-01:008

State site #: 50-80-04-00236
Site name: UKOA FISHPOND
Site description: A LONG NARROW FRESH-WATER POND,APPROX 1 MILE LONG.LAN IWAHINE WAS THE GODDESS(MOO)OF UKOA WHO LIVED THERE W ITH HER BROTHER PUHIULA.

Period: 1
TMK: 1-6-2-02:001

State site #: 50-80-04-00237
Site name: ILIILIKEA HEIAU 237
Site description: THRUM: OF 2 DIVISIONS, 75' BY 267', ITS WALLS WELL DE FINED, THOUGH IN RUINS.MCALLISTER: DESTROYED IN 1916 BY W HARPHAM FOR WAIALUA AG CO. 1933: NOW COVERED WIT H CANE.
Period: 1
Significance criteria: CDE
TMK: 1-6-1-05:001

State site #: 50-80-04-00240
Site name: KOHOKUWELOWELO HEIAU 240
Site description: (MCALLISTER 1933:143)FORMER DWELLING PLACE OF KAHUNAS RELOCATED BY E. NELLER: ON MTN SIDE OF PLANTATION RD ACROSS KAWAILOA BEACH (1989);AS MCALLISTER DESCRIBED IT EXCEPT FOR ADDITION OF 2 WWII BUNKERS.
Period: 1
TMK: 1-6-1-05:015

State site #: 50-80-04-01334
Site name: WAIALUA COURT HOUSE

Period: 4
TMK: 1-6-6-09:023

State site #: 50-80-04-01337
Site name: KAWAILOA RYUSENJI TEMPLE
Site description: CONSISTS OF 3 SECTIONS:EXTERNAL WALKWAY,PRAYING ROOM, & COLUMBARIUM;ONE STORY ELEVATED WOOD FRAME STRUC- TURE;BUILT IN 1914 BY SOTO BUDDHIST RELIGION
NRHP date: 11/21/78
Period: 0
TMK: 1-6-1-05:001

State site #: 50-80-04-01348
Site name: HALEIWA ELEMENTARY SCHOOL

NRHP date: 8/11/80
Period: 4
TMK: 1-6-6-13:012

State site #: 50-80-04-01439
Site name: HALEIWA HISTORIC DEPOSIT 1439
Site description: A DEPOSIT OF BOTTLES, CERAMIC VESSEL FRAGS & OTHER MA TERIALS LOCATED ON THE TOP & SIDES OF A LOW ROCKY KNO LL. BOTTLES DATE AD 1880-1920. AREA 8 X 15M. EXCAVAT ION REVEALED IN-SITU REMAINS ARE ON THE SURFACE.
Period: 3
TMK: 1-6-2-04:035

State site #: 50-80-04-01440
Site name: HALEIWA WALL REMNANT 1440
Site description: A MASSIVE WALL REMNANT SITUATED IN THE MIDDLE OF A LG CLEARED & PLOWED FIELD 25 X 1.2 X 1.3M HIGH. ALIGNME NT OF LG BOULDERS PLACED ON END WITHA CAP & FILL OF S MALLLER BASALT ROCKS. SHELLLS.
Period: 1
TMK: 1-6-2-02:022

State site #: 50-80-04-01441
Site name: HALEIWA AGRICULTURAL TERRACES 1441
Site description: AREA 100 X 100M;CONSISTS OF INDETERMINATE NO. OF TERR ACES FORMED BY EARTH EMBANKMENT WALLS. NUMEROUS BASAL T ROCKS OBSERVED ERODING FROM SIDES:LIKELY STONE WALL S THAT HAVE BEEN FILLED IN & COVERED OVER WITH EAR
Period: 1
TMK: 1-6-2-04:003

State site #: 50-80-04-01442
Site name: EMERSON HOMESTEAD
Site description: 2 STORY MASONRY & WOOD STRUCTURE, RECTILINEAR 15 X 60 FT. FIRST FLR 18" THICK MASONRY WALLS, 15 X 30 FT. 2 OPENINGS: DOORS OR WINDOWS;MILLWORK DATE TURN OF THE CENTURY. WALLS DATE 1830-1860, OF CUT CORAL ROCK CO
Period: 3
TMK: 1-6-2-12:010

State site #: 50-80-04-01443
Site name: HALEIWA "OLD CHURCH" 1443
Site description: INTERIOR ACCESS NOT PERMITEED. A RECTILINEAR WOOD ST RUCTURE WITH GABLE ROOF FACING THE ROAD. WOODEN WALL OF SINGLE WALL BOARD & BATTEN. FISHSCALE SHINGLE ON THE WEATHER GABLE END. CONSTRUCTION DATES TURN OF
Period: 3
TMK: 1-6-2-02:010

State site #: 50-80-04-02032
Site name: HALEIWA THEATER SITE
Site description: HISTORIC TRASH DUMPS, OLD CONCRETE FOUNDATION

Period: 0
TMK: 1-6-6-17:029

State site #: 50-80-04-03400
Site name: KAWAILOA ENCLOSURE AND PAVEMENT 3400
Site description: NEAR THE E CORNER OF THE KAWAILOA WASTEWATER TREATMEN T PLANT. CONSISTS OF 2 ADJACENT STRUCTURES OF UNMORTA RED STONE MASONRY: AN ENCLOSURE & A FOUNDATION FOR A STRUCTURE SINCE GONE.
Period: 1
TMK: 1-6-1-05:001

State site #: 50-80-04-03723
Site name: POAMOHO GULCH STONE MOUND
Site description: A BOULDER 1.7M X 2.8M X 1.0M HIGH, ON TOP OF WHICH WERE PLACED SEVERAL SUBANGULAR BASALT ROCKS BETWEEN 20CM X 20CM X 35CM & 40CM X 40CM X 50CM. NO MIDDEN, ARTIFACTS OR OTHER EVIDENCE OF HUMAN ACTIVITY
Period: 1
TMK: 1-6-4-01:006

State site #: 50-80-04-03956
Site name: PAPAILOA ROAD BURIAL 3956
Site description: UNCOVERED WHILE EXCAVATING A SHALLOW PIPELINE TRENCH IN BEACH DUNE DEPOSIT. NEAR W EDGE OF PROPERTY APPRX 20M MAKAI OF PAPAILOA RD. SKULL, LEFT FEMUR,TIBIA, BOTH RADII, ULNA, ATLAS & AXIS. NO ARTIFACTS.FLEXED.
Period: 1
TMK: 1-6-1-04:093

State site #: 50-80-04-04094
Site name: HALEIWA ROCK SHELTERS 4094
Site description: LOCATED AT THE BASE OF A LIMESTONE TERRACE, 2 SMALL R OCKSHELTERS LESS THAN 2M LONG BY 1M HIGH.SILT DEPOSIT OF SIGNIFICANT DEPTH, RECENT GARBAGE LITTER, POTHUNTE RS' HOLES, TURBO SHELL.
Period: 1
TMK: 1-6-6-17:028

State site #: 50-80-04-04240
Site name: PAPAILOA ROAD BURIAL 4240
Site description: HUMAN SKELETAL REMAINS FOUND IN SAND TAKEN TO HAWAII COUNTRY GOLF COURSE ON KUNIA ROAD. SAND CAME FROM 61- 745 PAPAILOA RD WHERE A SWIMMING POOL WAS DUG. PRELIM INARY ANALYSIS: ADULT MALE 25-30 YRS OLD.
Period: 0
TMK: 1-6-1-04:081

State site #: 50-80-05-00220
Site name: PA AIKANAKA 220
Site description: SITE OF CANNIBAL FEASTS OF AN O'AHU CHIEF; LOCATED 8 MILES EAST OF HALEIWA IN THE MOUNTAINS OF HAUPU;VISTE D BY G F MATHISON IN 1821-22:FLAT STONE, 5'BROAD X 6-7'LONG,SMOOTH SURFACE COVERED WITH DRAWINGS. ETC.
Period: 1
Significance criteria: CDE
TMK: 1-6-3-01:001

State site #: 50-80-05-09510
Site name: KAWAINUI PLATFORM
Site description: A PLATFORM IN POOR CONDITION;PROBABLY HISTORIC;DIMEN-SION & POSSIBLE PLATFORM NOT SPECIFIED;LOCATED ALONG KAWAINUI STREAM

Period: 0
TMK: 1-6-3-01:001

State site #: 50-80-05-09511
Site name: KAWAIIKI AGRICULTURAL COMPLEX
Site description: CONSISTS OF AGRICULTURAL TERRACES ALONG KAWAIIKI STREAM;IN POOR CONDITION;PROBABLY PREHISTORIC

Period: 0
TMK: 1-6-3-01:001

State site #: 50-80-05-09512
Site name: KAWAILOA COMPLEX 9512
Site description: A HABITATION COMPLEX IN KAWAILOA GULCH;FEATURE TYPES NOT SPECIFIED;IN GOOD CONDITION;HISTORIC

Period: 0
TMK: 1-6-3-01:001

State site #: 50-80-05-09513
Site name: KAWAINUI ENCLOSURE 9513
Site description: AN ENCLOSURE IN POOR CONDITION ALONG THE STREAM; DIMENSION & PROBABLE FUNCTION NOT SPECIFIED;PROBABLY PREHISTORIC

Period: 1
TMK: 1-6-3-01:001

State site #: 50-80-05-09514
Site name: KAWAIIKI PLATFORMS
Site description: PLATFORMS IN POOR CONDITION ALONG KAWAIIKI STREAM; NUMBER,FUNCTION & DIMENSIONS NOT SPECIFIED;PROBABLY PREHSTORIC

Period: 0
TMK: 1-6-3-01:001

Explanation of significance criteria:

A = Associated with events that have made an important contribution to the broad patters of our history;
B = Associated with the lives of persons important in our past;
C = Embodies the distinctive characteristics of a type, period, or method of construction; represents the work of a master; or possesses high artistic value;
D = Has yielded, or is likely to yield, information important for research on prehistory or history;
E = Has an important traditional cultural value to an ethnic group of the State.

APPENDIX B

BOTANICAL STUDY

WAIALUA-KUILIMA TRANSMISSION ALIGNMENT

BOTANICAL RECONNAISSANCE REPORT

FOR

R. M. TOWILL CORPORATION
461 Waikamilo Road, Suite 411
Honolulu, Hawaii 96817-4941

BY

Evangeline J. Funk, Ph.D.
BOTANICAL CONSULTANTS
AUGUST 1992

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FIGURES

INTRODUCTION

A field survey of five proposed powerline alignments, from Waialua to Kuilima, Oahu, Hawaii was carried out in late July and early August, 1992. The purpose of the survey was to ascertain the type of vegetation found along these alignments, its identity, density, and approximate heights. The information generated by this survey will be used during the route selection process.

METHODS

Data were collected by surveying the undeveloped areas along the proposed alignments. Using aerial photographs, USGS topographic maps, and an altimeter the approximate alignments were located and information on the species composition, height, and density of the vegetation was collected. No time was spent in the cane fields, pastures, and suburban areas. Only cursory information was collected along the paths of A-Alignment, Kamehameha Highway, and the B-Alignment, mostly at the makai edge of the cane fields.

RESULTS

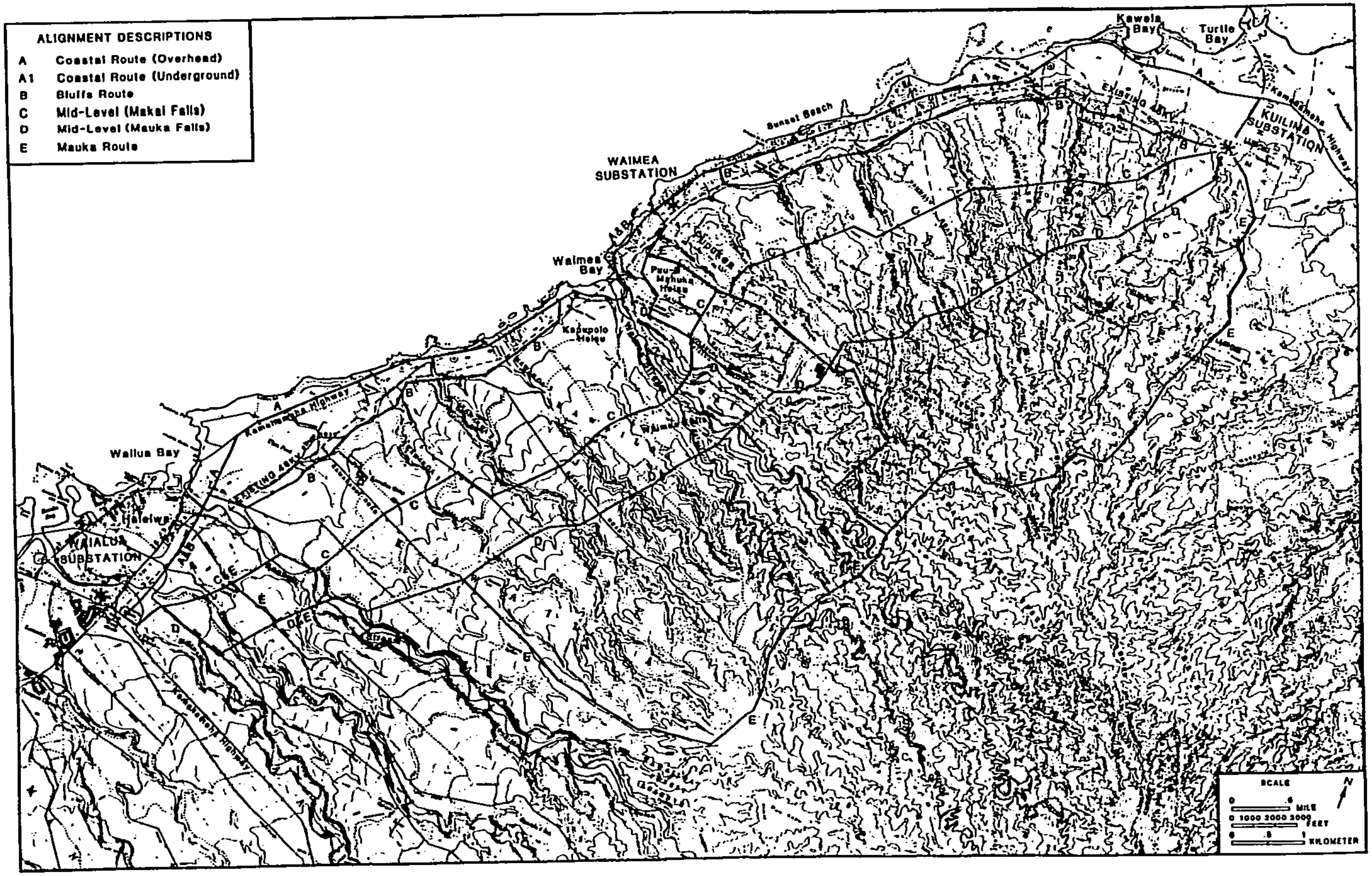
The origin and terminus for all lines is the same; they begin at the Waialua substation and they end at the Kuilima substation (Figure 1). Each alignment will be described seperately beginning at the common origin, Waialua substation, and ending at the common terminus, Kuilima station.

All proposed alignments are shown in Figure 1. Wherever possible, photographs have been used to illustrate points of interest.

THE E-ALIGNMENT

The E-Alignment leaves the Waialua substation near Weed Circle and travels in a southeasterly direction for approximately 2000 feet, crossing over an urbanized area and the new alignment of Kamehameha Highway.

Figure 1. Location Map of Five Proposed Powerline Alignments.



It turns to travel in a northeasterly direction for approximately 1500 feet ,across sugarcane fields. From here, E-Alignment follows a northeasterly course for approximately 3500 feet where it makes a right turn and crosses Opaeula Stream. This crossing is at approximately 200 feet elevation and, rim to rim, Opaeula Stream is approximately 200 feet across. The walls of the gulch are covered with koa haole (*Leucaena leucocephala* Lam de Wit). At this elevation, the bottom of the stream is heavily forested with Java plum (*Syzygium cumini* (L.) Skeels) and a few scattered silk oak trees (*Grevillea robusta* A. Cunn. ex r. Br.) which are about 30 feet in height. Between the stream and the cane fields is a dense band of guinea grass (*Panicum maximum* Jacq.).

Traveling in approximately the same direction and at a slightly higher elevation, E-Alignment again crosses sugarcane fields until it comes to Anahulu Stream at 250 feet elevation. At this crossing several small feeder streams converge with the main Anahulu water course. Rim to rim, the stream gulch is approximately 1500 feet across. The vegetation is thick and varied, but made up of mostly alien plants. The ironwood trees (*Casurina equisetifolia* L.) are 50 to 60 feet in height. There are also African tulip (*Spathodea campanulata* P. Beauv.), monkey pod (*Samanea saman* (Jacq.) Merr., silk oak, date palm (*Archontophoenix alexandrae* H. A. Wendl. & Drude), and banyan (*Ficus microcarpa* L.fil.) trees. Sisal (*Agave sisalana* Perrine), Apple of Sodom (*Solanum linnaeanum* Hepper & Jaeger), Indian fleasbane (*Pluchea indica* (L.) Lees), and sour grass (*Digitaria insularis* (L.) Mez ex Ekman) are also common. The indigenous shrub or small tree, 'A'ali'i (*Dodonaea viscosa* Jacq.) begins to occur in the vegetation at this elevation.

E-Alignment then continues across more sugarcane fields until it intersects Kamananui Road. It follows Kamananui Road uphill in a southeasterly direction to the highest point of the study area, ± 1100 feet. The proposed line then crosses the upper reaches of an unnamed stream (here referred to as Kawailoa Gulch Plus 1, Figure 1). This gulch contains an amazing array of native Hawaiian vegetation including koa (*Acacia koa* A. Gray), sandalwood (*Santalum freycinetianum* Gaud.), *Pleomele fobesii* Degener, Myrsine sp. trees, ie'ie vines (*Freycinetia arborea* Guad.) and false staghorn fern (*Dicranopteris linearis* (Burm.) Underw.). In addition there are also introduced trees, weeds, and grasses. This canyon is about 300 feet across and about 80 feet deep.

From Kawailoa Gulch Plus 1, to the the intersection of Kamananui Road and Ashley Road there are sugarcane fields. Beyond this intersection the E-Alignment follows a northeasterly course across the Kawailoa and Kahuku Forest Reserves for approximately seven miles into the coastal lowlands where the Kuilima substation is located at about 200 feet elevation. This course is cut by many small and large streams and ridges.

About one quarter of a mile beyond Ashley and Kamananiu Roads the pathway changes course to follow Pupukea Ranch Road, but from the edge of the cane fields to Pupukea Ranch Road there is a mixed Koa/Ohia (*Metrosideros polymorpha* Gaud.) forest which also contains Kukui (*Aleurites moluccana* (L.) Willd.), Java plum, strawberry guava (*Psidium cattleianum* Sabine), trumpet tree (*Cecropia obtusifolia* Bertol.), avocado (*Persea americana* Mill.), Siris (*Albizia lebbeck* (L.) Benth.) Gunpowder (*Trema orientalis* (L.) Blume) and banyan trees, some sixty to eighty feet in height. Among the forbs and grasses can be found molasses grass (*Melinis minutiflora* P. Beauv.), false staghorn fern and *Cyclorus interruptus* (Frosk.) Ching. among others.

The mixed forest continues, where Pupukea Ranch Road begins, but here trees of one hundred feet or more in height are common. The really tall trees are mostly introduced gunpowder, siris, Eucalyptus and banyan trees. This tall tree mix is found along the long downhill gradient into the Kaiwikoele Stream drainage at about seven hundred feet elevation. Kaiwikoele Stream itself is insignificant and from here the proposed line gains elevation to about one thousand feet where it crosses the Waimea Grant Boundary. Large sections of the forest from here to the boundary of Kawailoa Forest Reserve can be characterized as scattered ohia/koa with a false staghorn fern understory. This forest contains sandalwood, pleomele, tree ferns (*Cibotium splendens* (Gaud.) Krajina) and many other native species. Alien plants are most common along the shoulders of Pupukea Ranch Road as it travels between the branches of Kamananui Stream.

Just east of the intermittant branch of Kamananui Stream, E-Alignment branches. One branch travels makai for approximately one mile, turns north for approximately one mile more until it reaches the McCormack Gate. Here it turns makai and follows Pupukea Road down to sea level.

From where the makai E-Alignment leaves the Mauka E-Alignment it parallels the 800 foot contour, an area of mixed vegetation. Swamp mahogany (*Eucalptus robusta* Sm.) ohia, sandalwood, and strawberry guava are common trees. Shrubs such as mountain naupaka and many types of ferns, both native and introduced, are also frequent. This mix of plants is often found along this part of E-Alignment route (Figure 2). From the McCormack Gate, past the Boy Scout Camp and on down to Kamahameha Highway, the vegetation is eucalyptus and ironwood trees up to 60 to 80 feet in height. There are also many species of planted trees and shrubs. Along the Pupukea bluff down to Kamehameha Highway, there is Christmasberry, date palms, and of course, koa haole.

Upper E-Alignment loses elevation as it enters the Elehaha Stream drainage. The path is through mostly native Ohia/Koa/Staghorn fern habitat, but near the Koolauloa/Waialua District boundary, many small enclaves of planted trees such as eucalyptus, both *E. robusta* and *E. sideroxylon*, as well as paperbark (*Melaleuca quinquenervia* (Cav.) S.T.Blake), Formosan koa (*Acacia confusa*

Merr.), and silk oak are common. There are also occasional sandalwood, koa, ohia, *Canthium odorata* trees and mountain naupaka and pukeawe shrubs (*Styphelia tameiameiae* (Cham. & Schl.) F.v.Muell.).

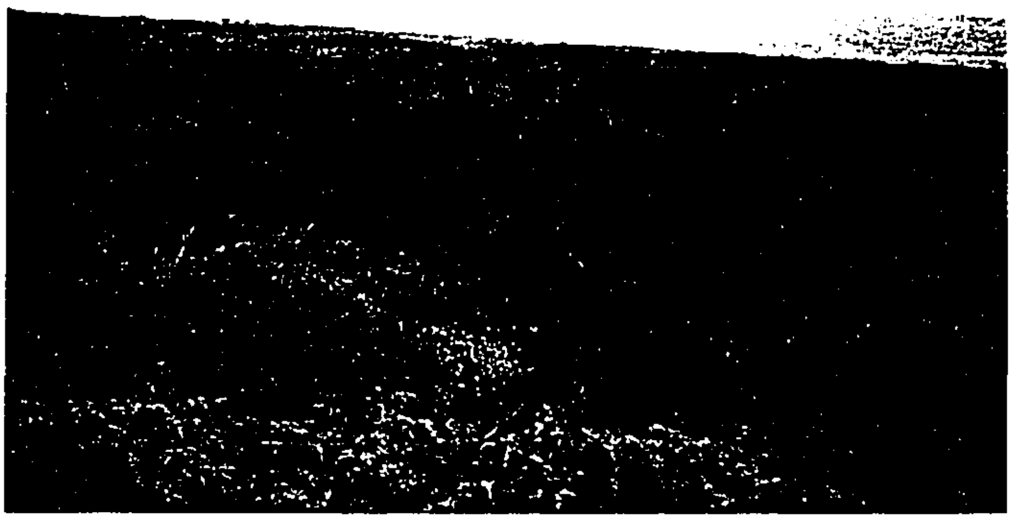


Figure 2. Mixed Native and Introduced Vegetation Along E-Alignment.

Where E-Alignment crosses Kaunala Stream the gulch is 1500 to 2000 feet across and perhaps 200 feet deep. The forest continues to be mixed native and introduced trees.

As it nears the Kahuku Training area headquarters, the proposed pathway begins to traverse dense stands of planted, mature trees such as paper bark, ironwood, and eucalyptus trees. At about 400 feet elevation, E-Alignment begins a more precipitus course from the east, down into Oio Gulch, where the Kuilima Substation is located. In this area it passes through scant, scrub vegetation composed of koa haole, Christmasberry, a small patch of hau (*Hibiscus tiliaceus* L.) and dense guinea grass. This vegetation is all less than fifteen feet in height.

D-ALIGNMENT

Upon leaving the Waialua Substation, the D-Alignment follows the course described for the E-Alignment across sugarcane fields, Opaeula Stream and Anahulu Stream (Figure 3) to Kamananui Road. The D-Alignment continues in a northeasterly direction at approximately 500 feet elevation to Kawailoa Plus 1 Gulch (Figure 1). Rim to rim, Kawailoa Plus 1 Gulch is approximately 600 feet across and 150 to 200 feet deep. The rim vegetation is Albizia (*Albizia lebbeck* (L.) Benth.), silk oak, Chinaberry (*Melia azedarach* L.), paperbark and java plum trees which are 50 to 75 feet in height. The vegetation of the gorge bottom is composed of these trees as well as Formosan koa. All of these trees are known to have been planted by the Territorial Forestry Department between 1910 and 1980 (Skolman 1980).

Figure 3. Anahulu Gulch Crossing of E and D-Alignments.

The next vegetated area along the D-Alignment is at Kawailoa Plus 2 Gulch (Figure 1). This little gulch is 500 to 600 feet across and approximately 150 feet deep. The cliff faces are ironwood trees 35 to 45 feet in height. There are also silk oak, Java plum, Albizia, and Chinaberry trees with an understory of Christmasberry shrubs (*Schinus terebinthifolia* Raddi). Many landscape plants such as Bougainvillea, Poinciana (*Delonix regia* Raf.), Hibiscus sp. and white shrimp plant are found along the edges of Kawailoa Plus 2 Gulch. Guinea grass fills all the space between the trees and shrubs.

The D-Alignment crosses Kawailoa Plus 3 Gulch, the next one to the northeast, at about 550 feet elevation. At this point, another small gulch joins the Kawailoa Plus 3 Gulch resulting in a rim to rim gulch about 1500 feet across. In this broad gorge, the species composition of the vegetation is similar to the previous two sites except here the ironwoods are 50 to 60 feet in height. There are also Kukui and mango trees (*Mangifera indica* L.) and some native vegetation, notably koa trees 25 to 35 feet in height, mountain naupaka, 'Akia (*Wikstroema oahuensis* (A. Gray) Rock), ti (*Cordyline fruticosa* (L.) A. Chev.) and palapalai fern (*Microlepia setosa* (Sm.) Alston).

D-Alignment crosses more cane fields and one more unnamed gulch before entering the Waimea Forest Reserve. In crossing the Waimea Stream drainage, D-Alignment crosses several small streams and ridges. Kaiwikoele Stream gorge, about 1000 feet across and Kamananui Stream gorge, about 1500 feet across, later join to form Waimea Stream. At the D-Alignment elevation, they are seperated by a narrow ridge. The alignment crosses the northeastern tributary of the Waimea River, the intermittant Elehaha Stream. Elehaha Gorge is about 1000 feet across and possibley 350 feet deep. From the southwestern rim of the Waimea drainage to the northeastern rim, this part of Waimea gulch is approximately 5000 feet across. The vegetation of the area is very diverse and includes large ironwood trees near the rim with silk oak, koa, ohia, strawberry guava and 'A'alii trees among others on the gorge walls. In the valley floor there are large mango, kukui and java plum trees. Christmasberry, strawberry guava, Formosan koa, pili grass and many roadside ferns are common. There is also an access road to the upper reaches of Waimea Stream along the valley floor.

Upon reaching the Kuilima side of Waimea Gorge, D-Alignment hugs the edge of Kauwalu Gulch, a small side gorge into the Waimea watershed, for about 3000 feet before crossing open pastures and house lots to Pupukea Road. The rim of Kauwalu Gulch and the edges of Pupukea Road are lined with ironwood and swamp mahogany (*Eucalyptus robusta* Sm.) trees.

At the rim of Kauwalu Gulch, the D-Alignment splits and a feeder line heads seaward in a northwesterly direction toward Pu'u O Mahuka Heiau. This route is along the ridge top through an almost pure ironwood forest. Near the heiau, swamp mahogany, Formosan koa, Java plum, and strawberry guava trees ultimately become the dominant vegetation. As D-Alignment crosses Kalahopele Stream, ironwoods and Java plum trees form dense thickets. From here to the base of the Pupukea bluffs, the vegetation is mixed Christmasberry, koa haole, stawberry guava, and sisal (*Agave sisalana* Perrine).

The cross country D-Alignment from Pupukea Road to Kawela Gulch crosses Kalunawaikaala, Pakulena, Kaleleiku, Paumalu, Kaunala, Waialee, and Pahipahialua Streams. These are major streams and gulches. The territory between the major streams is cut by small ridges and waterways. Along this entire alignment the major vegetation is ironwwod and swamp mahogany trees, with Christmasberry, silk oak, and both strawberry and yellow guava becoming more common along the northeastern end of the corridor. The height of the ironwoods and swamp mahogany decreases from 80 to 90 feet in height in the Kalunawaikaala and Pulena Stream area to less than 35 feet near Kawela Gulch.

Between Paumalu Stream and Kaunala Gulch the D-alignment crosses some working pastures and near Motorcross Road it just skirts the Kahuku windmills. It is in this area that the old, buried, telephone cable is exposed due to erosion.

At the D-Alignment crossing of Kalunawaikaala Gulch, the gulch is more than 2000 feet across and at least 300 feet deep. Along the stream floor there are some kukui trees and in the sparse openings there are some ferns, tree seedlings and weedy species.

The forest where D-Alignment crosses Pakulena Gorge is still ironwoods and swamp mahogany with some silk oak coming in. The gorge at this location is steep and narrow.

At Kalekeika Stream, D-Alignment will span a gorge 1500 feet across and about 300 feet deep. The ironwood/swamp mahogany forest is 60 to 75 feet in height and strawberry guava has become the most important understory plant.

D-Alignment encounters another 1500 foot rim to rim gorge at Pamalu Stream. This gorge is 250 to 300 feet deep and the vegetation is much more varied. The upper edge of the gorge on the Waialua side is covered with ironwoods and only scattered swamp mahogany trees. On the steep drop down into the stream bed, the cliff walls are covered with strawberry guava and some young silk oak trees. On the Kahuku side, the vegetation is scrub silk oak trees, some Christmasberry, yellow guava (*Psidium guajava* L.), lots of pili grass, sword fern (*Nephrolepis exaltata* (L.) Schott) and Philippine ground orchid (*Spathoglottis spicata* Bl.). From Pamalu Gorge, the D-Alignment looses elevation as it traverses the Girl Scout Camp and some well kept pastures as it approaches Kaunala Stream. In this area the vegetation is more open and varied. This gorge is 1000 to 1500 feet across and approximately 300 feet deep. The scattered ironwoods are 40 to 60 feet high and there are also silk oak, koa, 'ohia, Java plum and Pandanus trees (*Pandanus tectorius* S. Parkinson ex Z.).

Native shrubs such as mountain naupaka and pukeawe are common as are many species of ferns.

D-Alignment, near the head of Waialee Gorge, is in the Kahuku Motorcross area. The gulch is 1200 to 1500 feet across and perhaps 200 feet deep. The swamp mahogany, silk oak, and ironwood trees are 35 to 40 feet in height; and the understory is Christmasberry, all three species of guava, the weedy Ardesia (*Ardisia elliptica* Thunb.), and several species of ferns. In this area the line crosses above the HECO windmills.

At Pahipahialua Gulch the D-Alignment continues to traverse stands of swamp mahogany and ironwood trees, 15 to 40 feet in height, and also lots of planted paperbark trees. In this gorge and at this elevation, as in all the other gorges northeast of Kaunawaikaala Gulch, there is a series of small gorges and narrow ridges which extend into each main gorge for varying distances.

The elevation at which D-Alignment crosses Pahipahialua gulch is much lower and the habitat is much drier, but the weed community is much richer and more diverse.

Kawela Gulch is the last stream that D-Alignment crosses before dropping down to the Kuilima substation. Near the windmills there are still some swamp mahogany and ironwood trees, but they are much farther apart and the understory is largely Christmasberry. The ironwoods are 35 to 40 feet in height.

THE C-ALIGNMENT

The C-Alignment coinsides with that of the E and D Alignments to as far as Twin Bridge Road. Northeast of Twin Bridge Road, but at a somewhat lower elevation, the C-Alignment crosses Opaeula Stream and Opaeula Camp 3. At this point, Opaeula Stream is 500 to 600 feet across and the principle vegetation on the gulch walls and edges is koa haole with Guinea grass as a common understory plant. On the valley floor there are some Java plum and silk oak trees approximately 30 feet in height. At Opaeula

Camp Three, there is some development with the usual domestic plantings. The C-Alignment pathway passes through this development.

At about 180 feet elevation, the C-Alignment crosses Anahulu Stream. At this point the waterway floor is wide and flat enough to accomodate a narrow, 500 to 900 feet wide cane field (Figure 4). On the sides of the gorge grow koa haole, Java plum, silk oak, ironwood and monkey pod trees. Some of the ironwood trees protrude as much as 40 feet above the surrounding cane fields. On the Kuilima side of Anahulu Stream, C-Alignment turns and travels upslope on the rim of the gorge for about 1000 feet. At about 250 feet elevation it turns in a northeasterly direction and for about one and one quarter miles crosses sugar cane fields to Kawailoa Plus 1 Gulch.

Figure 4. C and E-Alignments Cross Anahulu Gulch Across Cane Field.

Rim to rim, Kawailoa Plus 1 Gulch is about 150 feet across. The canopy vegetation is Java plum which reaches a height of about 35 feet. The shrub layer is Christmasberry and haole koa which is 8 to 15 feet high. The ground layer is mixed grasses and weeds.

From Kawailoa Plus 1 Gulch to Kawailoa Plus 2 Gulch, the C-Alignment gains about one hundred feet in elevation and crosses this second gorge just above a large water storage dam. Kawailoa Plus 2 Gulch is between 500 and 600 feet across and 200 to 250 feet deep. The vegetation cover, at this location, contains many of the same plants such as Java plum, silk oak, and strawberry guava trees. In addition there are paperbark and Albizia trees, many of which are 60 to 70 feet in height. The ground layer contains, among other taxa, molasses grass (*Melinis minutiflora* P Beauv.), guinea grass, and Vervain (*Stackytarfeta urticifolia* (Salisb.) Sims.). The native shrub, 'Ulei (*Osteomeles anthyllidifolia* (Sm.) Lindl.) is common.

C-Alignment crosses Kawailoa Plus 3 Gulch at 450 feet elevation. At this crossing the waterway is 1000 to 1200 feet across and is accessable via a cane haul road. The vegetation is primarily ironwood trees from 70 to 80 feet in height. In addition, there are Kukui, chinaberry, and Formosian koa trees and lots of guava trees, both red and yellow. Woodrose (*Merremia tuberosa* (L.) Rendle) and white morningglory vines (*Ipomea alba* L.) festoon many of the large trees. The understory is made up of mostly guinea grass and Hilo grass (*Paspalum conjugatum* Bergius).

Where the C-Alignment traverses the small, intermittant branch of Waimea Stream the ironwood and silk oak trees are 50 to 60 feet high and the Java plum trees are 35 to 40 feet in height. Here, again there are kukui, Albizia, and chinaberry trees. In addition both native koa and Alahe'e (*Canthium odoratum* G. Forster) Seem.) trees persist.

Beyond this feeder stream, C-Alignment crosses the last sugarcane fields before entering the broad gorge through which the Waimea River flows. C-Alignment crosses the right branch of Waimea Stream, a narrow, low ridge, and then the left or intermittant branch of Waimea Stream. Christmasberry, Java plum, silk oak, Formosan koa trees are common on the valley walls. In addition, inside Waimea Valley are many large mango, kukui and ironwood trees. On the Kuilima side of the valley some scattered native plants such as 'ohia and koa trees, ulei and *Wikstroemia oahuensis* (A. Gray) Rock. shrubs are found among the java plum and silk oak trees and the Christmasberry and pili grass.

Upon leaving Waimea Stream gorge, C-Alignment enters an area where swamp mahogany and ironwood trees become the dominant vegetation. In fact, both sides of Kalahopele Stream are covered with dense stands of ironwood trees which are 90 to 100 feet in height. Along the gulch floor can be found swamp mahogany, silk oak and strawberry trees. This gorge is approximately 600 feet across and 200 feet deep.

From the northeastern edge of Kalahopele Gulch to Kalunawaikaala Stream, the C-Alignment pathway is through an urbanized area. In this area the swamp mahogany is scattered and interspersed with a variety of landscape trees. Kalunawaikaala Gulch is about 500 feet across and maybe 200 feet deep. There are scattered swamp mahogany, ironwood, and mango trees in this gently sloping area. The understory has been removed and the grass is kept mowed.

Ironwood trees 60 to 70 feet in height are the common vegetation from Kalunawaikaala Stream to Pakulena Stream. Some java plum, silk oak, and swamp mahogany trees persist at the edges and in the openings in the ironwoods. Palapalai fern (*Microlepia setosa* (Sm.) Alston) was common along the stream and in other openings.

Between Pakulena Stream and Paumalu Stream are some open places which appear to be or have been farm or pasture sites. The vegetation of Paumalu Gulch itself is varied and includes swamp mahogany, ironwood, three types of guava, African tulip (*Spathodea campanulata*, Beauv.) and banyan trees. Mauka of the Comsat Station, between Paumalu and Kaunala Streams are open, well kept cow and horse pastures.

Kaunala Gulch is about 1200 feet across and 200 to 300 feet deep. It is cut by small side ridges and gulches. The vegetation is primarily ironwood trees 70 to 80 feet high interspersed with swamp mahogany and banyan trees and Christmasberry bushes.

Between Kaunala Gulch and Pahipahialua Gulch, C-Alignment crosses the Hawaii Motorcross field which is broad and surrounded with ironwood trees 50 to 70 feet high. There are occasional swamp mahogany, silk oak and guava trees plus the usual low elevation, weedy scrub.

This vegetation type persists as C-Alignment crosses Pahipahialua gulch which is more than 1500 feet across and perhaps 100 feet deep. Here there are side ridges 25 to 50 feet below the gulch rim that are mostly covered with Christmasberry scrub.

C-Alignment, as it approaches Waialee Gulch from the Motorcross race course, passes near the electricity generating windmills where the same vegetation, ironwoods, swamp mahogany, and Christmasberry is present. There are broad open places which may have at one time been farmland or pastures. This same vegetation persists in the abandoned pasture along the C-Alignment pathway to Kawela Gulch. This gulch is 1200 to 1300 feet across and 200 to 250 feet deep. Within the gulch the ironwoods are scattered as are the swamp mahogany trees. The understory is Christmasberry, haole koa and mixed grasses.

As it leaves Kawela Gulch to traverse the escarpment down into Oio Gulch and the Kuilima substation, C-Alignment passes some ironwoods, but in this area, Christmasberry is the dominant vegetation.

THE B-ALIGNMENT

The paths of A-Alignment and B-Alignment coincide from the Wailua Substation to just past Anahulu Stream. They travel in a southheasterly direction for about 1200 feet to just mauka of Weed Circle, then follow the Haleiwa bypass road on the mauka side in a northerly direction near the fringe of the developed area of Haleiwa Town. Except for some monkey pod, Java plum, and occasional African tulip trees, most of the vegetation of the place where B-Alignment and A-Alignment cross Anahulu Stream is either koa haole or landscape material. There are houses on both sides of Anahulu Stream. Residents in this area have some small gardens and raise some taro, lotus root and other vegetables. There are large monkey pod, mango, and banyan trees near the houses and the river.

On the Kuilima side of Anahulu stream, B-Alignment angles off in an easterly direction for a short distance to the edge of the escarpment which separates the coastal lowlands from the lower forest. For most of its length, from here to the Kuilima substation, this alignment maintains an elevation of between 150 to 300 feet. The vegetation varies but, the persistant dominants are kiawe (*Prosopis pallida* (Humb. and Bonpl.ex Willd) HBK), trees and koa haole and Christmasberry shrubs. From Anahulu to Kawailoa Plus 1 the koa haole is 12 to 15 feet in height and the scattered kiawe trees are 45 to 50 feet high. Scattered ironwood trees are found near the edge of the cane fields. The swale at Kawailoa Plus 2 Gulch is broad and shallow along the B-Alignmsent and the vegetation is scant. Scotch attorney tree (*Clusia rosea* Jacq.), Java plum, kiawe, christmasberry, and castor bean plants are frequent. The understory is guinea grass and other weed species. Some banyan and chinaberry trees begin to appear as B-Alignment nears the Waimea River.

Before reaching Kupupolo Heiau, B-Alignment turns north and follows Kamehameha Highway through the Waimea Bay area and on to the town of Sunset Beach. From Kawailoa

Plus 2 Gulch to Kupupolo Heiau, the bluff vegetation is still primarily Christmasberry, scattered kiawe, and Java plum trees, but along the walls of Waimea gorge some date palm trees and sisal plants begin to appear.

Near Kalunawaikaala Stream, the B-Alignment again returns to an elevation of about 200 feet on the low bluffs behind Sunset Beach Village. Ironwoods, Chinaberry, date palm trees and Christmasberry and koa haole shrubs are common on the bluffs and in the stream beds at Pukulena, Paumalu and Kaunala Streams. Near Kaunala gulch, Java plum trees become more common.

At the Kahuku Motorcross Gate the B-Alignment vegetation is very much like that already described, i.e., ironwoods, date palm, sisal, strawberry guava, koa haole, and guinea grass.

Ironwoods, scattered chinaberry, banyan, and date palm trees appear above the dense Christmasberry along this bluff into Oio Gulch (Figure 5). In Oio Gulch the stature of most of the vegetation is much reduced and most of the vegetation is summer decidious.

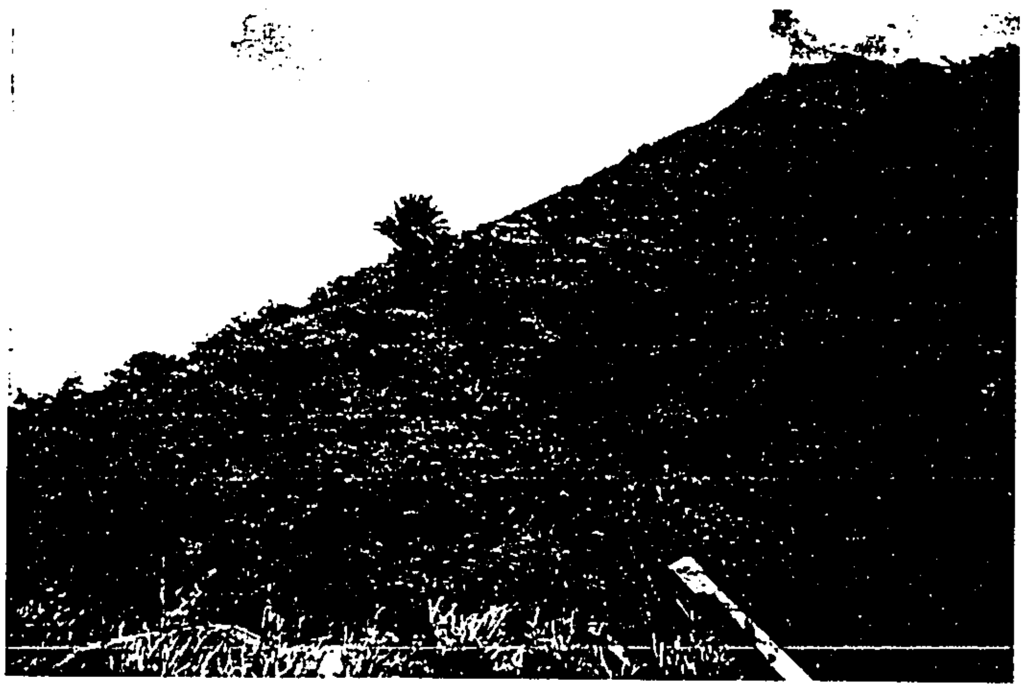


Figure 5. Bluff Vegetation Along the B-Alignment.

THE A-ALIGNMENT

The path of A-Alignment from the Waialua Substation to beyond Anahulu Stream has been described. From the Kuilima side of Wailua Bay to the old Meadow Gold Dairy site the A-Alignment (Kamehameha Highway) passes through an undeveloped area. On the mauka side of the road are kiawe, date palm, banyan, Norfolk Island pine (*Araucaria heterophylla* (Salisb.) Franco) and milo trees (*Thespesia populenea* (L.) Sol.). On the makai side of the road many of the same trees are found as well as poinciana (*Delonix regia* Bojer) Raf.), coconut trees (*Cocos nucifera* L.), Indian sourbush (*Pluchea indica* (L.) Less., sour bush (*Pluchea odorata* (L.) Cass), Christmasberry and koa haole.

From the old Meadow Gold Dairy site to Waimea Bay, most of the makai side of the highway has been developed. The mauka side is vegetated with very common landscape and feral trees, shrubs, and forbs. There are banyan, kiawe, chinaberry, palm, opiuma (*Pithecellobium dulce* (Roxb.) Benth.), and sea grape (*Coccoloba uvifera* (L.) trees scattered sparsely along the Alignment. The understory vegetation is mostly summer decidious koa haole, Castor bean, and Christmasberry. Occasionally there are bright orange or cerise Bouganvillea vines.

From Waimea Bay to Sunset Beach the pathway of A and B-Alignments has been described and from Sunset Beach to Waihee the Alignment is nearly all urbanized.

From Waihee to the Kuilima Substation road, much of the land is in agriculture, either vegetable fields or pasture lands. There are scattered ironwood, kiawe, be-still trees (*Thevetia peruviana* (Pers.) K. Schum.), coconut, banyan, and chinaberry trees along this alignment as well as lots of koa haole, Christmasberry and large stands of guinea grass.

The same general type of vegetation is found along the makai side of Kamehameha Highway, except where there are houses. Ironwood trees and Norfolk island pines, some mango, monkey pod and kiawe trees are common. From Kawela Bay to the Kuilima Substation road there is the Turtle Bay golf course.

ENDANGERED SPECIES

No State of Hawaii (DLNR Update 1991) or Fish and Wildlife Service (USFWS 50 CFR 17. 1991) proposed or listed threatened or endangered species were found during this study.

CONCLUSIONS

This study was not an in depth botanical survey. It was a general assessment of the vegetation found along these proposed powerline alignments. It is fair to say that if the E-Alignment is selected for the powerline a more detailed botanical survey should be carried out. The E-Alignment is the only corridor along which long stretches of native vegetation were found.

Both the D and C alignments pass through long stretches of undeveloped land, most of which is vegetated with ironwood or swamp mahogany trees which of themselves are of little value. However, they do attain considerable height and it would require some effort to keep the alignment open. In the Pupukea area, both of these alignments traverse urbanized areas.

The location and the vegetation along the the B-Alignment appears at first glance to present the fewest problems. Most of the vegetation is below the height limit and is relatively scant. There are no dwellings or roads on this alignment.

The vegetation of the A-Alignment or Kamehameha Highway alignment is of value to the homeowners along the way. Most of it consists of fairly common landscape type material and most of it is well below the height limit.

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APPENDIX C

ELECTROMAGNETIC EFFECTS STUDY

Summary of Technical Information

on

Electric and Magnetic Fields

for

Waialua - Kuilima 46 kV Subtransmission

Line Project

Prepared by

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February, 1993

Agency	COASTAL ZONE MANAGEMENT, OFFICE OF STATE PLANNING, STATE OF HAWAII
Permit	Coastal Zone Management (CZM) Program Federal Consistency
Reference	Section 307, National Coastal Zone Management Act of 1972, as amended (16 USC 1451, et seq.); Section 205A-3(3), Hawaii Revised Statutes; 15 CFR 930
Action Requiring Permit	Activities requiring a Federal license, permit, or permission that are likely to affect land or water uses in the Coastal Zone (defined as all land areas within the State except for State forest reserves). Such Federal permits include Corps of Engineers Section 404/Section 10 Permits.
Process	As part of the application to the Federal permitting agency and to the DBED (with a copy to the City/County Department of Land Utilization), applicant includes an assessment of the activity's impacts with respect to Hawaii's CZM objectives and a statement that the activity is consistent with the CZM program. Submission should be 90 days before a final decision is made by the permitting agency. Within 90 days after a review process, including public comment, DBED must approve consistency statement or prescribe conditions for consistency.

I. INTRODUCTION

Overhead power lines similar to the proposed Waialua-Kuilima subtransmission line have been used throughout the United States for many years. In recent years, concerns have been raised about possible health effects of the electric and magnetic fields associated with these lines. Many studies have been performed, sometimes with conflicting results. The studies are technically complex, and their relevance to projects like the Waialua-Kuilima subtransmission line is not always clear. Therefore, this report has been prepared to summarize and explain the current knowledge in this area.

The report is organized into the following major sections:

II. VOLTAGE CLASSIFICATIONS

Electric power lines are used to carry electricity from generating stations to homes, businesses, and other users. These power lines are classified as "transmission," "subtransmission," or "distribution" lines, depending on the voltage (or electrical "pressure") at which the line operates. Voltage usually is expressed in kilovolts, or thousand volts, and abbreviated kV. Lines with a voltage of 100 kV (100,000 volts) or higher usually are considered "transmission" lines. Lines with a voltage of less than 100 kV but more than 34.5 kV usually are considered "subtransmission" lines. Lines with a voltage of 34.5 kV or less usually are considered "distribution" lines.

The proposed Waialua-Kuilima line will operate at a voltage of 46 kV, which is one of the most common subtransmission voltages used in Hawaii. The highest transmission voltage used in Hawaii is 138 kV. Elsewhere in the United States, transmission lines are in use with voltages up to 765 kV.

Table 1 summarizes the circuit miles of transmission and subtransmission lines in service at different voltage classifications, as of 1990.

Table 1
Transmission and Subtransmission Line Circuit Miles in Service in the United States

Nominal Voltage (kV)	Thousands of Circuit Miles in Service
41 - 70	145
71 - 131	95
132 - 253	91
254 - 400	46
401 - 600	23
601 - 800	4
Total	469

Source: Edison Electric Institute[1]

III. PROJECT DESCRIPTION

The proposed project will entail the installation of a new single-circuit 46 kV subtransmission line between the Waialua and Kuilima substations (a distance of approximately 13.5 miles). Short portions of the line will be underground, but most of the line will be overhead. Two types of pole structures will be used for different parts of the line. In relatively flat areas (most of the proposed alignment) single pole structures approximately 65 feet in length (57 feet above the ground) will be used. Where the line must cross gulches or other rugged terrain, H-frame wooden pole structures will be used. The height of these structures will vary depending on the required span length. Both types of structures are shown in Figure 1. The single pole structures will be centered in a right-of-way (ROW) 25 feet wide, and the H-frame structures will be centered in a ROW 50 feet wide.

Conductors for the overhead portion of the line will be 556.6 KCM-AAC (kilo-circular mills - all aluminum conductor) cables. They will be mounted on the poles with horizontal post, line post, or suspension porcelain insulators.

Conductors for the underground portion of the line will be 1,500 KCM-AAC polyethylene-jacketed cables. There will be one cable per phase, with three phases for the underground circuit. Each cable will be installed in a 5-inch PVC conduit encased in concrete at the bottom of a 4.5-foot deep trench. Figure 2 shows a typical cross-section of the underground cable installation.

Both the overhead and underground portions of the new subtransmission line will be designed to comply with the State of Hawaii Public Utilities Commission General Order No. 6 and the National Electric Safety Code.

IV. ELECTRIC FIELDS

Definition and Description

Electric fields are caused by the potential or voltage on an object. An electric field exerts a force that repels or attracts electrical charges. Any object with an electric charge on it has a voltage (potential) at its surface, caused by the accumulation of more electrons on that surface as compared with another object or surface. The voltage effect is not limited to the surface of the object but exists in the space surrounding the object. The change in voltage over distance is known as the electric field. The units describing an electric field are volts per meter (V/m) or kilovolts per meter (kV/m). These units refer to the difference in electrical potential or voltage that exists between two points one meter apart. The electric field becomes stronger near a charged object and decreases with distance away from the object.

Electric fields are a common phenomenon. Static electric fields can result from friction generated when taking off a sweater or walking across a carpet. Body voltages have been measured as high as 16,000 volts due to walking on a carpet[2]. The earth creates a natural static field in fair weather of about 150 volts/meter (0.15 kV/m) at ground level because of the 300,000- to 400,000-volt potential difference between the ionosphere and the surface of the earth[3,4]. This means that a 6-foot tall person would have a static potential of about 275 volts across the top and bottom of their body.

The normal fair weather static electric field of the earth varies from month to month, reaching a maximum of about 20 percent above normal in January, when the earth is closest to the sun, and falling to about 20 percent below normal by July, when the earth is farthest from the sun. Much stronger static electric potentials can exist underneath clouds, where the electric potential with respect to earth can reach 10 to 100 million volts. Natural static electric fields under clouds and in dust storms can reach 3 to 10 kV/m[4,5].

Almost all household appliances and other devices that operate on electricity create electric fields. However, these fields differ from the earth's static or direct current (dc) field because they are caused by alternating current (ac), which reverses direction many times per second. The electric power used in the United States alternates back and forth 60 times each second; this is known as 60 hertz, or 60 Hz, power. In some other countries, the frequency of electric power is 50 Hz. In any case the electric field is caused by the voltage on the appliance, and the field decreases rapidly with distance from the device. The field caused by point-source (small-dimension) household appliances generally attenuates more rapidly with distance than do line-source fields such as power lines. Appliances need not be in operation to create an electric field; any appliance that is plugged into an electrical outlet produces an electric field. Typical values measured 1 foot away from some common appliances[6] are shown in Table 2.

Table 2 Typical Electric Field Strengths for Appliances at 12 Inches	
Appliance	Electric Field (kV/m)
Electric Blanket	0.25*
Broiler	0.13
Stereo	0.09
Refrigerator	0.06
Iron	0.06
Hand mixer	0.05
Phonograph	0.04
Coffee pot	0.03

* 1 to 10 kV/m next to blanket wires[7].

Field Calculation Methods

The electric and magnetic fields expected to result from operation of the proposed Waialua-Kuilima line, were calculated using computer software developed by the Electric Power Research Institute. A set of load currents, line design details, and phasing were supplied by Hawaiian Electric Company, Inc. (HECO) for the electric and magnetic field calculations. Based on the information provided by HECO, the loading was set at 113 amperes and the currents in each of the phases were assumed to be balanced for the calculations. Conditions differing from these assumptions could result in higher or lower field strengths. A system load flow study would be necessary to validate these general assumptions.

Calculated Subtransmission Line Electric Fields

The electric fields calculated for the proposed Waialua-Kuilima 46 kV subtransmission line single pole configuration are shown in Figure 3. The results are plotted as electric field strength (in kV/m) as a function of the lateral distance (in feet) left or right of the ROW centerline at 1 meter above the ground.

As can be seen in Figure 3, the maximum electric field strength for the single pole configuration is predicted to be approximately 0.42 kV/m and this is expected to occur 5 feet to the left of the ROW centerline (the side where the conductor will be suspended at a lower height on the pole). At the edges of the ROW (12.5 feet to either side of the centerline) the electric field strength is predicted to be approximately 0.32 kV/m on the left and 0.21 kV/m on the right.

The electric fields calculated for the H-frame pole configuration are shown in Figure 4. As can be seen, the maximum electric field strength is predicted to be approximately 0.86 kV/m, and this is expected to occur approximately 15 feet to either side of the centerline. At each edge of the ROW (25 feet to either side of the centerline) the electric field strength is predicted to be approximately 0.63 kV/m.

Because electric fields are "shielded" by concrete, soil, and other solid substances, there would be no appreciable electric field at the surface of the ground from the underground cable configuration.

V. MAGNETIC FIELDS

Definition and Description

An electric current flowing in a conductor (electric equipment, household appliance, or otherwise) creates a magnetic field. The unit most commonly used to express magnetic field intensity is the Gauss (G) or milliGauss (mG, one-thousandth of a Gauss), which is a measure of the magnetic flux density (the intensity of magnetic field attraction per unit of area). As a reference, the earth has a natural static direct current (dc) magnetic field of about 360 mG, near the Hawaiian Islands[9].

Transmission lines also have magnetic fields, but the characteristics are different from the earth's dc field because power line fields are caused by alternating currents (ac). The magnetic field under transmission lines is relatively low in comparison with measurements near many household appliances and other equipment. The magnetic field near an appliance decreases rapidly with distance away from the device. The magnetic field also decreases with distance away from line sources, such as power lines, but not as rapidly as it does with distance from appliances. Since a magnetic field is caused by the flow of an electric current, an appliance must be operating in order to create a magnetic field. The magnetic field of a larger number of typical household appliances was recently measured by the Illinois Institute of Technology Research Institute (IITRI) for the U.S. Navy[9] and by Enertech Consultants[10] for the Electric Power Research Institute (EPRI). Typical values are presented in Table 3 as numerical examples to understand magnetic field strengths.

Magnetic field measurements were made by Enertech Consultants[11] in February 1992 at several public locations in Waipahu and in January 1990 at several public locations on the Island of Hawaii to characterize everyday magnetic field levels. These measurements were made using an EMDEX II magnetic field meter (developed for EPRI by Enertech). This meter can be worn at the waist; the meter automatically records data every 1.5 seconds and stores the results for readout to a personal computer. The measurement results are summarized in Table 4. Magnetic field measurements were also taken under and near existing 46 kV and 12 kV lines in Ewa, Village Park, Waipahu, and Pearl City. The measurements ranged from 1 to 11 mG. Electric loads on the lines were low at the time of measurement. If the power lines had been fully loaded at the time of measurement, the magnetic field levels would have been higher.

Calculated Subtransmission Line Magnetic Fields

Magnetic fields calculated for the proposed Waialua-Kuilima 46 kV subtransmission line single pole configuration are shown in Figure 5. The results are plotted as field strength (in mG) vs. the lateral distance (in feet) left or right of the ROW centerline at 1 meter above the ground.

As can be seen in Figure 5, the maximum magnetic field strength is predicted to be approximately 12.6 mG, and this is expected to occur at the ROW centerline. At each edge of the ROW (approximately 12.5 feet to either side of the centerline) the magnetic field strength is predicted to be less than 8.5 mG.

The magnetic fields calculated for the H-frame pole configuration are shown in Figure 6. As can be seen, the maximum magnetic field strength is predicted to be approximately 43.1 mG, and this is expected to occur at the ROW centerline. At each edge of the ROW (25 feet to either side of the centerline) the magnetic field strength is predicted to be approximately 19.3 mG.

Magnetic field strengths for the underground cable configuration were calculated at 1 meter above the ground, as they were for the overhead configurations. The maximum magnetic field strength is predicted to be approximately 10.6 mG, and this is expected to occur at the ROW centerline. The magnetic field strength is predicted to drop to a maximum of 2.7 mG at 12.5 feet on either side of the centerline.

Table 3 Typical Magnetic Field Strengths From Household Appliances[10]		
	Magnetic Field (mG)	
Appliance	12" Away	Maximum
Electric range	3 to 30	100 to 1,200
Electric oven	2 to 5	10 to 50
Garbage disposal	10 to 20	850 to 1,250
Refrigerator	0.3 to 3	4 to 15
Clothes washer	2 to 30	10 to 400
Clothes dryer	1 to 3	3 to 80
Coffee maker	0.8 to 1	15 to 250
Toaster	0.6 to 8	70 to 150
Crock pot	0.8 to 1	15 to 80
Iron	1 to 3	90 to 300
Can opener	35 to 250	10,000 to 20,000
Mixer	6 to 100	500 to 7,000
Blender, popper, processor	6 to 20	250 to 1,050
Vacuum cleaner	20 to 200	2,000 to 8,000
Portable heater	1 to 40	100 to 1,100
Fans/blowers	0.4 to 40	20 to 300
Hair dryer	1 to 70	60 to 20,000
Electric shaver	1 to 100	150 to 15,000
Color TV	9 to 20	150 to 500
Fluorescent fixture	2 to 40	140 to 2,000
Fluorescent desk lamp	6 to 20	400 to 3,500
Circular saws	10 to 250	2,000 to 10,000
Electric drill	25 to 35	4,000 to 8,000

Table 4 Summary of Everyday Magnetic Field Levels at Selected Locations in Hawaii[11]	
Location	Magnetic Field (mG)
Waipahu	
Gem's Department Store	0.2 to 2.5
Gem's Jewelry	10 to 300
Gem's Parking Lot	0.5 to 2.0
Times Supermarket	0.5 to 14
"Skill Crane" Game	12 to 50
Tokyo Deli	0.5 to 8
Bakery	2 to 5
Driving on Farrington Highway	0.5 to 10
McDonald's Restaurant	0.5 to 15
Waipahu Sporting Goods	1 to 5
Arakawa's Department Store	0.5 to 5
Arakawa's Jewelry	4 to 120
Hilo	
McDonald's Restaurant	1 to 32
Post Office	0.5 to 34
State Building	0.2 to 12
Sure Save Supermarket	0.2 to 57
Ben Franklin Department Store	0.5 to 70
J. C. Penney Department Store	0.2 to 5
7-11 Convenience Store	0.5 to 8
Liberty House Department Store	0.3 to 3
Tilt-Video Arcade	1 to 40
Kay Bee Toy Store	0.5 to 28
Puna	
Pahoa Post Office	0.3 to 10
Dairy Queen Restaurant	0.5 to 12
DA Store -- Convenience Shop	0.5 to 5
Walking Past Stores on Highway No. 130	0.2 to 7

VI. HEALTH EFFECTS OF ELECTRIC AND MAGNETIC FIELDS

Overview

A number of studies in the 1960's and early 1970's generally found no clear evidence of any harmful effects from typical transmission line electric and magnetic fields. Some studies during this period did report the potential for harmful effects. Most of these studies focused on electric fields. However, more recent reports (since 1979) have suggested a possible association between occupational and residential exposure to magnetic fields and adverse health effects, including cancer. The evidence for such an association is still inconclusive, and studies are under way to obtain more definitive information on this subject. Although most of the research has been prompted by concern about the effects of extra high voltage transmission lines, some of the recent research results are of interest in assessing potential health concerns for 46 kV lines.

New York State Power Lines Project

One of the most comprehensive recent programs of research in the field was made up of sixteen studies and two follow-up projects conducted during the period from 1985 through 1987. These studies, administered by the New York State Power Lines Project[12], were undertaken "to determine whether there are health hazards associated with electric and magnetic fields produced by 60 Hz power transmission lines (especially 765 kV lines)." The $5 million research effort was funded by electric utilities that serve the State of New York and supervised by a scientific advisory panel reporting to the New York State Health Department. In general,the field levels used in the laboratory studies were larger than typical fields because of the 765 kV lines.

The studies fall into the broad areas of epidemiology, laboratory animal, and cellular research. None of the studies showed significant adverse effects on reproduction, growth, or development from the laboratory-created fields. The studies also showed no significant evidence of genetic or chromosomal damage that might lead to inherited effects or that might cause cancer. Two of the project's epidemiological studies, however, also examined the effects of lower voltage distribution lines. These two studies, of childhood cancer in Denver and adult cancer in Seattle, have generated much public interest and follow-up work.

The Denver Study

The Denver study evaluated the incidence of cancer among children living in homes near different kinds of electric power lines. Measurements were taken inside the home with appliances turned off (low-power condition) and turned on (high-power condition). Distribution "wiring configuration codes" were used as a surrogate for likely magnetic field exposures over time in the home due to external power lines. The wiring code is an index loosely based on the type, number, and diameter of conductors, the distance from house to power line, and the number of nearby service drops.

The New York Scientific Advisory Panel interpreted the Denver study to show an association between the household wiring codes and street addresses of the childhood cancer cases. The New York Panel reported that the study appeared to show an increase in the frequency of childhood cancer in Denver from about 1 in 10,000 children per year to about 1.7 in 10,000. However, the study results were puzzling in several respects. There appeared to be no correlation when high-power condition measurements were used (that is, with many electrical appliances turned on). No clear relationship between the level of exposure and the increased incidence of cancer could be discovered for the low-power conditions (appliances turned off) for which a correlation with childhood cancer was found. The New York Scientific Advisory Panel was also concerned about the study's low interview response rate and possible coincidental factors, such as traffic density, that could also affect the incidence of cancer. Nevertheless, this study was seen as a positive study (in that it confirmed the earlier work by Wertheimer and Leeper) and a reason to conduct more research.

The Seattle Study

The other epidemiological cancer study funded by the New York State Power Lines Project was conducted in the Seattle area. The design of this study shared many features with the Denver study; for example, exposure to magnetic fields was assessed by field measurements and by the same wire coding system. In the Seattle study, the New York Scientific Panel found that "regardless of how exposure was characterized, no relationship with cancer incidence was disclosed."[12] In other words, the results of this study were negative -- no association between cancer and magnetic field exposure (as estimated by the wire code system).

In evaluating the research results, the New York Scientific Advisory Panel cautioned that research has not found any biological mechanisms that could explain the role of magnetic fields in the development of cancer. The panel also noted that methodological uncertainties exist in quantifying magnetic field exposure levels. The panel concluded that the findings to date could not and should not be translated into specific recommendations for regulating right-of-way widths, line heights, or the location of lines near homes.

The Los Angeles Study

Another residential epidemiology study, funded by EPRI in an attempt to replicate the Denver Study, was completed in 1990 in Los Angeles, California. The results generally confirm the results of the Denver study (and the Wertheimer-Leeper work). There was an increased risk of cancer associated with certain wire codes, but not for direct field measurements.

Preliminary results of this study of childhood leukemia, conducted by Dr. John Peters in Los Angeles County, have been informally presented at conferences and were recently published.[13,14] This study was essentially a replication of the Denver study, but in a different location. The researchers concluded that: "our data offer no support for a relationship between measured electric field and leukemia risk, little support for the relationship between measured magnetic field exposure and leukemia risk, some support for a relationship between wiring configuration and leukemia risk, and considerable support for a relationship between children's electrical appliance use and leukemia risk." The reason why wiring configuration correlates with leukemia risk better than measured exposure is not clear.

It remains unresolved why an indirect magnetic field measure such as wire code is associated with a positive finding, while direct field measurements are not. This is even more perplexing because this Los Angeles study had the most sophisticated direct measurements of magnetic fields to date. Possible explanations for these apparently contradictory research findings are:

- Wire configuration coding is a better predictor of long-term average magnetic field exposure than 24-hour measurements.

- Wire code categories are a marker for some as-yet-unidentified biologically effective characteristics of the magnetic field (e.g., transient pulses or intermittent fields).

- Some wire configuration code categories are associated with some confounding factor or set of factors in the urban environment that are the true cause of the increased risk but that are unrelated to magnetic fields.

- Relatively subtle biases in subject selection (especially for the controls) have produced a spurious association between wire codes and leukemia risk in the Denver and Los Angeles studies.

EPA Preliminary Draft Report
(This report has been under review by the EPA Science Advisory Board. It will be rewritten and submitted for further scientific review before it is published again).

The U. S. Environmental Protection Agency prepared a preliminary draft report in 1990 on electric and magnetic fields that was based on a review of the scientific literature.[15] The preliminary draft report evaluated the likelihood that electric and magnetic fields pose a risk for the development of cancer in humans. In this preliminary draft report, the EPA concluded that "with our current understanding, we can identify 60 Hz magnetic fields from power lines and perhaps other sources in the home as a possible, but not proven, cause of cancer in people." One problem cited by the EPA is a poor understanding of the basic nature of the interaction between magnetic fields and biological processes. The EPA preliminary draft report states, "For example, a real possibility exists that exposure to higher field strengths is actually less hazardous than exposure to low field strengths. Because of this uncertainty, it is inappropriate to make generalizations about the carcinogenicity of EM fields."

More recently, the EPA has reviewed the research needs for electric and magnetic fields and published a report which identifies the major research topics and their relative priorities.[16] Exposure assessment research and research into possible biophysical mechanisms were listed as two "high-priority" areas of future study. Definitive exposure data will be required to judge the validity of the suggested causal link between magnetic field exposure and cancer. A better understanding of possible biophysical mechanisms is needed to quantify which, if any, aspect of magnetic field exposure might be related to adverse health outcomes.

EPA Science Advisory Board

On January 29, 1992, the Nonionizing Electric and Magnetic Fields Subcommittee of the Science Advisory Board's Radiation Advisory Committee submitted to the EPA Administrator its report on the EPA's draft report on electric and magnetic fields. In its report, the Science Advisory Board (SAB) Subcommittee concluded that "....there is insufficient information to designate specific values of magnetic-field strength that may be hazardous to human health." The SAB Subcommittee made two specific policy recommendations:

Policy Recommendation No. 1. The Subcommittee is unanimous in its belief that the question of electric and magnetic field effects on biological systems is important and exceptionally challenging, and that the Subcommittee's advice to the EPA should be that the reports should be rewritten by the EPA and then reviewed by the Science Advisory Board.

Policy Recommendation No. 2. The EPA should complete its efforts with regard to radio frequency (RF) electromagnetic fields (including microwaves) and issues exposure guidelines independent of present issues pertaining to lower frequencies. The current EPA report inadvertently leads even the careful reader to conclude that the potential carcinogenicity of electric and magnetic fields of extremely low-frequency (ELF) (i.e., power line) frequencies is the only -- or at least the principal -- subject of concern with regard to nonionizing fields. Such a conclusion would reinforce the skewed and somewhat sensationalized picture presented to the public in recent years by the news media and government agencies responding to this publicity. The report should therefore declare explicitly that the attention given to nonionizing electric and magnetic fields derives, in the first place, from longstanding concern over the hazards of RF (including microwave) radiation. The EPA has expended substantial resources on the study of such radiation over a period dating back to the EPA's inception and the EPA should complete its efforts directed toward the issuance of RF exposure guidelines. RF fields present long-known and well-understood hazards such as temperature elevation in tissue and heat stress resulting from acute exposures against which users and the general public must be warned and protected. Any published exposure guideline should specifically identify the hazards from RF exposure.

Office of Technology Assessment -- Background Paper

A fairly comprehensive background paper on the biological effects of electric and magnetic fields [17] was recently prepared for the U.S. Congress' Office of Technology Assessment (OTA). This extensive paper discusses the present state-of-knowledge on the health effects of extremely low-frequency (60 Hz) electric and magnetic fields. A small brochure[18] was also prepared that more concisely summarizes the OTA report and various policy opinions.

The OTA report provides a good overview of the sources and nature of electric and magnetic field exposure. It points out that we do not yet know what field attribute, or combination of attributes, if any, could produce public health effects. This means that the simple assumption that "more is worse" may not be true. Because of this, simple field strength standards "cannot be adequately supported by the science that is now available."

The OTA report also provides a summary of the basic areas for research: cellular experiments, whole animal experiments, exposure assessment, and epidemiological studies. Using the review of the scientific literature, the report states that:

> As recently as a few years ago, scientists were making categorical statements that on the basis of all available evidence there are no health risks from human exposure to power-frequency fields. In our view, the emerging evidence no longer allows one to categorically assert that there are no risks. But it does not provide a basis for asserting that there is a significant risk.
>
> If exposure to fields does turn out to pose a health risk, it is unlikely that high voltage transmission lines will be the only sources of concern. Power-frequency fields are also produced by distribution lines, wall wiring, appliances, and lighting fixtures. These non-transmission sources are much more common than transmission lines and could play a far greater role than transmission lines in any public health problem.

The OTA report and brochure also consider the public policy question of what should be done, given our present knowledge. Three basic approaches are suggested:[18]

- **Do nothing.** Conclude that there is not yet enough evidence to warrant any action.

- **Prudent avoidance.** Adopt strategies that can limit field exposures with small investments of money and effort. Don't do anything drastic or expensive until research provides a clearer picture of whether there is any risk at all.

- **Aggressive regulation.** Conclude that there is a problem and spend some serious time and money on an aggressive program limit field exposure, while recognizing that we may eventually learn that some or all of this effort and money has been wasted. This would be either because it wasn't needed or we spent it the wrong way because we did not understand the science well enough to spend it effectively.

Committee on Interagency Radiation Research and Policy Coordination (CIRRPC)

A federal interagency committee, the committee on Interagency Radiation Research and Policy Coordination (CIRRPC) released a review of the scientific literature in late 1992[19]. The report states that there is no convincing proof in the scientific literature that EMF is a health hazard. The report concludes that, compared to other health risks, EMF research does not deserve a funding priority. In spite of this conclusion, the U.S. Congress recently authorized a 5-year, $65 million research program on EMF health risks, to be sponsored by the Department of Energy[20]. The actual studies are to be administered by the National Institute of Environmental Health Sciences, as an independent, objective agency.

Connecticut Academy of Science and Engineering

In response to an inquiry by Connecticut Department of Health Services, the Connecticut Academy of Science and Engineering reviewed and evaluated the scientific literature regarding epidemiological and laboratory investigations of EMF effects. The Academy also considered information in the EPA draft report. The results of the Academy's review were published in April 1992.[21] Consideration was restricted to magnetic fields "because they are significantly more penetrating than electric fields and because they have been the focus of recent epidemiological and laboratory studies."

The scientists on the committee concluded that current scientific knowledge does not allow firm judgments about possible adverse health effects of magnetic fields on human health, including cancer. The literature neither supports or disputes the existence of adverse effects. They concluded that there are some known biological effects of EMF at or above levels that commonly occur, but that these effects are not health hazards (e.g., effects on cells and tissues of magnetic fields greater than 500 mG). No reproducible effects of weaker magnetic fields have been reported. They found no reports of mutagenic action by EMF at commonly occurring field strengths and only a few studies of effects similar to carcinogenic effects. The findings of epidemiological and laboratory studies have been very difficult to interpret, and very few attempts have been made to repeat and confirm any of the studies.

The Academy recommended that the state <u>not</u> adopt any guidelines or standards regarding EMF exposure. They also concluded that it would be inappropriate for public authorities to recommend "prudent avoidance."

California Energy Commission
The California Energy Commission (CEC) reviewed and published a summary of health effects studies in July of 1992[22]. The CEC concluded that significant health effects from EMF exposure cannot be established; that the scientific information available does not justify establishing health-based EMF limits; and that any significant modifications to existing lines would be premature. However, they could not dismiss the possibility of significant biological effects, and therefore recommended that California utilities conduct surveys of magnetic fields from existing transmission lines, identify line configurations with the lowest magnetic fields, promote public education on EMF, and site new transmission lines away from populated areas when fiscally reasonable. The CEC determined that the present electric field safety standard of 1.6 kV/m at the edge of the right-of-way should maintain future exposures within existing levels. Although magnetic fields are not limited, 230 kV lines permitted by the CEC have generally had magnetic field strengths of less than 100 mG at the edge of the right-of-way.

Wisconsin Public Service Commission
In May 1992, the Public Service Commission of Wisconsin (WPSC) issued an order on electromagnetic fields[23]. They concluded that electric fields do not pose a significant health risk to the general public. They further concluded that the state of scientific evidence is not sufficient to determine whether magnetic fields are a hazard to human health. They determined that considerably more evidence is needed before the scientific community can reach a consensus on the magnetic field issue. They concluded that current scientific knowledge did justify a continuing concern, however. The WPSC determined that a moratorium on new transmission lines was not a reasonable response and recommended that the National Electric Code Council evaluate methods to reduce magnetic fields, that transmission line route studies consider the number of people that could be exposed and estimate EMF levels, and that utilities use low EMF designs whenever cost, safety, and reliability factors make it reasonable.

The Swedish Studies

Two recent Swedish epidemiological studies have been widely reported in the popular press[24], although they are as yet unpublished in the scientific literature. The first, a residential study, reportedly shows a statistically significant relationship between estimated EMF exposure and childhood leukemia, and a weaker relationship to adult cancer. According to the scientists who conducted the study, the results show "more support for an association than against it." Although this study draws upon a better database then previous epidemiological studies, several criticisms have already been raised, including that cancer cases were found to be associated with estimated historical annual average magnetic field levels but not with measured current levels, and that the actual number of cancer cases was small (e.g., 39 cases of childhood leukemia out of 400,000 subjects)[25].

The second recent Swedish study, an occupational study, appears to confirm a link between worker exposure to magnetic fields and chronic lymphocytic leukemia. The study of 104 cases of this disease diagnosed in male workers showed an association with the worker's job description (and probable magnetic field exposure) in the last ten years.

Both studies reported that they have essentially confirmed earlier residential and occupational study findings, with some exceptions (for example, in the residential study there were no positive findings for brain tumors and in the occupational study the type of leukemia found was not the type most commonly reported in other studies). The most interesting features of these studies is the exposure assessment, which included contemporary measurements and historical field calculations for the residential study and job category personal exposure measurements for the occupational study. An important point in both studies is that average magnetic field values were used as the measure of exposure, and the positive results suggest that future studies should focus on this parameter.

Continuing Research

Almost all researchers are careful to point out that it is very difficult to identify health hazards that are subtle or evident only after long periods of time. The converse is also true: no experiment, no matter how well designed, can prove that no health hazards at all exist from any source studied. Studies that do suggest a health effect are usually repeated to verify the results. Because any one study can be fallible, a study needs to be replicated before any conclusions can be reached about health hazards.

Because of the difficulty of reaching any meaningful conclusions about health hazards from the current studies, most researchers (including the New York Scientific Advisory Panel and EPA) recommended carrying out additional research. Several areas, in particular, merit further research.

- So far, research has not been able to discover the biological mechanism by which electric or magnetic fields might cause adverse health effects. Additional basic laboratory research is needed to determine if physiological changes result from exposure to electric or magnetic fields, and how such changes might affect health.

- Another exposure assessment subject deserving further research is the effect of the fields typically experienced in homes -- fields caused by televisions, electric blankets, hair dryers, other appliances, and electric wiring in house walls. As noted earlier in this paper, although field strengths near some of the larger transmission lines may be larger than field strengths in homes, people can experience significant exposure to magnetic fields in homes. The Denver and Los Angeles studies found evidence of an association between the incidence of childhood cancer and the configuration of electric power line wiring (mostly distribution lines) outside the home. Further study will help clarify the relative risk, if any, from fields at home and near transmission or distribution lines.

VII. OTHER EFFECTS OF ELECTRIC AND MAGNETIC FIELDS

Electric and magnetic fields can have other effects that are well-established and clearly understood. These effects are discussed below under the general categories of corona related effects, electrostatic effects, and magnetic effects on cardiac pacemakers.

Corona Related Effects

Voltage gradients near the conductors of a transmission line can cause partial breakdown of the air around the conductors. This phenomena is called corona. The corona can be a source of radio noise, television interference, and audible noise. A principal objective of transmission line design is to minimize these disturbances to a generally acceptable level. The design of the proposed transmission line will ensure that corona generation is generally negligible, and that any corona effects are imperceptible to the great majority of people who cross below the line.

Transmission line corona activity is highest during rain or mist, and consequently this is when corona related effects are most pronounced. Since periods of heavy rain or mist occur only a small percentage of time and this is also when people are less likely to be in the right-of-way, the impact of these effects is naturally minimized. During fair weather the corona activity is substantially reduced.

Radio noise (RN) is an electromagnetic disturbance that may interfere with existing radio signals and prevent clear reception. Studies conducted by the Electric Power Research Institute (EPRI) have determined that transmission line generated RN has very little effect on FM radio reception. The main effect is on AM radio reception, and the effect is most noticeable during heavy rain. RN for the Waialua-Kuilima 46 kV subtransmission line was calculated and found to be negligible.

Television interference (TVI) is similar to radio noise, except that the frequency band is higher and the primary effect is on video signals, which are amplitude modulated, in contrast to audio signals which are frequency modulated. Even during worse-case conditions, the operation of the proposed line is not predicted to produce any noticeable TVI.

Audible noise (AN), although generated by high-field gradients similar to radio noise, produces pressure waves in the air that fall within the audible frequency range. The noise, a crackling sound or hum, is most noticeable when the ambient audible noise level is low.

The fair weather AN generated by the proposed line is predicted to be virtually undetectable directly under the conductors. Any noise that is generated by the line is not expected to cause any annoyance.

Electrostatic Effects

Near ground level, the electric field due to an energized line is substantially less than near the conductors where the corona is generated. Nevertheless, ground level electric fields theoretically could cause an electric shock.

A person under or near a transmission line could receive an electric shock due to the capacitive coupling effect of the electric field. The shock would be felt as a result of electric discharge either from an insulated object to a grounded person or from an insulated person to a grounded object.

The first type of electric shock could result from a grounded person touching an automobile or an insulated fence under or near a transmission line. The seriousness of the shock received would depend on both the magnitude and the duration of the discharge current that flows from the insulated object through the person's body. The National Electrical Safety Code (NESC) has established a 5 milliamperes maximum limit for the discharge current due to any vehicle or equipment anticipated to be on a transmission line right-of-way. The proposed line will be designed so that this limit is not exceeded even with the worst possible position of objects under the transmission line. Under normal circumstances, the discharge current levels that could be experienced by touching an insulated object in the subtransmission line right-of-way will be imperceptible.

The second type of electric shock is felt when a person wearing insulated shoes approaches a grounded object, such as an uninsulated fence. The capacity charge on the person will produce a spark from the part of the body approaching the grounded object. This spark discharge is similar to those often experienced in everyday life, for example, by people walking on carpets in very dry rooms and touching grounded objects.

Magnetic Effects on Cardiac Pacemakers

Certain types of cardiac pacemakers may be affected in their operation by electrical signals in the patient's body. Electric and magnetic fields under or near a transmission line are a source of such interfering signals, as are operating appliances and vehicles, and even skeletal muscle contractions within the patient's own body. It has been found that appropriate circuits can be incorporated in the pacemaker design to eliminate this problem, and, in fact, most pacemakers manufactured today are not affected by electrical interference. Users of pacemakers that are susceptible to electrical interference should be educated about all possible interference effects as part of their patient training. However, possible interference with pacemakers is not considered to be a significant problem with line voltages as low as 46 kV.

VIII. ELECTRIC AND MAGNETIC FIELD STANDARDS

General transmission line safety standards are imposed by the State of Hawaii Public Utilities Commission General Order No. 6 (Rules for Overhead Electric Line Construction) and the National Electrical Safety Code (NESC). The Waialua-Kuilima 46 kV Subtransmission Line will be designed to fully comply with these codes and standards. Currently these documents do not address the potential health effects of electric and magnetic fields.

The Hawaii State Department of Health issued on April 3, 1991, a policy relating to electromagnetic fields from electric power lines. The policy states:

> A prudent approach is needed at this time to regulate electric and magnetic fields around low-frequency electric power facilities, including high-voltage transmission lines. The existing research data are inconclusive and not sufficient enough for adequate, accurate risk assessment. However, the data suggest that a "prudent avoidance" approach to siting new facilities is appropriate. Where technically feasible and practical, public exposures should be minimized. Too little is presently known to be able to determine where or what rules would provide useful public-health protection.

Implementing actions:

(a) All newly-installed power lines should be constructed with engineering controls to reduce exposure (for example, the "delta" configuration).

(b) The Department of Health will continue to collect and evaluate research data on electromagnetic fields in order to be aware of significant findings with public-health implications.

Strategies consistent with the prudence-based approach have been used in routing and designing the proposed Waialua-Kuilima subtransmission line. Evaluating land use along the line route options and different engineering design options (such as unlike or low-reactance phasing) is consistent with application of the prudence-based approach to this project. The use of unlike phasing (placing opposite phases next to each other) can reduce field levels for the assumed magnitude and direction of current flow in each circuit.

There are no national or federal government standards in the United States for electric or magnetic field exposure. A few states have some type of electric field guideline and two states have a magnetic field standard. These standards are summarized in Table 5. The purpose of most of the standards is to ensure that field levels from new lines are similar to the field levels from existing lines or to avoid nuisance effects from the electric fields of the larger transmission lines. The predicted Waialua-Kuilima subtransmission line field values are far below any of the levels in this table.

Table 5 Summary of State Regulations Limiting Electrical and Magnetic Field Strengths from Transmission Lines[17,18]	
State	Maximum Field Limit
Montana	1 kV/m at edge of ROW in residential areas
Minnesota	8 kV/m maximum in ROW
New Jersey	3 kV/m at edge of ROW
New York	1.6 kV/m at edge of ROW; 200 mG at edge of ROW
North Dakota	9 kV/m maximum in ROW
Oregon	9 kV/m maximum in ROW
Florida	10 kV/m maximum for 500 kV lines in ROW; 2 kV/m for 500 kV lines at edge of ROW; 8 kV/m maximum for 230 kV and smaller lines in ROW; 3 kV/m maximum for 230 kV and smaller lines at edge of ROW; 200 mG for 500 kV lines at edge ROW; 250 mG for double-circuit 500 kV lines at edge of ROW; and 150 mG for 230 kV and smaller lines at edge of ROW

The International Non-Ionizing Radiation Committee of the International Radiation Protection Association has published "Interim Guidelines on Limits of Exposure to 50/60-Hz Electric and Magnetic Fields" in the January 1990 issue of *Health Physics*. The guidelines were approved by the council on May 3, 1989; those guidelines relating to the general public are summarized below:

General Public Exposure Characteristics	Maximum Electric Field Strength (kV/m)	Maximum Magnetic Flux Density (mG)
Up to 24 hours/day	5	1,000
Few hours/day	10	10,000

As with the state standards, the predicted Waialua-Kuilima subtransmission lines field values are far below the values cited above.

IX. Conclusions

Research to date has not demonstrated conclusive evidence of any health hazards due to the electric or magnetic fields from power lines similar to the Waialua-Kuilima 46 kV subtransmission line. Nevertheless, routing and line design steps to minimize public exposure to electric and magnetic fields have been considered in the proposed project. The proposed design will comply with HECo's policy on electric and magnetic fields, which represents prudent steps to minimize exposure, and will be consistent with the Hawaii State Department of Health's policy on electromagnetic fields. The proposed route alignment also will minimize exposure, because most parts of the alignment are distant from residences and other areas where people congregate.

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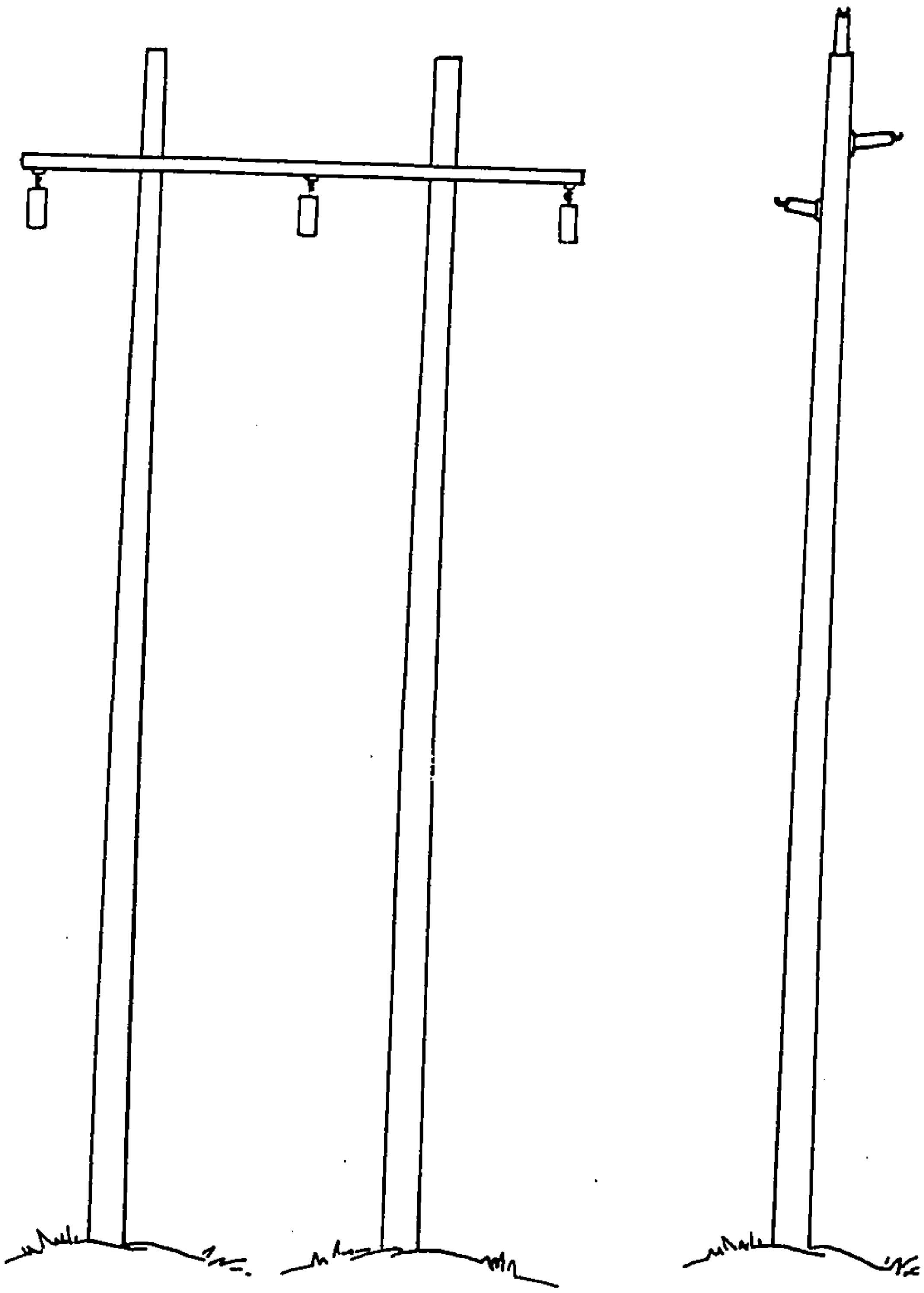
Figure 1

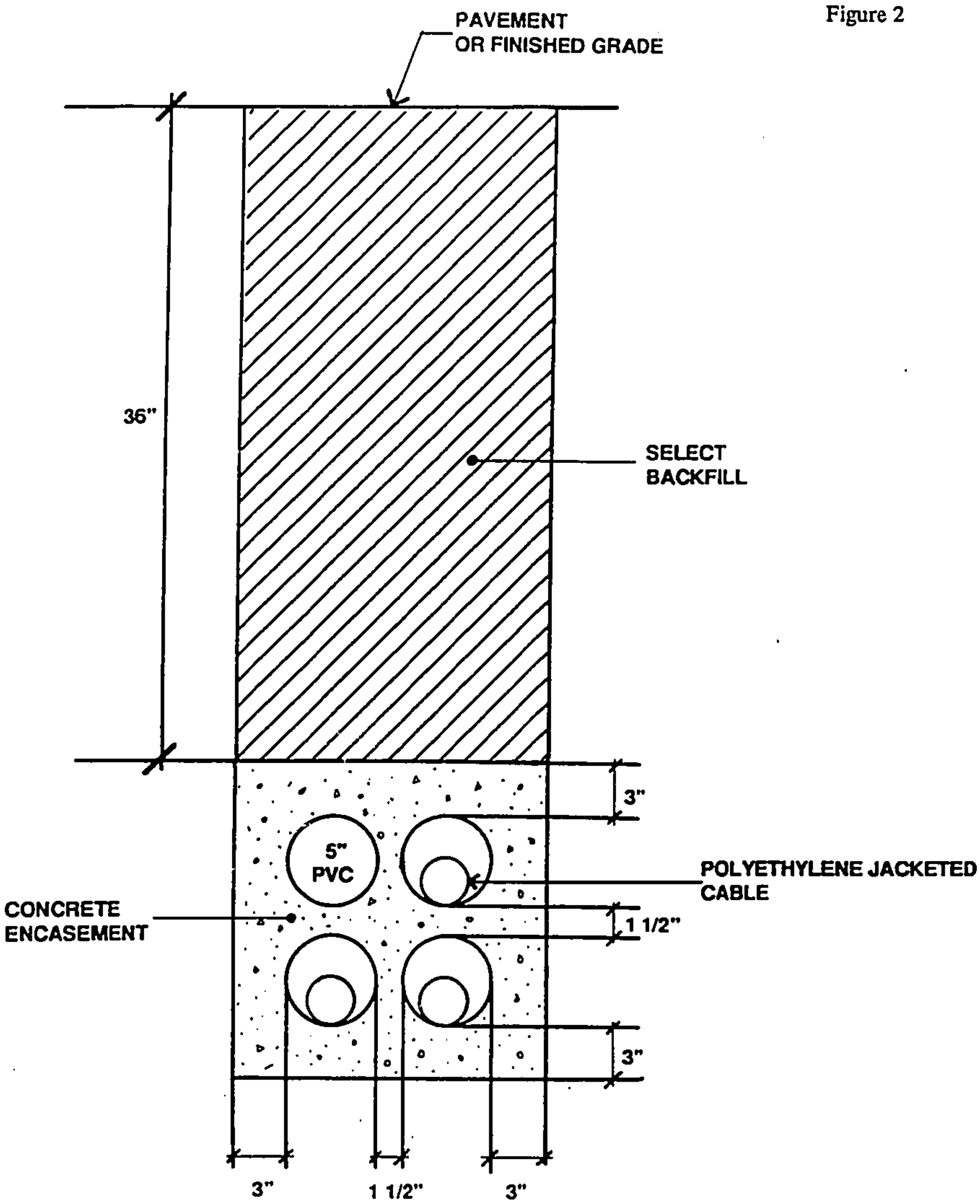


H-FRAME POLE
(Height Varies)

NEW SINGLE POLE
(Typical Height 57')

TYPICAL OVERHEAD LINE SUPPORT STRUCTURES
WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE
HAWAIIAN ELECTRIC COMPANY

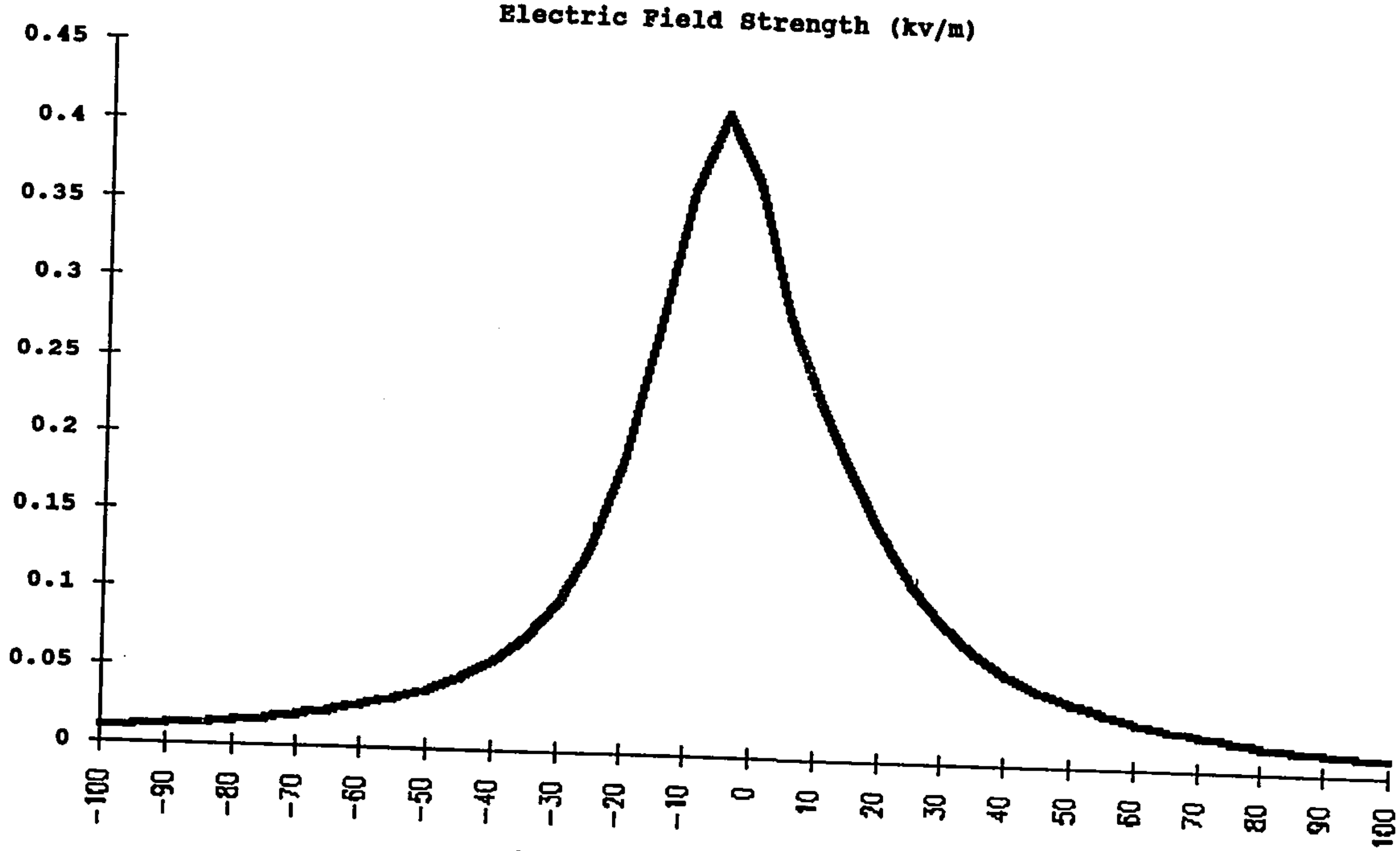
Figure 2



TYPICAL UNDERGROUND SECTION
WAIALUA-KUILIMA 46 KV SUBTRANSMISSION LINE
HAWAIIAN ELECTRIC COMPANY

Hawaiian Electric Company

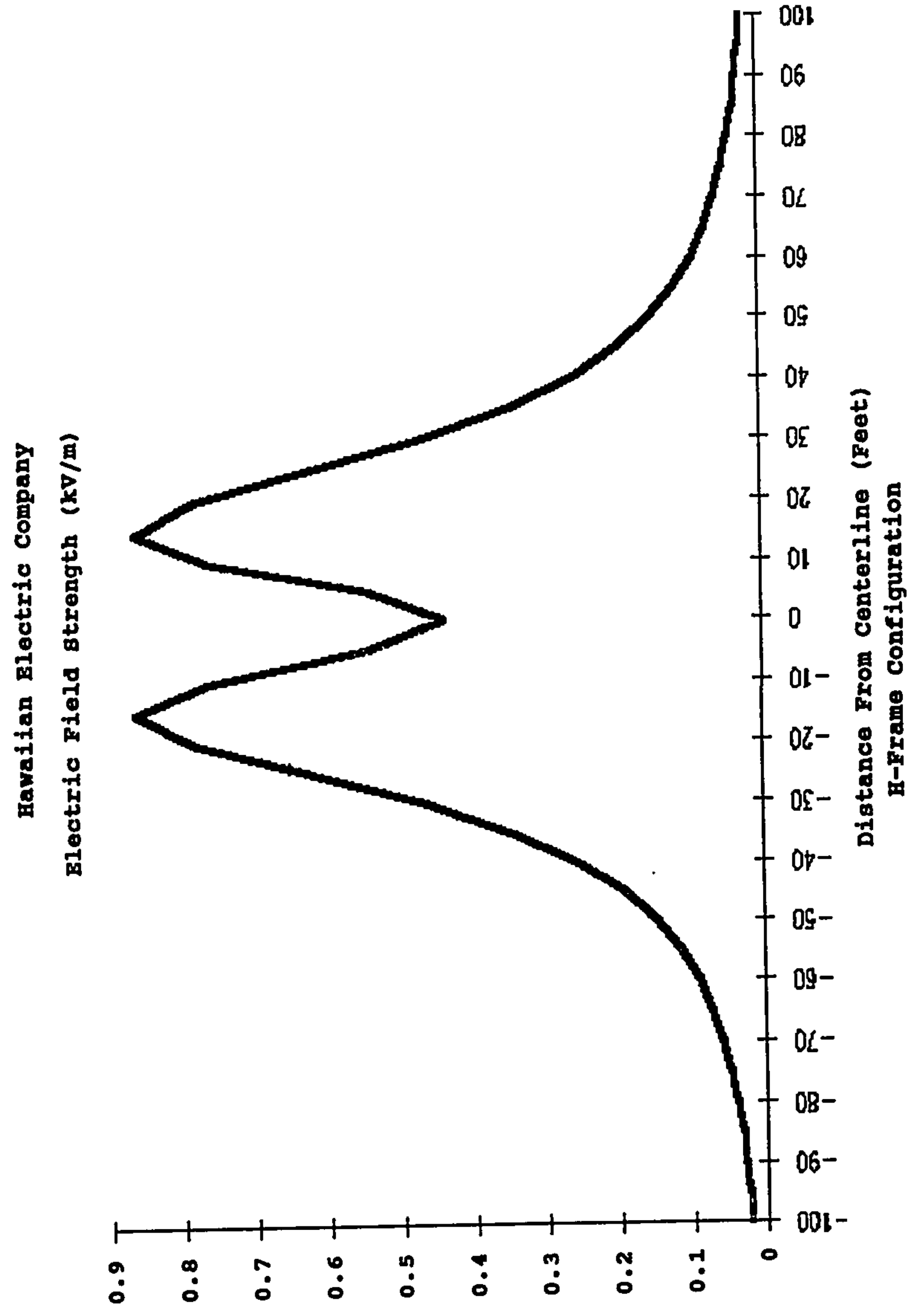
Electric Field Strength (kv/m)



Distance From Centerline (Feet)
Single Pole Configuration

Figure 3

Figure 4



Hawaiian Electric Company
Electric Field Strength (kV/m)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-100
-90
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20
30
40
50
60
70
80
90
100
Distance From Centerline (Feet)
H-Frame Configuration

Figure 5

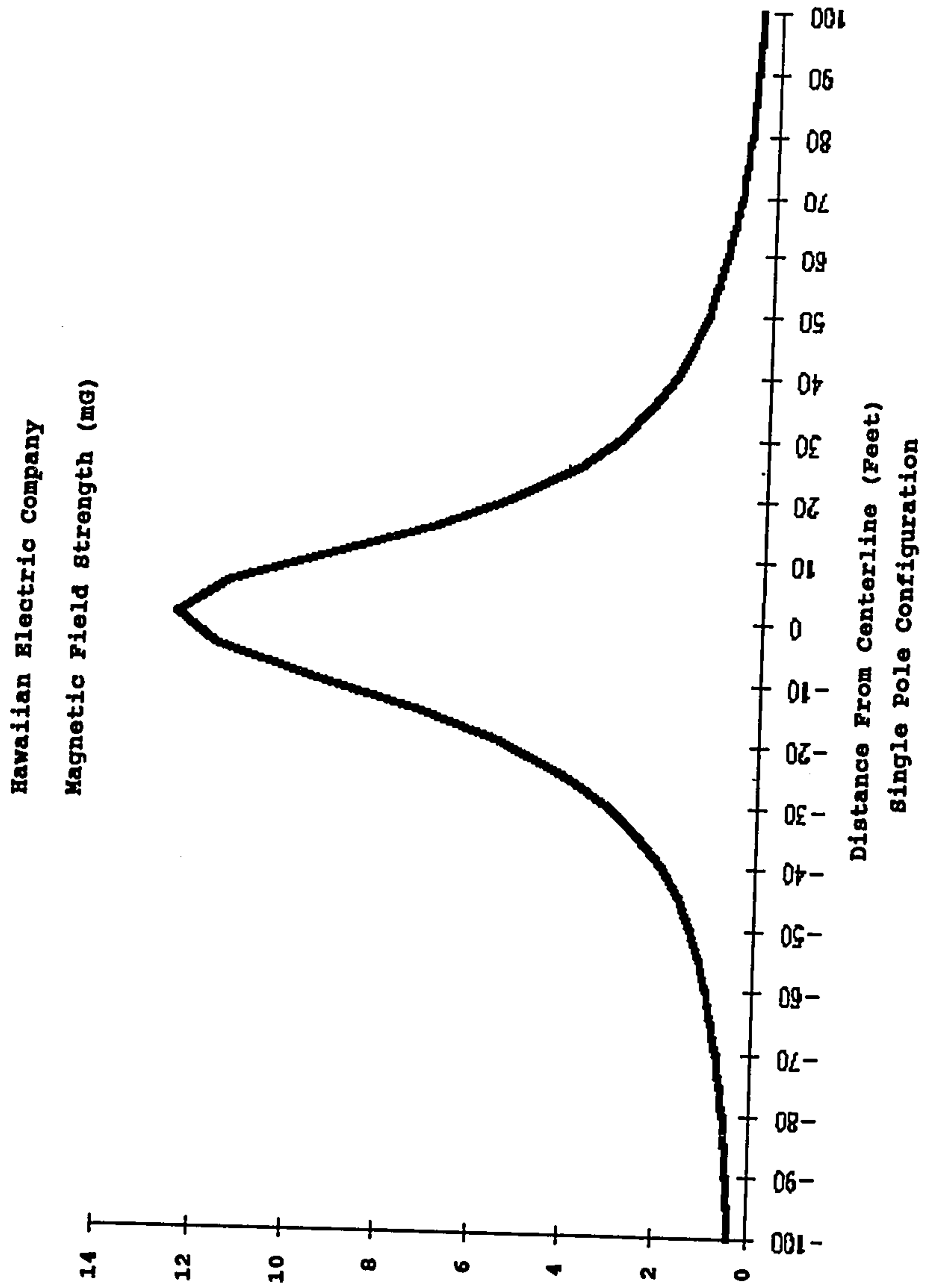
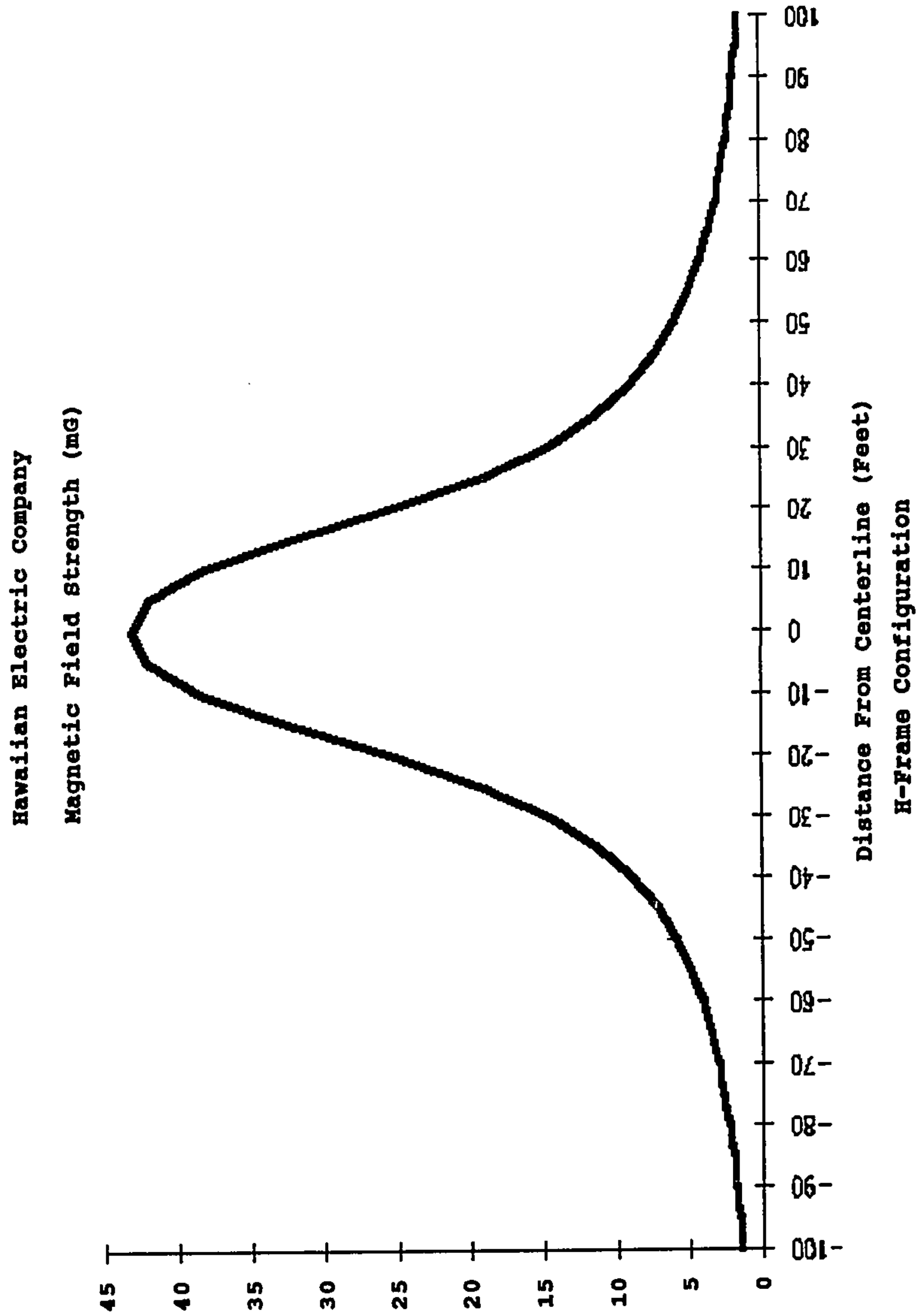

Hawaiian Electric Company
Magnetic Field Strength (mG)
14
12
10
8
6
4
2
0
-100
-90
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20
30
40
50
60
70
80
90
100
Distance From Centerline (Feet)
Single Pole Configuration

Figure 6



Hawaiian Electric Company
Magnetic Field Strength (mG)
Distance From Centerline (Feet)
H-Frame Configuration
0
5
10
15
20
25
30
35
40
45
-100
-90
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20
30
40
50
60
70
80
90
100

APPENDIX D

PERMITS DESCRIPTION

FEDERAL AGENCIES

Agency	CORPS OF ENGINEERS, U.S. DEPARTMENT OF THE ARMY
Permit	Section 10 Permit General Permit for Utility Crossings
Reference	Section 10 of the Rivers and Harbors Act of 1899, as amended (33 USC 403); 33 CFR 320-330
Action Requiring Permit	Applies to utility crossing of navigable waters of the United States, including coastal and tidal waters, rivers, and the mouths of major streams. Activities requiring the general permit include construction of wires, cables, or other structures over the waters, and pipes, cables, or tunnels under the water; dredging and excavation; and depositing fill and dredged materials.
Process	Permit request filed with the U.S. Army Corps of Engineers. At least 30 days prior to commencing the work, District Engineer must authorize the work by writing to the applicant. The District Engineer also coordinates the notification of the agencies of the proposed activities at least 20 days prior to the date that an activity will begin and consider their comments before authorizing the project. The agencies notified include both State and Federal entities. The permit is effective for 5 years from the date of issuance and may be considered for revalidation at that time.

STATE AGENCIES

Agency	DEPARTMENT OF HEALTH, STATE OF HAWAII
Permit	Section 401 Water Quality Certification
Reference	State of Hawaii Department of Health Environmental Permits Branch Section 401 Water Quality Certification Guideline
Action Requiring Permit	Any applicant for a Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may result in any discharge into the navigable waters, shall provide the licensing or permitting agency a certification from the State in which the discharge originates.
Process	Application is made to the Department of Health Environmental Permits Branch. Construction plans, any Federal Permit applications, and the Environmental Impact Statement are reviewed before approval.

Agency	DEPARTMENT OF HEALTH, STATE OF HAWAII
Permit	Variance From Community Noise Control Rules
Reference	Hawaii Revised Statutes, Chapter 342, Title 11, Administrative Rules, Department of Health, Chapter 43: Community Noise Control for Oahu
Action Requiring Permit	Use or operation of vehicles, construction equipment, power tools, sound amplifiers, and other devices that emit or may emit noise levels in excess of the limits specified int e regulations, or at times other than those allowed by the regulations.
Process	Application must be submitted at least 30 days before activity to begin. The application will be reviewed by the Director of the Department of Health. The following factors will be considered:

- Whether the proposed noise-emitting activity is in the public interest as defined by HRS §342-6.
- Whether the services or activities for which the permit is sought are temporary and cannot be delayed, postponed, or rescheduled to a time period in which such services are permitted.
- Whether the applicant has disclosed any possible impact from noises created by the proposed nighttime activity that may affect the immediate surroundings.
- Whether the applicant plans to notify the people in the surrounding area of planned nighttime activity.

A decision to grant or deny the permit will be made by the Director within 30 days. If the Director does not act on the application within 30 days, the permit is deemed granted. Each permit is valid for only a specific location, date(s), and time period.

Agency	DEPARTMENT OF LAND AND NATURAL RESOURCES
Permit	Conservation Use District Permit
Reference	Hawaii Revised Statutes, Chapter 2, Title 13, Administrative Rules, Department of Land and Natural Resources
Action Requiring Permit	Anyone proposing to make any use of lands within the Conservation District, as established by the State Land Use Commission, must apply.
Process	Applications are considered during Board meetings which are opened to the public. If the Board fails to act within 180 days after receipt of an application, the applicant may automatically put his land to the use or uses requested.

Agency	DEPARTMENT OF LAND AND NATURAL RESOURCES
Permit	Perpetual Easement for Use of State Lands
Reference	Chapter 171, Hawaii Revised Statues
Action Requiring Permit	A perpetual easement covering occupancy and use of state-owned property is required for occupancy and utilization of state-owned lands for all types of uses.
Process	Review and recommendation for approval or disapproval is made by the Division of Land Management. The Board of Land and Natural Resources approves the final application. Documentation is made by the Attorney General's Office and the Division of Land Management.

Agency	DEPARTMENT OF TRANSPORTATION, HIGHWAYS DIVISION, STATE OF HAWAII
Permit	Permit to Perform Work on a State Highway
Reference	Hawaii Revised Statutes Chapter 264; Department of Transportation Administrative Rules Chapter 105, Title 19
Action Requiring Permit	Any work within the State highway right-of-way (ROW).
Process	Permit issuance is contingent on approval by DOT of construction plans and adherence to all requirements of Chapter 264, Hawaii Revised Statutes.

Agency	COASTAL ZONE MANAGEMENT, OFFICE OF STATE PLANNING, STATE OF HAWAII
Permit	Coastal Zone Management (CZM) Program Federal Consistency
Reference	Section 307, National Coastal Zone Management Act of 1972, as amended (16 USC 1451, et seq.); Section 205A-3(3), Hawaii Revised Statutes; 15 CFR 930
Action Requiring Permit	Activities requiring a Federal license, permit, or permission that are likely to affect land or water uses in the Coastal Zone (defined as all land areas within the State except for State forest reserves). Such Federal permits include Corps of Engineers Section 404/Section 10 Permits.
Process	As part of the application to the Federal permitting agency and to the DBED (with a copy to the City/County Department of Land Utilization), applicant includes an assessment of the activity's impacts with respect to Hawaii's CZM objectives and a statement that the activity is consistent with the CZM program. Submission should be 90 days before a final decision is made by the permitting agency. Within 90 days after a review process, including public comment, DBED must approve consistency statement or prescribe conditions for consistency.

Agency	PUBLIC UTILITIES COMMISSION, STATE OF HAWAII
Permit	Approval for Construction in a Residential Area
Reference	Hawaii Revised Statutes, Chapter 269
Action Requiring Permit	PUC approval is required for construction of a utility line of 46 kV or greater in a residential area.
Process	PUC approval is required prior to any commitment for construction of the project. A public hearing is required and the PUC requires 3 months from time of application to approve the project. If a General Order No. 7 approval is also required (for capital expenditure costing more than $0.5 million), the two processes can be combined in a single application.

Agency	PUBLIC UTILITIES COMMISSION, STATE OF HAWAII
Permit	Public Utilities Commission (PUC) General Order No. 7 Approval
Reference	Hawaii Revised Statutes, Chapter 269; Public Utilities Commission, Standards for Electric Utility Service in the State of Hawaii, General Order No. 7, Section 2.3(g)(2).
Action Requiring Permit	Any capital expenditure related to plant expansion or modernization costing more than $500,000.
Process	Application must be made to PUC at least 60 days before the earlier of beginning construction or committing to the expenditure. A public hearing is required. If the PUC takes no action within 90 days, the utility may include the costs in its rate base. This application may be combined with the application for PUC approval for construction in a residential area.

CITY AND COUNTY OF HONOLULU AGENCIES

Agency	DEPARTMENT OF LAND UTILIZATION, CITY AND COUNTY OF HONOLULU
Permit	Flood Determination In General Flood Plain
Reference	Permits Register, Department of Land Utilization, City and County of Honolulu
Action Requiring Permit	All proposed developments within the General Flood Plain District are subject to review and approval by the Director of Land Utilization.
Process	The Director, with the recommendation of the Chief Engineer or other appropriate agencies, evaluates and determines whether the proposed project is located within a floodway or flood fringe area, and review related flood data such as flood elevation, riverine flood velocities, boundaries, etc.

Agency	DEPARTMENT OF LAND UTILIZATION, CITY AND COUNTY OF HONOLULU
Permit	Flood Hazard Variance
Reference	Permits Register, Department of Land Utilization, City and County of Honolulu
Action Requiring Permit	When a person wishes to vary from the requirements of Section 7.10 of the Land Use Ordinance.
Process	The application is referred to the Chief Engineer and Building Superintendent or other appropriate agencies for comments and recommendations.

A Flood Hazard Variance may be granted by the Director upon showing of:

- Good and sufficient cause and determination that failure to grant a variance would result in exceptional hardship to the applicant.
- That the variance will not result in adverse increase to flood elevations, additional threat to public safety, extraordinary public expense or conflict with other laws or regulations.
- A variance granted within a floodway district would not result in adverse increase of the regulatory flood elevation.

The Director may approve, approve with conditions, or deny the application.

Agency	DEPARTMENT OF LAND UTILIZATION, CITY AND COUNTY OF HONOLULU
Permit	Shoreline Setback Variance
Reference	Hawaii Revised Statutes, Chapter 205-31, Ordinance No. 4631(76), Ordinance No. 84-90
Action Requiring Permit	A variance is required for all proposed construction within the shoreline setback area (40 feet inland from the certified shoreline or 20 feet inland in certain circumstances). Harbor facilities generally do not have certified shorelines and are exempted form the shoreline setback requirements.
Process	The applicant is responsible for surveying the land to determine whether construction activities will take place within the shoreline setback area. The determination must then be certified by the State Land Surveyor. If project activities will take place within the setback area, a variance is required. This variance is usually combined with the SMA Use Permit (since the SMA includes the setback area). The DLU has the authority to act on shoreline setback variances only for projects exempt from the SMA Use Permit or those receiving an SMA "Minor Permit."

Agency	DEPARTMENT OF LAND UTILIZATION AND HONOLULU CITY COUNCIL, CITY AND COUNTY OF HONOLULU
Permit	Special Management Area Use Permit
Reference	Hawaii Revised Statutes, Chapter 205A, Revised Ordinance of Honolulu, Chapter 33, as amended.
Action Requiring Permit	Any development within the designated Special Management Area (SMA)
Process	Development costing less than $125,000 and having no significant environmental effects (as determined by DLU) can be issued a Minor Permit. Any project costing more than $125,000 requires an application for Special Management Area Use Permit, preceded by a Negative Declaration of environmental impact filed by the DLU with the Office of Environmental Quality Control or an EIS accepted by the DLU. After the application has been accepted, a public hearing is held between 21 and 60 days. The City Council must act on the application within 60 days after the hearing. Issuance of a Special Management Area use Permit must, by statute, precede any other permit approvals.

Agency	DEPARTMENT OF LAND UTILIZATION, CITY AND COUNTY OF HONOLULU
Permit	Special Districts, Special Design Permits
Reference	Permits Register, Department of Land Utilization, City and County of Honolulu
Action Requiring Permit	Districts are: The Hawaii Capital, Diamond Head, Punchbowl, Chinatown, Thomas Square, Waikiki, and Haleiwa. All development in any Special District are classified into one of three categories: major, minor or exempt. Major and minor projects require a Special Design Permit.
Process	A Special District Permit for a minor project must be issued by the department within 45 days after acceptance of the application. Upon acceptance of the application form for Major projects, appropriate agencies and neighborhood boards must submit comments and recommendations within 45 days of the request for comments to DLU. A public hearing, within the area, must be held no sooner than 45 days after the acceptance of the application. Within 30 days after the close of the public hearing, the Director must take action. Final action must be taken within 90 days from the date of application or 5 working days after action on the Special Management Area Use Permit.

Agency	DEPARTMENT OF PUBLIC WORKS, CITY AND COUNTY OF HONOLULU
Permit	Construction Dewatering Permit (Temporary)
Reference	Permits Register, Department of Land Utilization, City and County of Honolulu
Action Requiring Permit	Any person wishing to discharge waters resulting from construction operations onto public right-of way and/or into a storm drainage systems must obtain this permit.
Process	A special agreement form is required for construction dewatering discharge into the storm drainage system. The applicant must agree to the following:

- That the City would not be held liable for any suits or actions resulting from the operations.
- An adequate sump for desilting and discharge will constructed.
- That the temporary line will be removed, and the area restored upon completion of the dewatering operations.

Agency	DEPARTMENT OF PUBLIC WORK, CITY AND COUNTY OF HONOLULU
Permit	Grubbing, Grading, and Stockpiling Permit
Reference	Permits Register, Department of Land Utilization, City and County of Honolulu
Action Requiring Permit	A permit is required for grading, grubbing or stockpiling operations.
Process	After approval of the plan, three copies must be submitted to the Permit Section. At this point, a performance bond may be required in an amount equal to the cost of all work and services required to complete all of the work under the permit as approved by the Chief Engineer. This bond is required for all projects involving movement of more than 500 cubic yards of earth or for excavations or fills of over 15 feet in vertical height. The bond must be obtained from a surety firm operating in Hawaii. The permit will not be granted until all other environmental and regulatory requirements have been met.

Agency	DEPARTMENT OF TRANSPORTATION SERVICES CITY AND COUNTY OF HONOLULU
Permit	Street Usage Permit
Reference	Hawaii Revised Statutes, Chapter 286, City Ordinance No. 4650(76)
Action Requiring Permit	Any construction performed on City and County streets, highways, roads, lanes, paths, alleyways, and/or sidewalks; parking on City and County roads associated with construction; or street closure in association with construction.
Process	Application (accompanied by construction drawings) must be made to the Department at least 5 days before starting work. Permit is issued after review of traffic control plans. Applicant must notify other City services and utilities.

Agency	DEPARTMENT OF TRANSPORTATION SERVICES CITY AND COUNTY OF HONOLULU
Permit	Permit for Construction Within a County Road Right-of-Way
Reference	Article 1, Chapter 20, as amended, City and County of Honolulu Revised Ordinances
Action Requiring Permit	Any construction within the right-of-way of a County road. Also known as "trenching" or "excavation" permit.
Process	Application is made to the Department of Public Works. Construction plans are reviewed by the Department of Public Works, Department of Transportation Services, Board of Water Supply, and utility companies.

Agency	Building Department
Permit	Building Permit
References	Permits Register, Department of Land Utilization, City and County of Honolulu
Action Requiring Permit	Permits are required to erect, construct, enlarge, repair, move, improve, convert, alter, remove, or demolish any building or structure.
Process	The Building Department reviews the application and plans for compliance with the Land Use Ordinance, Building, Housing, Electrical, and Plumbing work. The application and plans are referred to a number of City and State agencies with jurisdiction over specific aspects of the proposed work to be done. Each of these agencies must sign the application form, indicating compliance with applicable laws. The Building Department issues the permit on the basis of this compliance.