1999 FEIS MAUI
ZOND-PACIFIC 20 MW WINDFARM PROJECT

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FINAL

KAHEAWA PASTURES 20 MW WINDFARM MAUI, HAWAII

ENVIRONMENTAL ASSESSMENT

ZOND PACIFIC
WAILUKU, HAWAII

PREPARED BY:

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Dear Participant:

Attached for your information is a Final Environmental Assessment (EA) which was prepared in accordance with the EA law (Hawaii Revised Statutes, Chapter 343) and the EA rules (Administrative Rules, Title 11, Chapter 200).

PROJECT TITLE: **Zond Pacific 20MW Windfarm Project**

LOCATION: ISLAND **Maui** DISTRICT **Ukumehame**

TAX MAP KEY NUMBERS: **4-8-01: par. 1**

AGENCY ACTION: ____ APPLICANT ACTION: __X__

ACCEPTING
AUTHORITY: **Department of Land and Natural Resources**
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Honolulu, Hawaii 96813

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If you no longer need this final EA, please return it to OEQC (**please do not recycle the document**). Thank you for your participation in the Environmental Assessment Process!

Final EA Cover Sheet -- January 27, 1999

PREFACE

This document is a Final Environmental Assessment (FEA) prepared to meet federal and state environmental requirements. An Environmental Assessment (EA) must be prepared in accordance with the requirements and standards established by the National Environmental Policy Act (NEPA) of 1964 when one or more circumstances occur, such as the use of federal lands for a proposed action (project). The State of Hawaii (SOH) established state requirements for EAs in compliance with NEPA in Chapter 343 of the Hawaii Revised Statutes (HRS), 1983. This statute was amended by Act 241, Session Laws of Hawaii, 1992. An is required in Hawaii whenever the use of state lands are proposed for a project. This is the case for the proposed action which is a 20 Megawatt (MW) Windfarm project to be sited in the Kaheawa Pastures, Ukumehame Conservation District.

A draft environmental assessment (DEA) was prepared in compliance with both NEPA and the SOH Chapter 343 by the project applicant, Zond-Pacific (ZPAC), a wind developer based in Wailuku, Hawaii. The DEA for the proposed project was submitted to the State of Hawaii (SOH) Department of Land and Natural Resources (DLNR) in April 1998. The DEA was subsequently submitted to the Office of Environmental Quality Control (OEQC) for public review in June. Comments were received from twenty-one (20) organizations and individuals, including DLNR. The DEA has been revised incorporating the review comments and related discussions with organizations and individuals, resulting in this document -- the Final Environmental Assessment (FEA).

The proposed action succeeds a related ZPAC action in the study area. Specifically, ZPAC was granted a Conservation District Use Permit (CDUP) by the Department of Land and Natural Resources (DLNR) in 1995 to perform a wind resource evaluation in the study area. In conjunction with its application for the CDUP, ZPAC prepared an Environmental Assessment entitled *Temporary Installation, Periodic Maintenance and Collection of Data from Wind Resource Monitoring Stations at Kaheawa/Ukumehame, Maui (DLNR File No. 2478).* Potential impacts were identified by several reviewers. Mitigation measures were identified and agreed upon with DLNR prior to approval of the CDUP. The wind resource measurements have since indicated that there is a sufficient resource in the study area to warrant a feasibility analysis of the project potential. ZPAC has initiated an application for a CDUP for use of the study area for a commercial windfarm.

This FEA is an informational document for decision-makers and citizens regarding the Zond-Pacific (ZPAC) proposed 20 MW windfarm on the Kaheawa Pastures, Ukumehame ahupua'a, West Maui, Hawaii. Information regarding the proposed action and its potential impacts on the natural, social and economic environments of Maui is described and discussed herein. Potential alternatives to the proposed action were investigated and are discussed, including a *no action* alternative.

This FEA is one element of the public/governmental involvement and review process, which will lead to an overall environmental decision-making process on the proposed action. The intent of the public/governmental involvement process, which can include coordination with technical specialists, meetings and hearings, is to establish and facilitate a flow of information between the project applicant (ZPAC), the citizens of the community and agencies of the federal, state and local governments. This process draws on the expertise and experience of all process participants to develop and analyze alternatives. Thereby, all participants can and are encouraged to assist in the review of this document and use it as decision-making tool.

This one-volume, final EA contains the following:

- A Table of Contents and a list of tables, figures, and acronyms used in this document,
- An Introduction and Summary (Section 1) to provide an overview of the document and to serve as an alternative for those who do not need to read the entire document,
- A Project Description (Section 2), including discussion of its purpose and the needs the project proposes to address, and the anticipated benefits to Maui,
- A discussion of alternatives considered to the proposed project (Section 2.3.2), including alternate windfarm sites evaluated and a *no action* alternative. Rationale for eliminating these alternatives from further consideration is provided,
- A description of the current natural, social and economic environments in the study area that could be affected by the proposed action (Section 3). Since the study area is remote, the description of the current social and economic environments includes the broader regional and island contexts.
- A discussion of environmental consequences, including potential beneficial and adverse natural, social and economic impacts, associated with the proposed action. (Section 3). Measures are discussed for mitigating or reducing the potential impacts.
- An assessment of how the proposed action relates to land use plans, policies and controls (Section 4),
- A discussion of topical issues, including unresolved issues (Section 5),
- A description of the public and agency organizations and individuals that were consulted during the preparation of this final EA (Section 6),
- A listing of references to this final EA (Section 7), and
- A Zond Systems Brochure, Enron Wind Corporation Written Hazard Communication Program, and three reports in the Appendix (Section 8). The Zond Systems Brochure includes information on the Zond Systems Z-750 kW Series wind turbines.

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Acronyms and Nomenclature

Acronym	Definition
AWEA	American Wind Energy Association
BLNR	Board of Land and Natural Resources
dB	decibels, a logarithmic ratio between pressures caused by a given sound and a standard sound pressure
dBA	decibel measurement using an "A-weighted" scale that takes into account the way humans perceive sounds
CDUA	Conservation District Use Application
CDUP	Conservation District Use Permit
DBED	Department of Business, Economic Development, Honolulu, HI
DBEDT	Department of Business, Economic Development and Tourism, Honolulu, HI
DOH	Department of Health
DLNR	Department of Land and Natural Resources, Honolulu, HI
EPRI	Electric Power Research Institute, Palo Alto, CA
EWC	Enron Wind Corporation, Tehachapi, CA
FAA	Federal Aviation Administration, US Department of Transportation
FEMA	Federal Emergency Management Agency
HRS	Hawaii Revised Statutes
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers, Washington, DC
IRPA	International Radiation Protection Association
NREL	National Renewable Energy Laboratory
OCEA	Office of Conservation and Environmental Affairs
SCS	Soils Conservation Service, Honolulu, HI
SOH	State of Hawaii
SMA	Special Management Area
SHPD	State Historic Preservation Division
USDOE	United States Department of Energy, Washington, DC
USDOT	United States Department of Transportation, Washington, DC
USLA	Use of State Lands Approval (DLNR)

1. INTRODUCTION AND SUMMARY

1.1. Background

1.1.1. Purpose of the Document

Zond-Pacific (ZPAC), a division of Enron Wind Corporation, Tehachapi, California, proposes to construct and operate a 20 MW windfarm on the Kaheawa Pastures, Ukumehame ahupua'a, West Maui. Since the proposed site is on State Conservation District lands, ZPAC has applied for a Conservation District Use Permit (CDUP) and seeks a Use of State Lands Approval (USLA) from the Department of Land and Natural Resources (DLNR). ZPAC has forwarded this Final Environmental Assessment (FEA) in support of its application.

This FEA was prepared by WSB-Hawaii, an independent consultant in Kaneohe, Hawaii, for ZPAC in accordance with:

- National Environmental Protection Act (NEPA);
- Chapter 343, Hawaii Revised Statutes (HRS);
- Act 241, Session Laws of Hawaii, 1992;
- Chapter 200, Title 11, Department of Health (DOH); and
- Chapter 5, Title 13, DLNR Administrative Rules.

The proposed windfarm project is consistent with guidelines of Chapter 344, HRS and the permitted public purpose uses of Conservation land as specified in Chapter 5, Title 13, DLNR Administrative Rules. DLNR is the accepting agency for this FEA. Cooperating agencies include the US Departments of Interior and Transportation, SOH Departments of Business, Economic Development and Tourism (DBEDT) and Health (DOH), and the County of Maui.

1.1.2 Proposed Action

ZPAC proposes to construct and operate a 20 MW windfarm on Kaheawa Pastures, Ukumehame ahupua'a, Maui. The windfarm would supply wind-generated electricity to Maui Electric Company Ltd. (MECO). The proposed site is located on a gently sloping portion of the Kaheawa Pastures between the Manawainui and Papalua Gulches approximately four miles mauka of McGregor Point. This site is contiguous to portions of the MECO transmission lines. Entry to the site is currently via an existing 4-wheel drive, jeep road network that connects with the Honoapiilani Highway (State Highway 30).

The proposed windfarm would consist of a single articulated row of twenty-seven (27) Zond Z-48 wind turbines installed on 50m (164ft) lattice towers. The windfarm elevation would extend from 2,000ft (610m)[1] on the lower end to about 3,200ft (976m) on the upper end. Each Z-48 wind turbine has an electrical output of 750 kilowatts (kW) bringing the total windfarm output to 20.25 megawatts (MW). The Z-48 has three fiberglass blades and a rotor diameter of 48m (157ft).

Site construction would include a foundation and tower for each wind turbine, one operation and maintenance building, an underground electrical distribution network and a substation for interconnection to MECO's transmission system and improving the access and site road networks.

[1] All elevations are above sea level, unless otherwise noted.

1.1.3 Evaluation of Alternatives

During the initial development phase of this project, ZPAC identified and evaluated several alternative sites. ZPAC first discussed the concept of a 10 MW windfarm near Kapalua airport on West Maui with MECO and Maui Pineapple and Pine in 1987. Two years of wind measurements confirmed the viability of a good wind resource. However, the project was not economically viable at 10 MW. Since the landowner was not interested in providing additional land sufficient for 20 MW, ZPAC began a search for alternate sites in 1992.

ZPAC sought to find alternative sites with good exposure to the prevailing tradewinds and close to MECO's transmission system. Potential sites included locations in the central valley, along the north shore, and the highland areas of the Ukumehame ahupua'a. The Kaheawa Pastures was selected as a candidate site in 1994 due its good exposure to the tradewinds and close proximity to MECO's transmission system. In addition, ZPAC felt that the site's remote location would help mitigate potential concerns regarding noise and visual impact.

ZPAC applied to DLNR for site access to install wind monitoring equipment in 1995. ZPAC prepared an EA in support of the site access application. The EA was accepted after revisions and the application was approved. Wind measurements, initiated in 1996, have confirmed an excellent wind resource. ZPAC has initiated negotiations with MECO for a power purchase agreement to sell the wind-generated electricity. Other key project implementation milestones are to obtain approval of this FEA, a Conservation District User Permit (CDUP) and a 25-year "Term Easement" or "Lease" from DLNR.

A *no action* alternative was considered. A *no action* alternative would mean that ZPAC would *not* seek to develop a windfarm on Maui, since other potential windfarms sites have been eliminated from consideration as discussed above. WSB-Hawaii evaluated the *no action* alternative as follows. First, the purpose of the proposed action is to develop a windfarm in an environmentally-sound manner to help meet energy needs as discussed below. Second, Maui Electric Company Ltd. (MECO) has indicated their willingness to purchase the electricity from the proposed windfarm, subject to the negotiation of the power purchase agreement. Third, none of the public and private sector representatives contacted to date by ZPAC have suggested that the project should not done. Finally, a *no action* alternative would mean that Maui would forgo a project that WSB-Hawaii believes would provide overall positive benefits as discussed in the next section. Therefore, WSB-Hawaii has recommended to ZPAC against a *no action* alternative.

1.1.4 Project Purpose, Needs and Benefits

The purpose of the proposed project is to develop a windfarm in an environmentally-sound manner on Maui and to sell renewable electricity to MECO. The needs of the proposed project (action) are to provide 20 megawatts (MW) of wind-generated electricity towards the growing electrical energy demand of Maui, to support the State's policy to reduce Hawaii's dependence on imported energy sources, and to help protect the State's environment. It is anticipated that MECO, DLNR, the citizens of Maui and the State, and ZPAC would all benefit as follows:

- *MECO would benefit by purchasing electricity at their avoided cost, reducing their use of fossil fuels, showing their support for renewable energy sources and diversifying their electrical power purchase portfolio;*
- *DLNR would benefit through collection of a land use fee.* This fee could be used to off-set a portion of the funds that have been spent by the State to develop renewable energy alternatives such as wind;

- *The citizens of Maui and the State would benefit from the energy, economic and environmental characteristics of the project:*
  - ◊ Energy - The windfarm would help diversify the energy resource base on Maui and *reduce* the amount of imported fossil fuels (estimated at the equivalent of 102,000 barrels of oil per year). *Avoidance of fossil fuels would help reduce energy security and price risks and would make Maui less dependent on oil and coal;*
  - ◊ Economic – There would be *direct* economic activity during construction and operation (temporary and permanent jobs, equipment, materials and supplies), and the project-related income and excise tax revenues over the project's lifetime. The primary *indirect* economic activity is stimulated by the reduction of the dollars that are paid for imported fossil fuels, i.e., those dollars recirculate on Maui and in Hawaii. In addition, a wind power purchase contract would specify the value (in cents/kWh) to be paid over contract lifetime. The price for the windpower is thus known and independent of the price of fossil fuels. Therefore, the ratepayers would benefit by saving the incremental cost of fossil fuels with respect to the cost of windpower; and
  - ◊ Environmental - Similarly, environmental benefits accrue from the reduction of fossil fuel use, i.e., fossil emissions would be reduced. There could be additional benefits to the environment through implementation of native plant and Nene propagation programs, as proposed by ZPAC; and
- ZPAC would benefit by the opportunity to recover its investment in the wind project and make a fair profit over the projected 30 year lifetime of the windfarm.

1.2 Summary of Potential Environmental Consequences and Mitigation Measures

The evaluation of the potential impacts, a discussion of the SOH significance criteria and the proposed mitigation measures are summarized in this section. See Section 3.0 for the detailed discussion. WSB-HAWAII notes that MECO performed an EIS in 1994 for a third 69KV transmission line from Maalaea to Lahaina. Portions of that EIS are relevant as background information for this study and are referenced herein.

1.2.1 Types of Impacts and Levels of Significance

WSB-HAWAII has identified and summarized the potential consequences (impacts) by category. The significance of the impacts was evaluated using guidelines established in Section 12, Chapter 200, Title 11, State of Hawaii (SOH) Department of Health, Administrative Rules as authorized by Chapter 343, HRS.

The significance of the impacts was evaluated in terms of context, duration and severity. *Context* refers to the setting of the action and how the significance of a specific impact may vary with the setting. For example, the significance of some impacts may be localized, i.e., impacting a local area, but not the whole island of Maui. *Duration* refers to the time period of the impact and its consequences. For example, some impacts may be short-term or temporary, such as potential impacts that would occur during the construction phase, while others may be longer-term or permanent, such as during the operational lifetime of the windfarm. *Severity* refers to the level of potential consequence (positive or negative) resulting from an impact.

An example of a positive (or beneficial) consequence would be modification of an existing road to reduce soil erosion. An example of a negative consequence would be physical injury, damage or casualty to a plant or an animal. A more severe negative consequence could occur if the plant or animal were an endangered specie. Given the above criteria, WSB-HAWAII has evaluated the severity of each potential impact to be in one of the following five levels:

- **Beneficial** -- the impact provides a positive effect on the environment;
- **None** -- there is no perceptible consequence (positive or negative);
- **Negligible** -- there is a negative impact, but the consequence is negligible;
- **Non-Significant** -- there is a non-negligible, negative impact, but the consequence of the impact does not meet defined standards of significance; and
- **Significant** -- there is a negative consequence that meets the standard of significance defined for the specific resource or environmental element.

1.2.2 Summary of the Potential Environmental Impacts

Overall, the project would not negatively impact the environment. This is due, in part, to the following four factors: (1) windfarms generally have less environmental consequences than conventional generation facilities, (2) ZPAC's goal is to minimize all potential negative environmental impacts, (3) ZPAC has already implemented mitigation measures in the design and layout of the windfarm, and (4) ZPAC has proposed a comprehensive mitigation measures program (See Section 1.2.3 for a summary of this program).

The environmental impacts are summarized in Table 1.2.2-1, including WSB-HAWAII's evaluation of the context, duration and severity of each potential impact. The summary includes an evaluation of the impacts before and after proposed mitigation measures. Only one potentially significant impact has been identified: avifauna may be impacted by the proposed 20 MW windfarm.

Table 1.2.2-1
Summary of Potential Environmental Consequences and Impacts

	Without Mitigation Measures			Following Mitigation Measures			
Factor	**Context**	**Duration**	**Severity**	**Mitigation Measures**	**Context**	**Duration**	**Severity**
Land Use							
Conservation	Local	Short-term	Significant	Coordinate land use planning with DLNR	Local	Short-term	Non Sig.
	Local	Long-term	Significant	Coordinate O&M procedures with DLNR	Local	Long-term	Non Sig.
MECO lines	Local	Short-term	Negligible	Coordinate route design and installation	Local	Short-term	Beneficial
	Local	Long-term	Negligible	Define/coordinate detail site O&M procedures	Local	Long-term	Beneficial
Grazing/ Hunting	Local	Long-term	Negligible	Define/coordinate detail site O&M procedures	Local	Long-term	Negligible
Topography							
Proposed Site	Local	Short-term	None	None Required	n. a.	n. a.	n. a.
		Long-term	None	None Required	n. a.	n. a.	n. a.
Site Access	Local	Short-term	None	None Required	n. a.	n. a.	n. a.
		Long-term	None	None Required	n. a.	n. a.	n. a.
Geology							
Proposed Site	Local	Short-term	None	None Required	n. a.	n. a.	n. a.
		Long-term	None	None Required	n. a.	n. a.	n. a.
Site Access	Local	Short-term	None	None Required	n. a.	n. a.	n. a.
		Long-term	None	None Required	n. a.	n. a.	n. a.
Soils							
Proposed Site	Local	Short-term	Not Sig.	Minimize grading/ replace grass/water	Local	Short-term	Negligible
	Local	Long-term	Not Sig.	Repair new damage/ replace grass/water	Local	Long-term	Negligible
Site Access	Local	Short-term	Not Sig.	Minimize grading/ repair damage/water	Local	Short-term	Negligible
	Local	Long-term	Not Sig.	Grade periodically/ repair damage/water	Local	Long-term	Negligible

***Note: Table 1.2.2-1 and Table 3.1-2 are identical**

Table 1.2.2-1
Summary of Potential Environmental Consequences and Impacts
(Continued)

	Without Mitigation Measures			Following Mitigation Measures			
Factor	**Context**	**Duration**	**Severity**	**Mitigation Measures**	**Context**	**Duration**	**Severity**
Hydrology and Water Resource	Local	Short-term	None	None Required	n. a.	n. a.	n. a.
	Local	Long-term	None	None Required	n. a.	n. a.	n. a.
Terrestrial Flora	Local	Short-term	Non Sig.	Coordinate route and site design/installation	Local	Short-term	Negligible
	Local	Long-term	Non Sig.	Define/coordinate detail site O&M procedures	Local	Long-term	Negligible
Fauna							
Birds	Local	Short-term	Significant	Conduct new surveys/ Implement mitigation measures	Local/ Regional	Short-term	Non. Sig.
		Long-term	Significant			Long-term	Non. Sig.
Mammals	Local	Short-term	Non Sig.	Implement mitigation measures	Local	Short-term	Negligible
		Long-term	Non Sig.			Long-term	Negligible
Cultural Resources	Local/ Regional	Short-term	Non Sig.	Implement mitigation measures	Local	Short-term	Negligible
		Long-term	Non Sig.			Long-term	Negligible
Socioeconomics	Local	Short-term	Beneficial	None Required	n. a.	n. a.	n. a.
		Long-term	Beneficial	None Required	n. a.	n. a.	n. a.
	Regional	Short-term	Beneficial	None Required	n. a.	n. a.	n. a.
		Long-term	Beneficial	None Required	n. a.	n. a.	n. a.
Infrastructure	Local	Short-term	Negligible	None Required	n. a.	n. a.	n. a.
		Long-term	Negligible	None Required	n. a.	n. a.	n. a.
Public Services & Facilities	Local/ Regional	Short-term	Non Sig.	Implement emergency response procedures	Local/ Regional	Short-term	Negligible
		Long-term	Non Sig.			Long-term	Negligible

Table 1.2.2-1
Summary of Potential Environmental Consequences and Impacts
(Continued)

Without Mitigation Measures				Following Mitigation Measures			
Factor	**Context**	**Duration**	**Severity**	**Mitigation Measures**	**Context**	**Duration**	**Severity**
Air Quality & Meteorology	Local	Short-term	Non Sig.	Minimize grading/ replace grass/water	Local	Short-term	Negligible
		Long-term	Non Sig.	Repair new damage/ replace grass/water	Local	Long-term	Negligible
	Regional	Short-term	Beneficial	None Required	n. a.	n. a.	n. a.
		Long-term	Beneficial	None Required	n. a.	n. a.	n. a.
Noise							
- Construction	Local	Short-term	Negligible	Ensure safe driving and operating procedures	Local	Short-term	None
	Region	Short-term	Negligible	Ensure safe driving and operating procedures	Region	Short-term	None
- Operation	Local	Long-term	None	None Required	n. a.	n. a.	n. a.
EMF							
- existing	Local	Short-term/ Long-term	Negligible	Establish/ensure safe O&M procedures	Local	Short-term/ Long-term	Negligible
- with windfarm	Local	Short-term/ Long-term	Negligible	Establish/ensure safe O&M procedures	Local	Short-term/ Long-term	Negligible
Visual Impact	Local	Short-term/ Long-term	Non Sig.	Solicit community input/ address & resolve issues	Local	Short-term/ Long-term	Negligible
	Regional	Short-term/ Long-term	Non Sig.	Solicit community input/ address & resolve issues	Regional	Short-term/ Long-term	Negligible
Community Acceptance	Local	Short-term/ Long-term	Non Sig.	Solicit community input/ address & resolve issues	Local	Short-term/ Long-term	Beneficial
	Regional	Short-term/ Long-term	Non Sig.	Solicit community input/ address & resolve issues	Regional	Short-term/ Long-term	Beneficial

CORRECTION

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

Table 1.2.2-1
Summary of Potential Environmental Consequences and Impacts
(Continued)

	Without Mitigation Measures			Following Mitigation Measures			
Factor	**Context**	**Duration**	**Severity**	**Mitigation Measures**	**Context**	**Duration**	**Severity**
Air Quality & Meteorology	Local	Short-term	Non Sig.	Minimize grading/ replace grass/water	Local	Short-term	Negligible
		Long-term	Non Sig.	Repair new damage/ replace grass/water	Local	Long-term	Negligible
	Regional	Short-term	Beneficial	None Required	n. a.	n. a.	n. a.
		Long-term	Beneficial	None Required	n. a.	n. a.	n. a.
Noise							
- Construction	Local	Short-term	Negligible	Ensure safe driving and operating procedures	Local	Short-term	None
	Region	Short-term	Negligible	Ensure safe driving and operating procedures	Region	Short-term	None
- Operation	Local	Long-term	None	None Required	n. a.	n. a.	n. a.
EMF							
- existing	Local	Short-term/ Long-term	Negligible	Establish/ensure safe O&M procedures	Local	Short-term/ Long-term	Negligible
- with windfarm	Local	Short-term/ Long-term	Negligible	Establish/ensure safe O&M procedures	Local	Short-term/ Long-term	Negligible
Visual Impact	Local	Short-term/ Long-term	Non Sig.	Solicit community input/ address & resolve issues	Local	Short-term/ Long-term	Negligible
	Regional	Short-term/ Long-term	Non Sig.	Solicit community input/ address & resolve issues	Regional	Short-term/ Long-term	Negligible
Community Acceptance	Local	Short-term/ Long-term	Non Sig.	Solicit community input/ address & resolve issues	Local	Short-term/ Long-term	Beneficial
	Regional	Short-term/ Long-term	Non Sig.	Solicit community input/ address & resolve issues	Regional	Short-term/ Long-term	Beneficial

1.2.3 Summary of Mitigation Measures Program

The mitigation measures program is being designed in two phases as follows:

Project Design and Preliminary Review Phase (Completed):

- conducted a botanical survey to avoid native plants during the wind resource measurements program and in the preliminary siting of individual wind turbines,

  Results. Native plants were not found at the preliminary sites identified for the wind turbines. Some native plants were found along the proposed alternative access spur through the Manawanui Gulch. If this route is approved, additional surveys will be needed to plan construction.

- conducted a downed bird survey to determine if any birds were being downed by the meteorological towers, identify which birds frequent the study area and to plan mitigation measures to reduce the impacts during construction and operation of the windfarm,

  Results. No downed birds were found. No Nene, Shearwaters or Petrels were observed in the area. However, since the survey was limited in scope, additional surveys are needed to confirm whether any endangered species frequent the area.

- conducted preliminary surveys to identify culturally-significant archaeological sites,

  Results. No culturally-significant archaeological sites were found on the site or along the proposed alternative access spur.

- took care in the visual design of the wind turbines and the windfarm layout, and

  Results. The 27 turbines would be installed in one, articulated string over a linear distance of over 8000ft. All of the site electrical collection network would be buried. Because of the remote location of the windfarm, the predominate views of the windfarm would be from distances over 6mi and from viewpoints where the turbines would be seen against the existing landscape. They would not be visible from along the Honoapiilani Highway.

- relocated wind turbine sites above the lower transmission lines to reduce the visual impacts along the Old Lahaina Pali Trail.

  Results. Some the turbines (or parts of the wind turbines) would still be visible from a section of up to one mile of the Old Lahaina Pali Trail. It is anticipated that portions of up to six to eight turbines would be visible.

Final Review Phase:

- conduct additional botanical and archaeological surveys to finalize the improvements to the access road network, including a spur that would will preclude traverse of 3.2km (2.0mi) of the upper, more sensitive areas of the Kaheawa Pastures,
- plan a native plant propagation program,
- continue monitoring for downed birds near the meteorological towers,
- conduct additional bird surveys prior to construction to characterize bird use in the project area and develop mitigation measures,
- continue coordination with DLNR/DOFAW, and
- continued solicitation and review of public comments.

1.2.4 Hawaii Administrative Rules -- Significance Criteria

The Hawaii Administrative Rules, Title 11, Department of Health, Chapter 200, Section 12 specifies thirteen criteria when considering the significance of potential environmental effects. Agencies are to consider the sum of the effects on the quality of the environment and shall evaluate the overall and cumulative effects of an action. The following is an assessment of the potential effects of the action.

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

WSB-Hawaii Assessment. An irrevocable (irreversible) commitment to loss or destruction of any natural or cultural resource is one that cannot be changed once it occurs. Natural resources include topographic and geologic features, soils, air, water, flora and fauna. No topographic or geologic features will be disturbed (See Section 3.5). Some soil will be disturbed during the construction of the windfarm, but this use is revocable. The windfarm could be decommissioned, all equipment and structures could be removed and the soil could be restored to its original condition. The project will not generate any air or water emissions and will provide positive benefits through the reduction of fossil fuel use and the resulting emissions on Maui.

Regarding flora and fauna, potentially negative impacts have been identified, studied and discussed (See Section 3.7). WSB-Hawaii believes that negative impacts to native flora can be reduced to a negligible level through proposed mitigation measures during construction and operation. These mitigative measures include temporary removal and replacement of native flora during construction and a native plant propagation program during operation.

There are concerns regarding potential negative impacts on avifauna, including the endangered Nene (See Section 3.8). These impacts could result in irrevocable loss of individual avifauna. Discussion of potential impacts on the Nene and other avifauna have not yet resulted in agreement on substantial mitigative measures. Additional study of the environmental impacts and development of appropriate mitigation measures, including a Nene propagation program, is recommended.

Cultural resources include culturally-significant archaeological sites, native practices and uses in the area, and other human resources. Based on an archaeological survey, there are no culturally-significant archaeological sites in the project area (See Section 3.9). An archaeological survey was also conducted along the proposed spur access trail with negative findings. Consultation with the native Hawaiian community has indicated there no cultural uses in the project area or in nearby areas of the Ukumehame that would be negatively impacted by the project. There are other irrevocable human resources that would be lost, e.g., the labor involved in constructing the project.

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

WSB-Hawaii Assessment. The project will not curtail the range of beneficial uses of the environment. The proposed windfarm is consistent with the primary purpose and use of the Conservation District. It also supports overall State policy to increase use of indigenous energy resources. The proposed windfarm is a use permitted in the Conservation District. Specifically, the proposed windfarm site lies within the "General" subzone of the Conservation District. The proposed windfarm is a use consistent with the objectives of the more restrictive Conservation District Protective

Subzone (See discussion in Section 3.3.2). Specifically, Section 13.5.22 of DLNR Conservation District Rules, identifies "energy generation facilities utilizing the renewable resources of the area (e.g., hydroelectric or wind farms" as a permissible "Public Purpose Use" in the "Protective" subzone. The proposed windfarm is consistent with and will not preclude other potential uses of the land, e.g., livestock grazing and bird hunting (See Section 3.4). Windfarms are generally deployed on lands already in use for some other purpose, e.g., livestock grazing or game hunting. As such, they are good examples of multiple purpose facilities.

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

WSB-Hawaii Assessment. Overall, the proposed windfarm is consistent with and supports long-term state policy to conserve the state's natural resources and to improve the quality of life. The project will help reduce our dependence on imported energy use and increase our use of indigenous natural resources, including energy, e.g., our tradewinds. The project helps improve the quality of life on Maui by offsetting a portion of the fossil fuel used to generated electricity. This reduced fuel use (estimated at about 102,000 barrels of oil a year) will also avoid the air pollutants that result from the fossil fuel use. The project further helps to improve the quality of life by bringing outside investment, tax and use revenues and new jobs to Maui. Finally, the use of the wind at the project site is consistent with native Hawaiian understanding and use of the wind. The only concern regarding this criteria is the potential negative impacts on avifauna as discussed above.

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

WSB-Hawaii Assessment. The proposed windfarm will have positive economic and social welfare impacts on the community. The project will bring outside investment which will create both short-term and long-term jobs, and tax and use revenues. Perhaps the most significant economic benefit will be the avoidance of imported energy fuel costs, as the dollars that would normally go out of state to pay for fossil fuels would recirculate on Maui and in the State. The project implementation will not negatively impact the social welfare (including cultural resources) of the community.

(5) Substantially affects public health;

WSB-Hawaii Assessment. The project will not result in any negative public health impact. The project health impacts will be positive through the reduction of pollution from the utility power plants at Kahului and Maalaea.

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

WSB-Hawaii Assessment. The project is anticipated to have negligible impacts on population and public facilities. Most of the jobs created by the project will be filled by local residents. The project will be self-contained and will require no extension of public facilities, e.g., water or other utilities.

(7) Involves a substantial degradation of environmental quality;

WSB-Hawaii Assessment. The project will not result in a substantial degradation of environmental quality. Quite to the contrary, the project is anticipated to improve environmental quality in the project area and within the county. This will be accomplished taking care taken during the construction and operation to minimize damage to the land, including flora and fauna, and the implementation of native plant and Nene propagation programs. It is anticipated that these propagation programs will provide a positive benefit over the project lifetime.

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

WSB-Hawaii Assessment. The proposed 20 MW windfarm is not anticipated to have any cumulative affects. The proposed windfarm is optimum given the size of the Zond Z-48 wind turbines and available land in the project area. Therefore, the proposed windfarm would not involve a commitment to larger actions, e.g., as addition of more wind turbines at a later time.

(9) Substantially affects air or water quality or ambient noise levels;

WSB-Hawaii Assessment. The project will not substantially affect air or water quality or ambient noise levels. In actuality, the project will provide an overall positive impact on air quality, since the project itself does not result in air emissions and because the wind-generated electricity will offset use of fossil fuels and their resulting emissions on Maui. All water used during construction and operation will be trucked in. As noted in Section 3.6, measures are recommended which should mitigate the potential impacts on the hydrologic and water resources *in the area*. Regarding noise levels, the wind turbines will slightly increase the ambient noise levels within the project area. It is believed that the noise will serve to alert avifauna in the area. As discussed in Section 3.14, the turbines would not be heard at the nearest residences (over two miles away) to the project.

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

WSB-Hawaii Assessment. The project will not detrimentally affect air or water quality or ambient noise levels. As discussed above, the impacts on air quality are considered positive, the impacts on water quality and ambient noise levels are negligible.

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

WSB-Hawaii Assessment. The proposed project site in the Kaheawa Pastures is not located in an environmentally sensitive area of the type as described above. Therefore, the project will not affect or is likely to suffer the type of damage of concern by this criteria. The site, which has been used previously by cattle ranchers for grazing, is a grassland and shrubland area dominated by non-native flora.

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

WSB-Hawaii Assessment. The project is not anticipated to substantially affect scenic vistas and viewplanes identified in county or state plans or studies. One comment was received from DLNR (Na Ala Hele Trails and Access Program) regarding potential impacts from viewpoints along the Old Lahaina Pali Trail. Several of the turbines or parts of the turbines would be visible from a one mile long section of the trail. The community has not expressed the concern visual impact would be significant. In part, the remote location of the proposed windfarm mitigates concern, as most people would not see the wind turbines. The West Maui Community Plan and the County of Maui Plan do not identify specific scenic vistas or viewplanes in the area.

(13) Requires substantial energy consumption.

WSB-Hawaii Assessment. The project would generate and consume electrical energy. The amount of electrical energy consumed is negligible to the amount that would be generated and delivered to the utility.

1.2.5 Unresolved Issues

WSB-Hawaii has evaluated one of the potential impacts to be *potentially significant,* requiring mitigation. Mitigation is also recommended for a number of impacts that have been evaluated as *non significant.* ZPAC's goal is to reduce the severity of these impacts by at least one level, i.e., to reduce *significant to non significant, non significant* to *negligible*, etc., through implementation of a mitigation measures program. The following are the key *potential* impacts that need to be resolved:

- Potential Impact on Avian Species and their Habitat (Preliminary rating: *significant*). A preliminary bird survey was conducted to determine if birds were colliding with existing meteorological towers and to identify birds in the area. A number of native birds were identified, but none that are endangered. However, endangered Hawaiian Nene were observed nearby and the Hawaiian Dark-rumped Petrel is known to be on Maui. Due to the uncertainty surrounding the presence and habits of the Nene in the project area, the impact is evaluated as potentially significant.

  Plans. ZPAC plans to continue monitoring the areas surrounding the meteorological towers for downed birds. As the next step, ZPAC plans to conduct more detailed surveys to characterize bird use of the project area in coordination with DLNR/DOFAW. ZPAC's intent is prepare, in partnership with DLNR/DOFAW, a mitigation measures program to reduce the risk to the Nene and other species of concern as much as possible. The mitigation measures will include ZPAC contributions to the Nene propagation program. With implementation of these mitigation measures, WSB-Hawaii believes that the severity of the impacts can be downgraded to *non significant.* See Section 3.9 for details.

- Potential Impact on Terrestrial Flora (Preliminary rating: *non significant*). While no endangered plant species have been found to date, a number of native plants were identified during the initial botanical survey. This survey led to the relocation of two of the meteorological towers. A second survey identified native plants along the existing spur from Puu Anu to the project area.

  Plans. ZPAC would conduct follow-up surveys to confirm the improvements to the access road network and the final sites for the turbines and other structures on the site. ZPAC also plans to implement a native plant propagation program with the assistance of local plant experts. With these measures, WSB-Hawaii believes the impact severity can be downgraded to "negligible." See Section 3.8 for details.

- Visual Resources (Preliminary rating: *non significant*). Concern has been expressed by DLNR/Na Ala Hele Trails and Access Program that viewplanes along the Old Lahaina Trail would be impacted. However, the community has not raised concerns suggesting that visual impact would be significant. With implementation of mitigation measures discussed in Section 3.16, WSB-Hawaii believes that the severity of the impacts can be downgraded to *negligible.*

1.3 Summary of Compatibility With Land Use Policies and Plans

The proposed windfarm is consistent with State and local plans and policies as summarized below. The relationship of the proposed action to land use plans, policies and controls in discussed in Section 4.0.

1.3.1 Federal

There are no known Federal plans or policies that directly relate to or influence the proposed action. There are three Federal policies which could result in Federal involvement on or actions related to the project: one with Federal Aviation Administration (FAA), one with the Department of Interior (DOI), and one with Army Corps of Engineers. ZPAC has filed a "Notice of Proposed Construction or Alteration" with the FAA. The FAA has subsequently determined that the proposed project would not be an obstruction to air navigation under Part 77 of Federal Aviation Regulations. Since the height of the turbines including the blades would exceed 200ft), lighting is required to alert pilots. For this project, the FAA has approved lighting with a steady burning red obstruction light on the top of every other turbine nacelle.

The DOI, Fish and Wildlife Service, administers the Federal Endangered Species Act of 1973. DOI normally becomes involved in projects where Federal lands and or funds are to be used. This is not the case for this project. DOI could also become involved if it, or another federal agency, took an action that could materially affect the project. In the case of this project, there is a potential trigger associated with the FAA's review of the "Notice of Proposed Construction or Alteration" filed by ZPAC. If the FAA determined that their action could impact an endangered specie, they would initiate a Section 7 consultation pursuant to the Endangered Species Act. However, the FAA did not make this determination (See Section 4.1).

ZPAC has proposed to improve and utilize a spur road that extends from near Puu Anu to the upper area of the project site. This spur crosses the upper portion of the Manawanui Gulch. Subject to further review of the proposed use of the upper spur for site access, the Army Corps of Engineers could become involved, if they determine that this upper portion of Manawainui Gulch falls under their jurisdiction. See also Sections 3.6 and 4.1.

1.3.2 State

The applicable State plans, policies and programs include: State land use and conservation and resource law related to land use districts; the Hawaii State Constitution; Hawaii State Plan; the Hawaii Integrated Energy Plan and related plans, e.g., the Hawaii Energy Strategy; and the Na Ala Hele Trails and Access Program.

State Land Use and Conservation and Resource Law. The proposed windfarm site is on state-owned Conservation District land within the Ukumehame ahupua'a of West Maui. The State's custodial agency is DLNR. The site is within "General" subzone. Therefore, use of the land requires submittal of a Conservation District Use Application (CDUA) for review and approval by the Board of Land and Natural Resources (BLNR) and issuance of a Conservation District Use Permit (CDUP). The use of the site for the proposed windfarm is consistent with the objectives of the Conservation District General Subzone.

Hawaii State Constitution. The proposed windfarm is consistent with the Hawaii State Constitution, referencing Article XI, section 1:

"For the benefit of present and future generations, the State and its political subdivisions shall conserve and protect Hawaii's natural beauty and all natural resources, including land, water, air, minerals and energy sources, and shall promote the development and utilization of these resources in a manner consistent with their conservation and in furtherance of the self-sufficiency of the State."

Hawaii State Plan and Hawaii Energy Strategy. The proposed windfarm is consistent with the Hawaii State Plan, Chapter 226, HRS) and the Hawaii Energy Strategy which include the overall objective of providing economic, efficient and reliable electrical service. The Hawaii State Plan and the Hawaii Energy Strategy include the following two additional goals which support the increased use of renewables in Hawaii, such as the proposed 20 MW windfarm:

- "Increased energy self-sufficiency where the ratio of *indigenous* to *imported* energy use is increased; and
- Greater energy security in the face of threats to Hawaii's energy supplies and systems."

Na Ala Hele Trails and Access Program. The Lahaina Pali Trail is 7.2km (4.5mi) long, extending from the Ukumehame County of Maui Beach Park to near Pu'u Hele. It traverses the Kaheawa Pastures below the lower end of the proposed windfarm site. The trail joins the access road just before the road crosses the Malalowaiaole Gulch at about the 488m (1600ft) elevation level. DLNR (Na Ala Hele Trails and Access Program) has expressed concern that the project will negative impact viewplanes along the trail. However, WSB-Hawaii believes that the proposed windfarm would not compromise the ability of the trail to meet the objectives of the Na Ala Hele Trails and Access program. See also discussion in Sections 3.4 and 3.16.3.

1.3.3 Maui County

The proposed windfarm is consistent with the Maui County General Plan and the West Maui Community Plan. The windfarm would provide electricity to MECO's transmission system, would be a compatible use of Conservation Lands and would provide an economic stimulus to the County. The electricity supplied to MECO's grid would help supply the energy needs of West Maui. The Conservation land in this area has been used for grazing of livestock in the past. The proposed windfarm would be compatible with the grazing of livestock, as it has been in California and other areas, and/or with bird hunting if that should be approved by DLNR.

1.4 Required Approvals and Permits

Federal, State and County permits and approvals required for the proposed windfarm are summarized in Table 1.4-1 and described in more detail in Section 4.

Federal Approvals. Because their heights, the wind turbines and their towers can represent possible obstacles to commercial or private aircraft. The site is near the primary landing flight paths for the Maui County Airport at Kahului. ZPAC has filed a "Notice of Construction or Alteration" to the Federal Aviation Administration (FAA). The FAA has subsequently determined that the proposed project would not be an obstruction to air navigation under Part 77 of Federal Aviation Regulations. Since the height of the turbines including the blades would exceed 61m (200ft), lighting is required to alert pilots. For this project, the FAA has approved lighting with a steady burning red obstruction light on the top of every other turbine nacelle.

Table 1.4-1*
Permits and Approvals

Accepting Authority: (Agency/Organization)	Approval/Permit/Action	Estimated Application Date	Processing Time	Public Hearing
USDOT FAA	Review and Approval of Notice of Construction or Alteration	December 14, 1998 (Actual)	Jan. 7, 1999 (Actual)	Not required
DLNR Land Management Division	Draft EA Final EA Draft EIS (if required) Final EIS (if required)	Apr. 30, 1998 (Actual) Jan. 27, 1999 Mar. 1, 1999 Sep. 1, 1999	Nov. 9, 1998 (Actual) 1 to 2 months 3 months	Jan. 13, 1999 (Actual)
DLNR Board of Land & Natural Resources	Conservation District Use Permit (*Board Permit*)	Apr. 30, 1998 (Actual)	15 to 18 months	Jan. 13, 1999 (Actual)
DLNR Land Management Division	Use of State Lands Approval (includes land use fee)	Apr. 30, 1998 (Actual)	15 to 18 months	If required by BLNR
DLNR Historic Preservation Division	Historic Sites Review	Apr. 30, 1998 (Actual)	Aug. 25, 1998 (Actual)	Not Required
DOT, Highways Division (*may not be needed*)	Permit to Perform Work on a State Highway	Apr. 1, 1999	3 months	Not Required
Maui County Planning Department	Site Construction Permit	May 1, 1999	3 months	If Required

*This Table is identical to Table 4.4-1

State Approvals and Permits (See also Section 4 for more details). Approvals and permits would be required from DLNR. As discussed above, the proposed windfarm site lies entirely within State lands, designated Conservation Land Use District requiring a Conservation District Use Permit (CDUP). In the case of the proposed windfarm, ZPAC must apply for and be granted a Use of State Lands Approval (USLA) from the Land Management Division and a Board Permit from the Board of Land and Natural Resources (BLNR). These applications require the submittal of and acceptance by DLNR of an Environmental Assessment or an Environmental Impact Statement (if required).

As part of ZPAC's application for approval of its wind monitoring program, a preliminary assessment was made by the State Historic Preservation Division (SHPD). At that time, no record was found of historic sites on the parcel (Evans, 1995). Mr. Evans indicated that a Historic Sites Review would be required should ZPAC proceed with the windfarm. SHPD has subsequently completed a Historic Preservation Review of the project CDUA and DEA. The DEA included the archaeological survey conducted for ZPAC by the International Archaeological Research Institute, Inc. (IARII). Per SHPD letter, dated August 25, 1998 (copy enclosed in Section 6), SHPD has found "the proposed windfarm to have 'no effect' on historic sites." SPHD also expressed concerns regarding possible historic sites along the proposed upper spur road. Note: IARII has conducted a follow-up survey along this proposed route. No sites were found (see Section 3.5 for details).

County Permits. Only construction permits and a height variance would be required. The application for the height variance may require a public hearing.

2. PROJECT DESCRIPTION

This section includes a discussion of the project purpose and need, background information on existing power generation and transmission needs, background information on site selection, a description of the project and the anticipated benefits of the project.

2.1 Project Purpose and Need

Zond Pacific Inc. (ZPAC), a division of Enron Wind Corporation, Tehachapi, California is a developer of windfarm projects. One of ZPAC's primary corporate objectives is to develop windfarms in an environmentally-sound manner for the people of Hawaii. ZPAC has worked with various organizations and individuals in Hawaii since 1984 to identify high potential sites for wind energy development. ZPAC has identified several potential sites on the islands of Hawaii, Maui, Molokai and Oahu.

The purpose of the proposed action is to develop a windfarm in an environmentally-sound manner on Maui. The need of the proposed action is to provide 20 megawatts (MW) of wind generated electricity towards the growing electrical energy demand of Maui. Maui Electric Company Ltd. (MECO) has indicated their willingness to purchase the electricity from the proposed windfarm, subject to the final negotiation of the power purchase agreement. Contract negotiations are underway.

2.2 Background: Existing Power Generation and Transmission System

The following information on MECO's existing power generation and transmission system and needs is provided as background discussion supporting the need for the proposed 20 MW windfarm. Unless otherwise noted, quoted sections are from MECO's EIS (MECO, 1994).

Generation

MECO's total generating capacity is currently about 217 MW. MECO operates its own combustion turbine and internal combustion diesel units at Maalaea (163 MW capacity) and oil-fired, steam turbine generation units at Kahului (38 MW capacity). "Hawaiian Commercial & Sugar Company (HC&S) generates electricity through the burning of bagasse, oil or coal, and through hydro power. 16 MW of power is supplied to MECO through a Power Purchase Agreement between MECO and HC&S." Overall, the Kahului Power Plant supplies approximately 17.5% of the current capacity, the Maalaea Power Plant about 75 percent and the HC&S Power Plant about 7.5 percent.

Transmission and Distribution

The power generated by MECO is supplied to its customers via an island-wide transmission and distribution system. "As power is generated, transformers step up the voltage to either 23KV or 69KV. The power is then transmitted through the 23KV and 69KV transmission grids. These higher voltages allow for more efficient transmission of large amounts of power over long distances to the substations at major load center. Local area distribution substations reduce the voltage from 69KV and 23KV to MECO's 12KV and 4KV local distribution voltage. Distribution feeders typically fan out from the 12KV and 4KV distribution substations along streets and roads either overhead or, where necessary, underground. Finally, individual customers are connected to the distribution system through small step-down distribution transformers sized for the particular load and voltage required by the customer. These transformers are located on poles or pads near the facilities they serve."

The 69KV system consists of 96 circuit miles of single-circuit, overhead lines and delivers power to West Maui (Lahaina to Napili) via three lines, to South Maui (Kihei and Wailea) via one line adjacent to the Piilani Highway and Up-Country (Kula and Pukalani) via one line forming a loop connecting Kanaha, Pukalani, Kula, Wailea, Kihei and the Maalaea Power Plant. The overhead system is designed to withstand most environmental hazards and remain continuously in service. Note: two of the overhead lines to West Maui are wood-pole designs and were installed in 1957 and 1970. The third line is a steel pole design and was installed in 1996.

"The 23KV system consists of 137 circuit miles of overhead lines and delivers power to Central Maui (Kahului, Kanaha, Wailuku, Waiinu) and East Maui (Paia, Makawao, Haiku, Hana)."

"MECO's distribution system contains nearly 730 circuit miles of 12KV and lower voltage feeders. This extensive network delivers power at utilization voltage to more than 43,000 customers." (HECO, 1992).

<u>**Existing and Future Loads**</u>

"West Maui has experienced steady load growth since 1985, due in large part to new resort developments." The West Maui peak load in 1985 was 33.8 and 54.6 MW in 1995, resulting in an increase of 61 percent or about 5 percent per year. The annual load growth was higher (7 percent) in 1990 and 1992. The island-wide trends were similar with an annual load growth rate of about 5% based on a system peak of 101.9 MW in 1985 and 170.7 MW in 1995. The load growth slowed dramatically in 1993 (actually decreased by 3 percent) then rebounded with positive 4 percent rates in 1994 and 1995. The slowdown in growth was due primarily to a decline in tourism that started in 1993 and completion of several major developments in West Maui. This slower load growth trend (3%) continued during 1996 when the island-wide peak was 174.8 MW. Note: historically, West Maui represents approximately one third of the total island load.

MECO has predicted an island-wide annual load growth rate of about 3 percent for the period of 1996 through 2009 (MECO, 1996). The load growth estimates are based on the projected resort, commercial and residential developments. To meet this load growth and to replace retired units, MECO is planning additions of new capacity at Maalaea (58 MW) and a construction of a new 232 MW power plant at Waena over the next 20 years. With the recent addition of the third transmission line, MECO anticipates that the transmission system will be adequate to cover the anticipated load growth over the next 20 to 30 years.

2.3 Background: Site Viability and Selection

This section includes discussion of ZPAC's site selection criteria, the sites considered and evaluated and summary of the site selection.

2.3.1 Site Selection Criteria

The following is a discussion of the key criteria that ZPAC evaluates in order to select a site suitable for wind energy development:

<u>Wind Resource Characteristics</u>. The key wind resource characteristics are the strength, direction, duration and turbulence of the wind and its temporal and spatial variations on the proposed site. Sites with wind speed averages of 15 mph or greater are generally viable in many locations in Hawaii. Averages of 18 mph or greater are considered excellent. Wind measurements are made using sensors mounted on temporary towers at various locations at the site. Ideally, the wind measurements should be conducted for a minimum period of two years. A highly energetic site provides incentive for the windfarm developer to consider the feasibility and costs associated other factors in determining the overall site viability.

Landowner Interests and Terms for Land Use Agreement. While a site may be windy enough for consideration, the windfarm developer must gain access to site, either by purchasing the land or through a land use agreement. Generally, it is not desirable or cost effective to purchase the land for wind use, especially in Hawaii. Instead, the windfarm developer typically obtains the "wind rights" on the site from the landowner via a lease or easement. Since the windfarm generally does not tie up all the land, an easement may be the preferred contractual vehicle. The use fee is generally a fixed amount per year or a percentage of the gross project revenues (usually 2% during capitalization and 3% thereafter) or a combination of the two.

Permitting Requirements. Since permitting requirements vary dramatically with the land designation and zoning, this can be a key consideration. In Hawaii, wind energy is a pre-approved use on privately-owned agricultural land and requires a minimum of permitting and approvals. On the other hand, a wind energy project on Conservation District Use Lands (as discussed herein) triggers the need for special permits and approvals, and potentially a number of special studies to address environmental issues. Thus, the developer must carefully weigh the permitting costs along with other project costs in determining the overall site viability.

Utility Interconnection and Integration Issues. Key issues are the design and rating of the utility's transmission system and the distance from the proposed wind site to the nearest point suitable for interconnection. Generally, the developer pays for the interconnection facility (substation) and the electrical network to collect and deliver the windfarm output to the substation. There may be special interconnection hardware requirements. Integration issues include delivered power quality requirements (e.g., voltage and frequency regulation, harmonic distortion) delivered to the utility and the possible curtailment in certain circumstances. These factors can result in additional hardware costs or potential loss revenues.

Site Construction. Key cost components are the hardware and construction costs (wind turbines, towers, foundations, site electrical collection network, transformers, substation and roads and other facilities). Additional factors are the distance required to interconnect to the utility's transmission system and other interconnection costs, the remoteness of the site, and the site terrain. Increased costs for remote and rugged sites must be traded-off against the other cost and performance factors in determining the overall site viability.

Environmental Issues. Environmental issues can play a key role in determining the overall viability of the site. Windfarms generally are recognized as providing positive environmental benefits, e.g., windfarms can reduce fossil fuel use and their associated air emissions, including greenhouse gases. As with all power plants, there can be damage to the environment due to potential impacts during construction and operation on topography, geology, soils, hydrological resources, flora and fauna and their habitats, archaeological or other cultural sites, visual resources and noise. The costs to study these issues and to design and implement mitigative issues must be evaluated in determining the overall site viability.

Community Acceptance Issues. Community acceptance issues can play a key role in determining the overall viability of the site. The community will accept and support a project based on their evaluation of its overall costs and benefits. Earlier in the site evaluation phase, it is important for the developer to get a sense of how the community views the project proposal.

Overall Project Viability. All of above factors must be evaluated and weighed. Given a preliminary assessment of the wind resource, the developer can estimate potential revenues (based the anticipated power purchase agreement), land use fees, site construction, permitting and other costs. With this preliminary assessment, the developer can then make the decision on taking the next step – examining overall project viability, including a more detailed examination of the above plus additional factors, e.g. evaluation of project financing options.

2.3.2 Sites Considered and Evaluated

During the initial development phase of this project, ZPAC identified and evaluated alternative sites. In 1987 ZPAC first discussed the concept of a 10 MW windfarm near the Kapalua airport on West Maui with MECO and Maui Pineapple and Pine. Two years of wind measurements confirmed the viability of a good wind resource, but the project was not economically viable at 10 MW. Since the landowner was not interested in making additional and available, ZPAC started looking for alternate sites in 1992.

ZPAC sought to find alternative sites with good exposure to the prevailing tradewinds and close to MECO's transmission system. Potential sites included locations in the central valley, along the north shore, and the highland areas of the Ukumehame ahupua'a. ZPAC discussed the potential project with landowners, government agencies and other interested parties. There were some concerns expressed about the location of a windfarm too close to urban areas, where noise could be an issue or in areas where there could be visual impact. The Kaheawa Pastures was selected as a candidate site in 1994 due its good exposure to the tradewinds and close proximity to MECO's transmission system. In addition, ZPAC felt that the site's remote location would help mitigate potential concerns regarding noise and visual impact.

In 1995 ZPAC applied to DLNR (Zond Pacific, 1995) for a Conservation District Use Permit (CDUP) to conduct wind resource measurements at various locations on the Kaheawa Pastures. ZPAC prepared an EA in support of the site access application. The EA was accepted after revisions and the CDUP was approved. Wind measurements were initiated in 1996. These measurements have confirmed an excellent wind resource.

In parallel, ZPAC continued negotiations with MECO for a power purchase agreement to sell the wind-generated electricity. Contract negotiations are underway. There has been substantial agreement on the general terms and conditions. ZPAC anticipates that the negotiations will soon be satisfactorily completed.

Assuming that ZPAC reaches agreement with MECO, the last major project implementation milestones are to obtain: (1) approval from DNLR for this FEA; (2) issuance of a CDUP and Use of State Lands Approval (USLA) from DLNR, and (3) financing for construction and operation of the windfarm.

2.3.3 Summary of Site Selection

ZPAC has selected the Kaheawa Pastures site for the proposed 20 MW windfarm. A number of factors make this site highly viable for wind energy development. First, the wind resource measurements have confirmed that the overall average wind speed for the site is in excess of 8.1m/s (18 mph). The high winds are due to the excellent exposure of the site to the tradewinds, which are accelerated as they ascend from the valley floor to the site. Since the site is highly energetic, the potential revenues justify added expenses associated with the remoteness of the site. These include the costs to construct a new site access road to shorten the total distance to the site, increased construction costs associated with the additional time and difficulty to reach the site, and the anticipated permitting costs. These increased costs are offset in part by the close proximity to the utility's transmission system. Additional factors supporting this decision include the avoidance of travel through the upper more sensitive areas of the Kaheawa Pastures, reduced visual impact and elimination of noise impacts due to the site's remote location, and the overall energy, environmental and economic benefits that the project would bring to the people of Maui.

2.4. Project Design

This section includes a presentation of the required facilities and activities, the proposed windfarm location and layout, and the detailed engineering design

2.4.1 Required Facilities and Activities

The proposed 20 MW windfarm would consist of the following facilities and activities:

(1) Improvements to the existing site access road network from the main highway to the lower end of the site. The improvements include smoothing the road surface and widening sections of the road, and upgrades to the spur extending from Puu Anu to the site. Use of this spur would shorten the distance required to reach the site by 1.6km (1.0mi) and avoid higher, more sensitive areas of the ahupua'a;

(2) Installation of 27 Z-48 wind turbines, including excavation and construction of foundations, and erection of the support towers and transformers;

(3) Construction of a site facility building and an intrasite road network;

(4) Construction of an intrasite electrical distribution network, including excavation and burying of all wires, and re-vegetation of the disturbed areas; and

(5) Construction of the site substation to MECO's transmission system.

Improvements to the access road network is expected to take three months. The *construction of the windfarm facilities* are expected to take four to six months. An additional three months would be required for check-out and commissioning of the windfarm. The windfarm could be fully operational 13 to 15 months from project go-ahead.

2.4.2 Proposed Windfarm Location and Layout

The proposed 20 MW windfarm would be located on a 200 acre narrow band of land running mauka to makai in the Kaheawa Pastures, Ukumehame ahupua'a (Ukumehame Conservation District Land) approximately four miles mauka of McGregor Point on the south shore of Maui. See Figures 2.4.2-1 (Site Location on West Maui), 2.4.2-2 (Tax Key Map) and 2.4.2-3 (Computer-Simulated Photograph of the Proposed 20 MW Windfarm). Note: MECO transmission lines pass through the pastures en route from the Maalaea Power Plant to Lahaina.

Referring to Figure 2.4.2-1, the windfarm would consist of a single articulated row of twenty-seven (27) Zond Z-48 wind turbines approximately 2,500m (8,200ft) long, an operation and maintenance (O&M) facility, a substation and intrasite road and electrical distribution networks. The wind turbines would be installed on 50m (164ft) tall lattice towers approximately 122m (400ft) apart. Each turbine, tower and foundation would require an area of approximately 12.2m (40ft) by 12.2m (40ft). The 6.1m x 12.2m (20ft x 40ft) operation and maintenance facility would be located approximately in the middle of the windfarm. The 15.2m x 30.5m (50ft x 100ft) substation would be determine after consultation with MECO. The site road network would include a single 3.5m (11.5ft) wide road approximately 2,600m (8,528ft) long with spurs to each turbine. The site electrical distribution network would be buried underground. Note: of the total 200 acre parcel, only 8.7 acres would be developed.

The upper two transmission lines cross the Kaheawa Pastures at an elevation of approximately 700m (2,300ft). The lower (third) line crosses the pastures at about 550m (1,800ft) and 1.6km (1.0mi) makai of the upper two lines. Seven of the turbines would be located between the two sets of transmission lines, 20 would be mauka of the upper lines. The uppermost turbine would be at approximately 976m (3,200ft) elevation, the lowermost at approximately 610m (2,000ft). The design details are discussed in the following section.

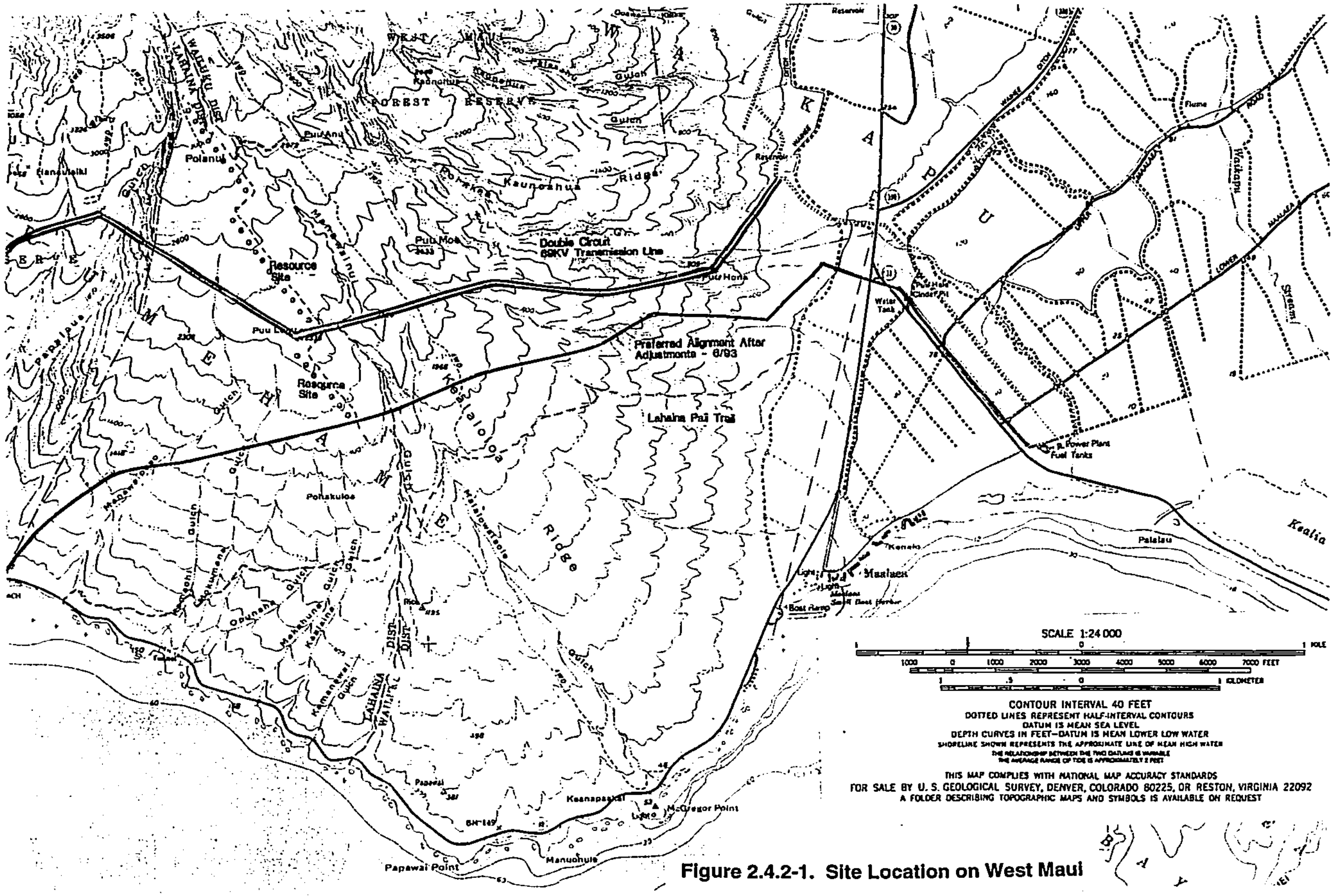


Figure 2.4.2-1. Site Location on West Maui

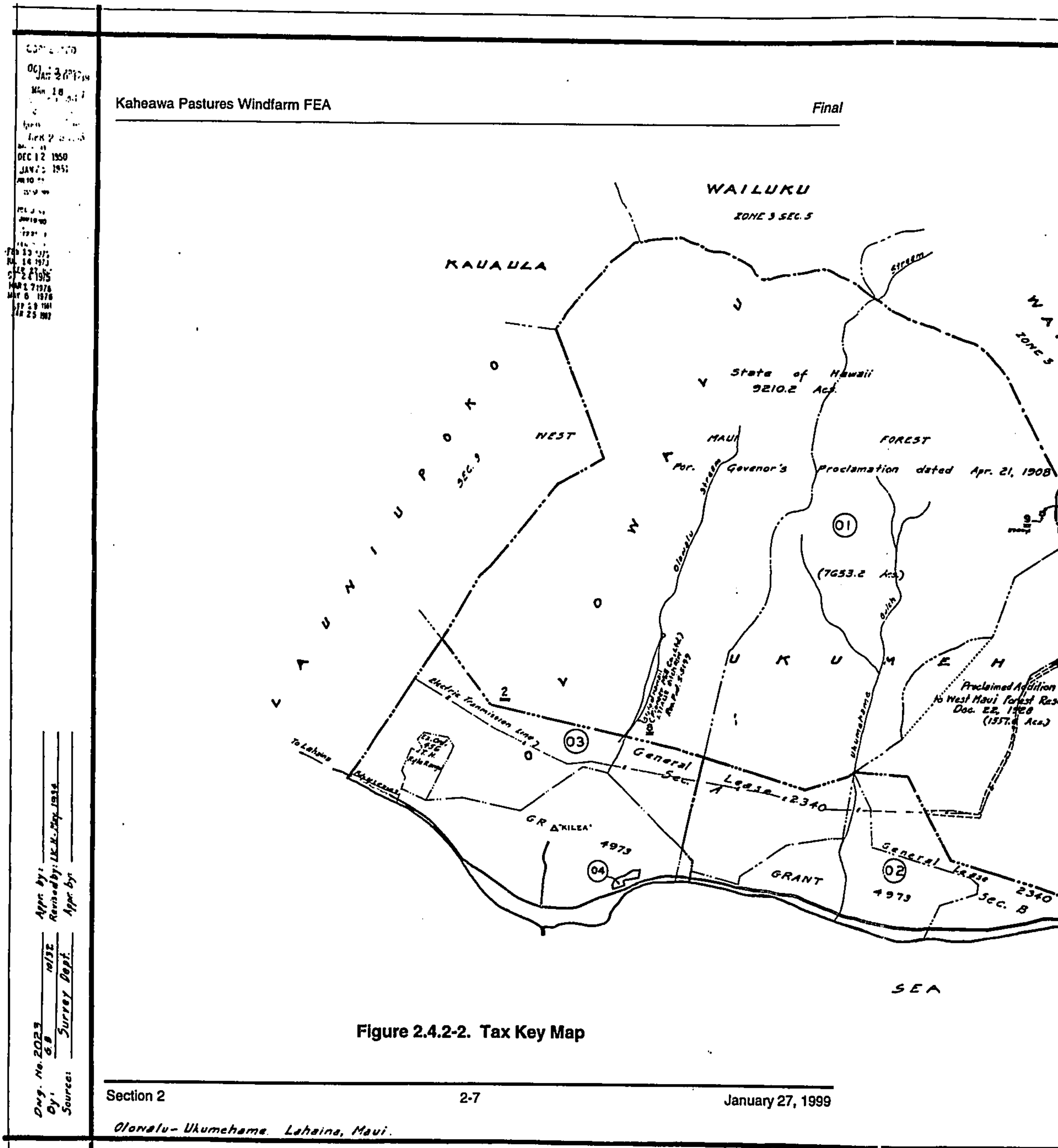
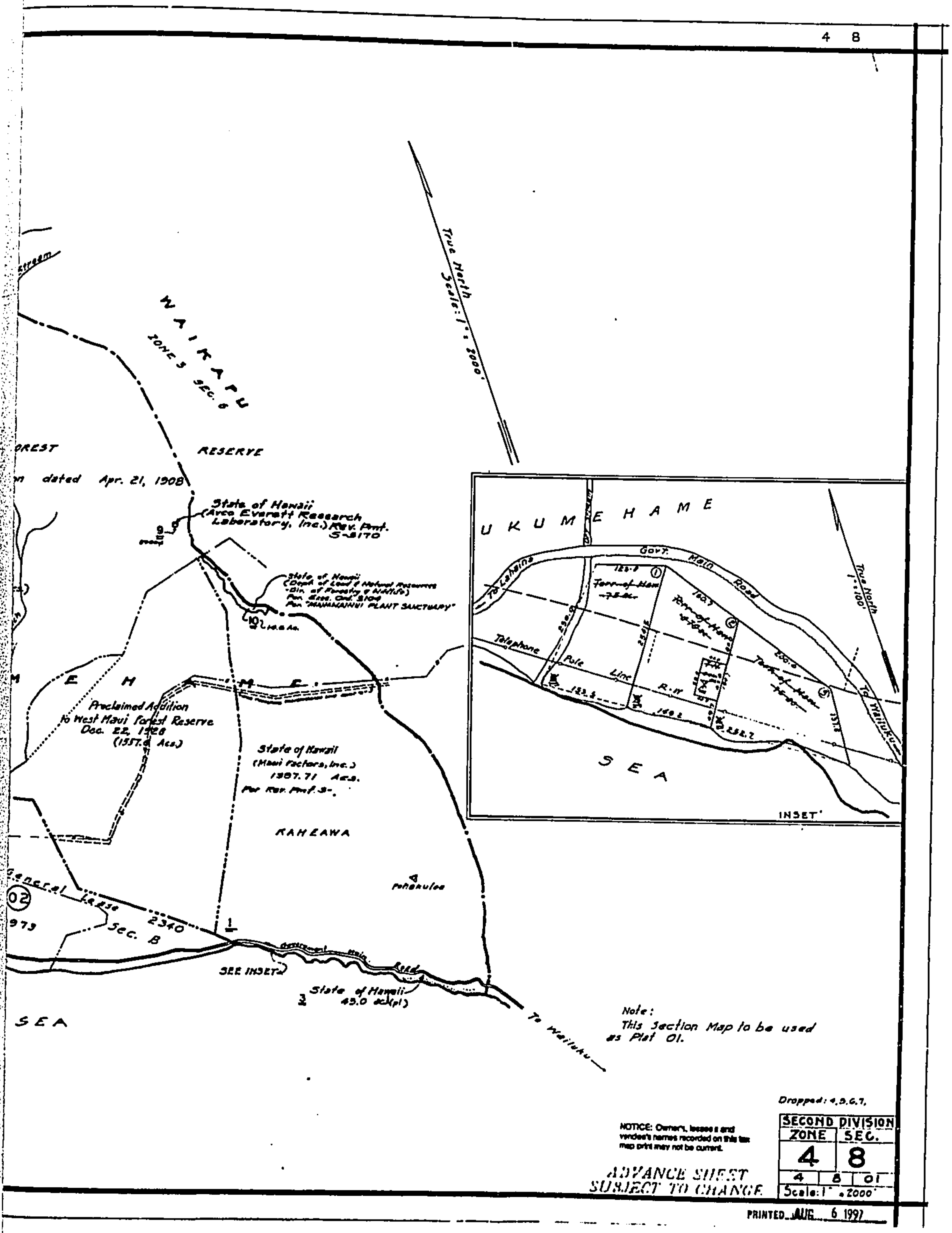


Figure 2.4.2-2. Tax Key Map


4 8
True North
Scale: 1" = 2000'
WAIKAPU
ZONE 3 SEC. 6
FOREST
RESERVE
dated Apr. 21, 1908
State of Hawaii
(Arco Everett Research
Laboratory, Inc.) Rev. Pmt.
S-5170
Proclaimed Addition
to West Maui Forest Reserve
Dec. 22, 1928
(1557.0 Acs.)
State of Hawaii
(Maui Factors, Inc.)
1387.71 Acs.
Per Rev. Pmt. S-
KAHEAWA
Pohakuloa
General Lease 2340
SEC. 8
SEE INSET
State of Hawaii
45.0 ac.(pl)
SEA
To Wailuku
UKUMEHAME
Govt. Main Road
To Lahaina
Telephone Pole Line R/W
True North
1" = 100'
To Wailuku
SEA
INSET
Note:
This Section Map to be used
as Plat 01.
Dropped: 4,5,6,7,
NOTICE: Owner's, lessee's and vendee's names recorded on this tax map print may not be current.
ADVANCE SHEET
SUBJECT TO CHANGE
SECOND DIVISION
ZONE 4
SEC. 8
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Scale: 1" = 2000'
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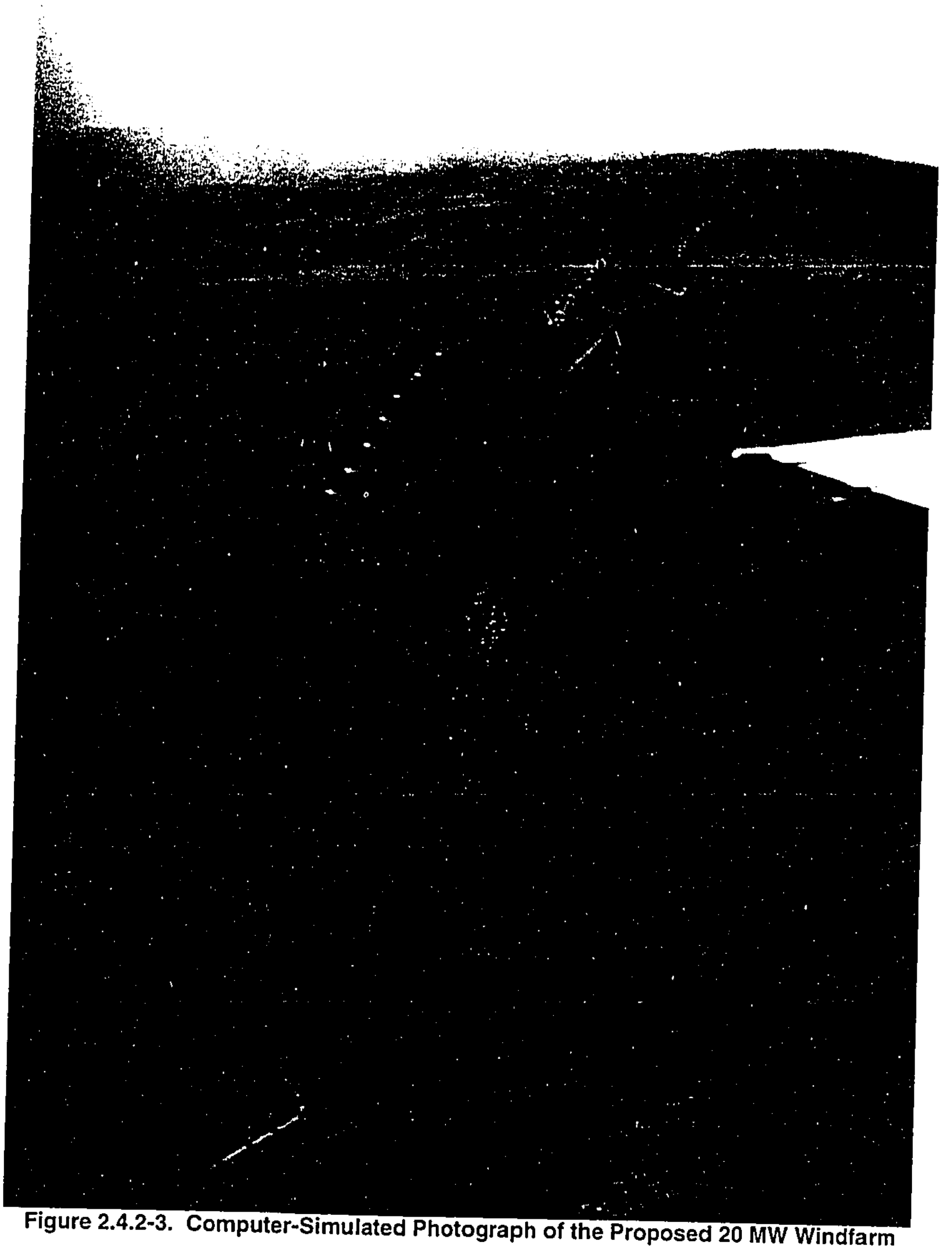

Figure 2.4.2-3. Computer-Simulated Photograph of the Proposed 20 MW Windfarm

2.4.3 Detailed Engineering Design

The proposed windfarm consists of the following systems: wind turbines with support towers and foundations, site electrical distribution network, substation and interconnection hardware, intrasite road network and access road, operation and maintenance facility, and wind monitoring equipment.

Wind Turbines with Support Towers and Foundations. The windfarm array would consist of twenty-seven (27) Zond Z-48 wind turbines installed on 50m (164ft) lattice towers. The Z-48 (See Figure 2.4.3-1) is designed in accordance with the International Electrotechnical Committee 1400-1 Standard and Germanischer Lloyd's rules and Regulations for Wind Turbine Design. The Z-48 is designed to withstand hurricane force winds and to operate reliably for 30 years. The detailed design characteristics are summarized here. Refer to the enclosed Zond Energy Systems, Inc. brochure in Section 8.1 for more details (Zond Energy Systems, 1997).

Each Z-48 wind turbine has an electrical output of 750 kilowatts (kW) bringing the total array output to 20.25 megawatts (MW). The Z-48 has three fiberglass blades and a rotor diameter of 48m (157ft). The rotor airfoils are advanced designs originally developed by the National Renewable Energy Laboratory, Golden, Colorado. The nominal rotor rotation speed is 34 rpm with a variable operating speed range of plus and minus 12.3 percent. The rotor speed is controlled via a hydraulic pitching system to limit the power output and to secure (shutdown) the turbine in high wind speed conditions. The turbine starts producing power in 3.5 m/s (7.8 mph) winds, reaches its rated power output at 11.6 m/s (25.9 mph) and shutsdown in winds of 29 m/s (64.9 mph)and above.

The Z-48 wind turbine is a variable speed design employing a proprietary doubly-fed generator and power converter system to ensure the delivery of constant frequency power to the grid. The generator output is three-phase 480 VAC (Voltage Alternating Current) at 60 Hz frequency. Zond's variable speed technology provides maximum energy capture, torque control, elimination of voltage flicker and power pulses, as well as power factor control. Zond's integrated drivetrain combines the mainshaft and the gearbox into one unit. The major attribute of Zond's variable speed technology is its ability to mitigate wind-induced torque spikes in the drivetrain and generator. This contributes to greater energy capture and reduction of the rotor and drivetrain loads, leading to a longer wind turbine lifetime.

The nacelle functions as a housing to protect the integrated drivetrain, generator, hydraulic brake and yaw gears from the outside environment. It is manufactured of fiberglass. The color is incorporated into the fabrication process and there is an outer, protective gelcoat layer similar to that on the blades. The nacelle, as well as the rotor, is positioned and held into the wind by a hydraulically-actuated, yaw drive system.

The Z-48 can be installed on either a lattice or tubular tower. Each tower has certain advantages. The lattice tower is the most economical, while the tubular tower offers protection to maintenance workers servicing the turbine in adverse weather conditions. Both tower designs are tapered, i.e., a larger base which tapers to a smaller dimension at the tower top. The lattice tower has been selected for the proposed windfarm.

The foundation for the lattice tower consists of four identical, steel-reinforced concrete caissons, one for each of the tower's four legs. The pads are designed for the specific soil conditions at the site. The approximate size of each caisson is 0.9m x 0.9m x 3.7m (3ft x 3ft x 12ft) and requires 3.1 cubic meters (12 cubic yards) of concrete or 12.4 cubic meters (48 cubic yards) per tower.

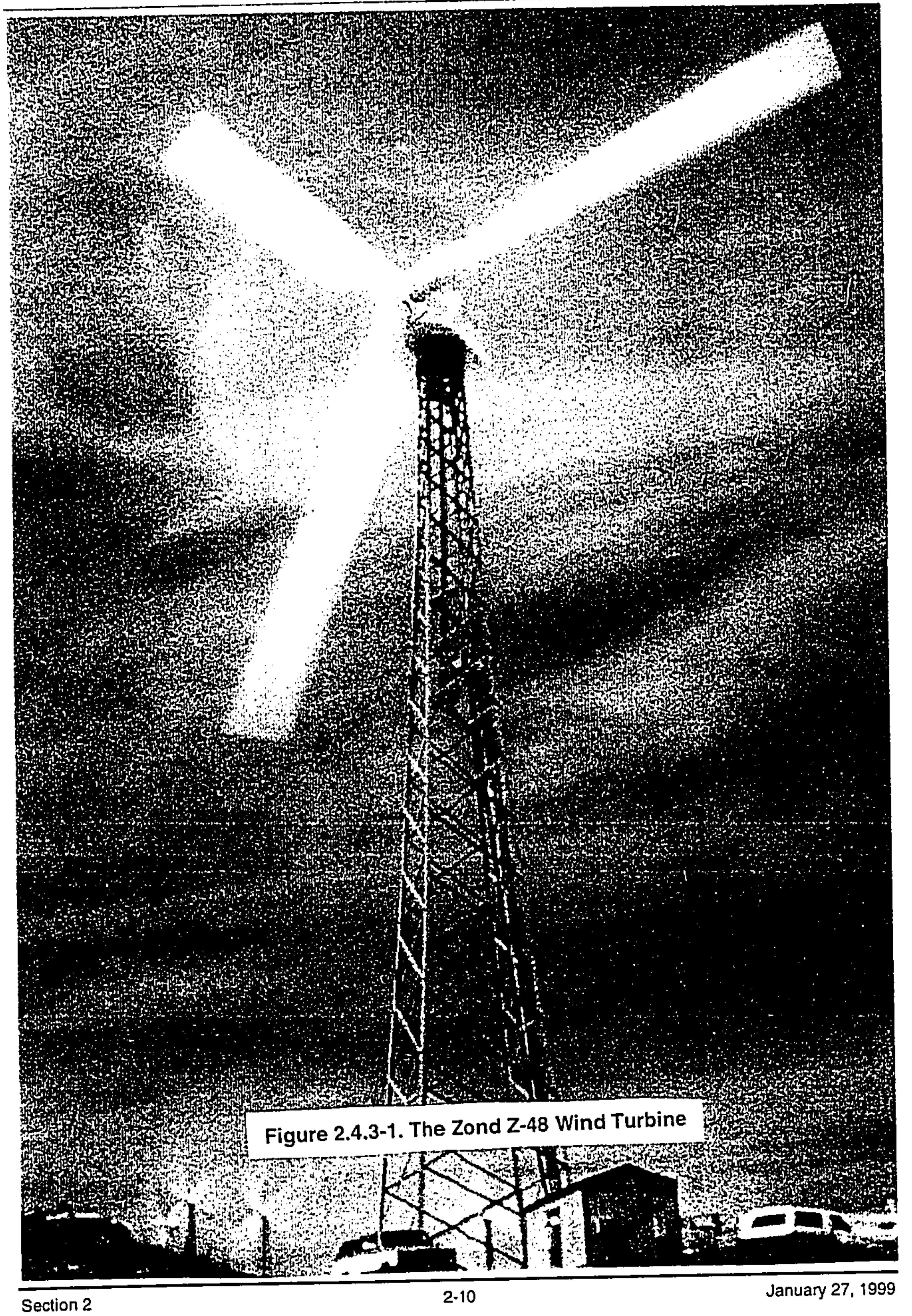

Figure 2.4.3-1. The Zond Z-48 Wind Turbine

Site Electrical Distribution Network. The output of each wind turbine would be transformed at the base of the tower to 12KV, collected and delivered to the site substation via the intrasite electrical distribution network. All electrical cabling and wiring would be buried in trenches approximately 0.6m (2ft) deep. All disturbed vegetation will be replaced in position.

Substation. The purpose of the substation and interconnection hardware is to transform and interconnect the electrical output from the intrasite electrical distribution network to MECO's transmission line. The 12KV output is first transformed to 69KV at the substation and then delivered to the interconnection point (exact location is to be determined in consultation with MECO). The interconnection point includes the primary metering equipment and emergency disconnect switches. See Figure 2.4.3-2

Intrasite Road Network and Site Access Road Network. All roads would be no more than 3.5m (12ft) wide and would be graded and maintained with gravel only where necessary. The design of the intrasite road network includes one main road about 2.6km (1.6mi) long and extends from the lower end of the site to the last turbine location at the upper end (See Figures 2.4.2-1 and 2.4.3-3). Individual spurs branch off from the main intrasite road to each turbine site. The operation and maintenance facility would be located close enough to the main road, such that a separate spur is not required.

The access road network includes the main jeep road that starts from the main highway, just east of McGregor point and the Manawainui Gulch. The road climbs steadily in the first mile and intersects with and joins the Old Lahaina Pali Trail at about 2.9km (1.8mi) *from the main* highway. The road/trail then crosses the Malalowaiaole Gulch. The road continues upward in a northwesterly direction as the trail continues eastward at a point about 3.7km (2.3mi) from the main highway. The jeep road continues for another 3.1km (1.9mi) where it reaches an old cattle corral and the intersection of the spur at Puu Anu. The spur [1.6km (1.0mi) long] connects to the upper end of the project site at an elevation of about 915m (3,000ft).

Operation and Maintenance Facility. A 6.1m x 12 m (20ft x 40ft) operation and maintenance facility would be constructed on a location approximately in the middle of the site. This facility would serve as the office for the site manager and maintenance workers. The windfarm system controller would be housed in the facility. The controller will provide for monitoring of the overall system, individual turbine and wind monitoring equipment operational status and performance. The system controller will have the capability of being operated remotely either by ZPAC or MECO. The facility will also provide for a small indoor work area and limited amount of spare parts storage.

Wind Monitoring Equipment. ZPAC plans to maintain six towers for monitoring the overall wind conditions at the site. These systems would provide data for analysis of the overall windfarm performance, as well as the long-term wind conditions at the site. The monitoring systems also provide wind direction input signals to the turbine yaw controller for maintaining the turbine's orientation into the wind.

2.4.4 Proposed Land Use Agreement

ZPAC has discussed alternative contractual arrangements with DLNR for securing the wind rights to the proposed site. Two options are under consideration: a lease and a term easement. A lease is generally used when a leasee wishes to secure the rights to an entire parcel of land, such as for grazing livestock. A term easement may be more appropriate when only a portion of the parcel is needed, as for a windfarm. Contractual negotiations with the Land Management Division are underway. This negotiation includes a land use fee which would be paid by ZPAC for the wind rights, conditions for granting access to the site for visitors, and restoration of the site at the end of the lease or easement period.

Figure 2.4.3-2. Computer-Simulated Photograph (Aerial View of the Site)

CORRECTION

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

Figure 2.4.3-2. Computer-Simulated Photograph (Aerial View of the Site)

Figure 2.4.3-3. Photograph of Proposed Site Substation

2.4.5 Proposed Power Purchase Agreement (MECO/ZPAC)

ZPAC has been negotiating a power purchase agreement with MECO and MECO's parent company, the Hawaiian Electric Company (HECO). There has been substantial agreement on the terms and conditions of the agreement. It is anticipated that the negotiations will be satisfactorily concluded soon.

The proposed term for the agreement is 25 years. MECO would purchase all the electricity the windfarm could produce subject to specified times when the utility would not be obligated, e.g., should operational circumstances require the windfarm to be shutdown or curtailed temporarily.

In general, MECO is willing to pay a non-utility generators (NUG) the utility's avoided cost for electricity delivered by the NUG to the utility's transmission system. Specifically, if the NUG can provide firm power, the NUG would receive both a capacity payment and an energy payment. For non-firm or as-available generators, the utility would make only the energy payment. At the present time, the proposed energy payment starts at approximately 5 cents per kWh and escalates at 1.5% per year for 20 years.

2.4.6 Construction Plan

Construction will proceed in two consecutive phases. During the first phase, the new access road would be constructed from the main highway to the lower end of the windfarm site. The routing of the new road is indicated in Figure 2.4.2-1. Care will be taken during the construction of this road to:

(1) minimize the amount of soil that must be disturbed,

(2) avoid disturbing native plants,

(3) avoid construction in areas where the slope of the terrain exceeds 30 degrees, and

(4) protect the existing watershed of the Manawainui Gulch.

During the second phase, construction of the windfarm would proceed in the following steps:

(1) construction of the main intrasite road and spurs to the individual turbine sites. Note: the main road would follow existing tracks on the site and would be improved only where necessary,

(2) construction of the operation and maintenance facility,

(3) excavation and installation of the individual turbine and transformer foundations,

(4) excavation and installation of foundations for the site substation and interconnection hardware,

(5) erection of towers, wind turbines and transformer,

(6) installation of the site substation and interconnection hardware, and

(7) excavation and installation of the intrasite electrical distribution network.

Note: see sections 3.5, 3.6 and 3.8 for additional discussion of the measures proposed to mitigate potential impacts on the topography, geology and soils; hydrologic resources; and flora.

2.4.7 Proposed Project Timeline

ZPAC estimates that the Phase 1 construction would take 3 months and the Phase 2 construction would take four to six months. Following the construction period, there would be a 3 month operational check-out and commissioning period.

2.5 Project Benefits

It is anticipated that MECO, DLNR, the citizens of Maui and the State, and ZPAC would all benefit as follows:

- *MECO would benefit by purchasing electricity at their avoided cost, reducing their use of fossil fuels, showing their support for renewable energy sources and diversifying their electrical power purchase portfolio;*
- *DLNR would benefit through collection of a land use fee.* This fee could be used to off-set a portion of the funds that have been spent by the State to develop renewable energy alternatives such as wind;
- *The citizens of Maui and the State would benefit from the energy, economic and environmental characteristics of the project:*
    - ◊ Energy - The windfarm would help diversify the energy resource base on Maui and *reduce* the amount of imported fossil fuels (estimated at the equivalent of 102,000 barrels of oil per year). *Avoidance of fossil fuels would help reduce energy security and price risks and would make Maui less dependent on oil and coal;*
    - ◊ Economic – There would be *direct* economic activity during construction and operation (temporary and permanent jobs, equipment, materials and supplies), and the project-related income and excise tax revenues over the project's lifetime. The primary *indirect* economic activity is stimulated by the reduction of the dollars that are paid for imported fossil fuels, i.e., those dollars recirculate on Maui and in Hawaii. In addition, a wind power purchase contract would specify the value (in cents/kWh) to be paid over contract lifetime. The price for the windpower is thus known and independent of the price of fossil fuels. Therefore, the ratepayers would benefit by saving the incremental cost of fossil fuels with respect to the cost of windpower; and
    - ◊ Environmental - Similarly, environmental benefits accrue from the reduction of fossil fuel use, i.e., fossil emissions would be reduced. There could be additional benefits to the environment through implementation of native plant and Nene propagation programs, as proposed by ZPAC; and
- ZPAC would benefit by the opportunity to recover its investment in the wind project and make a fair profit over the projected 30 year lifetime of the windfarm.

3. Existing Conditions, Environmental Consequences and Mitigation Measures

3.1 Introduction

The proposed action is the construction and operation of a 20 MW windfarm by ZPAC on the Kaheawa Pastures, Ukumehame ahupua'a, Maui. The project details are discussed in Section 2. The existing conditions and potential environmental consequences of the proposed action are described in this section. A program has been developed to mitigate potential consequences (impacts) of the proposed action. The engineering, environmental, and land jurisdiction and use characteristics for the proposed windfarm site are summarized in Table 3.1-1.

WSB-HAWAII identified and evaluated the potential consequences for the proposed action using the guidelines established in Section 12, Chapter 200, Title 11, State of Hawaii (SOH) Department of Health, Administrative Rules as authorized by Chapter 343, HRS. The significance of the impacts was then defined in terms of context, duration and severity (see also the discussion in Section 1.2.1).

WSB-HAWAII evaluated the potential impacts before and after proposed mitigation measures. These impacts are summarized in Table 3.1-2[2], including evaluation of the environmental consequences before and after the mitigation measures program. The details of this process are discussed below.

ZPAC's philosophy is to minimize the impact of its projects on the environment. While DLNR may approve a project that has an overall impact of *non significant*, ZPAC's goal is mitigate all impacts such that the potential impacts are evaluated as *beneficial* or in the worse case as *negligible."*

ZPAC designs its windfarms to be *compatible* with existing and planned land uses to the *mutual* benefit of the landowner and ZPAC. To ZPAC, *compatible* means the proposed use does *not* preclude or interfere with an existing or planned use and the proposed use is *consistent* with the existing or planned use. *Mutual* benefit means both the landowner and ZPAC have access to the land and both can benefit from the land.

For example, windfarms can be compatible on agricultural lands that are used primarily for grazing livestock. There are many windfarms that have been constructed and operated successfully on ranch lands in Hawaii, California and other states. The landowner derives *multiple* income streams from his own agricultural ventures, such as livestock, and from fees charged to the windfarm operator for the *wind rights* to his land. The windfarm operator benefits through the access to the windy land and the sale of the wind-generated electricity to the utility.

In Hawaii, ZPAC's goal is to design windfarms to be compatible with conservation lands, including their primary uses, e.g., protection the native flora and fauna, grazing of livestock and recreation in some locations. In this case, the State, as custodian of proposed windfarm site, could derive revenue for the wind rights. Note that using 1% of the land area may produce equal revenue to a grazing lease that uses 99% of the land area.

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[2] Identical to Table 1.2.1-2

Table 3.1-1
Windfarm Site Characterization

Factor	Engineering/Environmental/Land Ownership/Land Use
Design	
Site	Narrow band of land running mauka to makai on the Kaheawa Pastures from 976m (3,200ft) to 610m (2,000ft) above sea level
Site Layout	Consists of individual turbines with towers and foundations, electrical distribution network, interconnection substation, meteorological towers, operation and maintenance facility, and intrasite road network. Access to individual turbine sites would be provided by spurs from the main road.
Turbine Rating - kW	750
Number of turbines	27
Rotor Diameter	48m (157ft)
Height of towers	50m (164ft)
Turbine Layout	One articulated row approximately 2,500m (8,200ft) long
Site access	Site access would be via a main jeep road that starts from the main highway, just east of McGregor point and the Manawainui Gulch, and a spur. The total distance traversed is approximately 8.4km (5.2mi). The main road joins and crosses the Old Lahaina Pali Trail, then reaches the spur near Puu Anu at approximately 6.8km (4.2mi). The spur [1.6km (1.0mi) long] connects to the upper end of the project site at an elevation of about 915m (3,000ft).
Distance from substation to MECO transmission line	61m (200ft)
Environmental	
EA approval	SOH Department of Land and Natural Resources, Land Management Division
Major Stream/ Gulch Crossings	
Site	None
Access Road	Upper portion of the Manawainui Gulch
Archaeological Sites	
Site	None
Access Road	None
Geologic Formation	A' and pahoehoe basalt, Wailuku series (Tw); andesitic lava, Honolua series (Tw)
Soils Types	Honolua/Olelo Association
Vegetation Types	Mixed Grass/Shrubland
Birds and Wildlife Types	Mixed Native/Migratory Species
Land Ownership	
Site	SOH DLNR
Access Road Network	SOH DLNR
Land Use Designations	
Site	Conservation District, General Subzone
Access Road Network	Conservation District, General Subzone

Table 3.1-2*
Summary of Potential Environmental Consequences and Impacts

Without Mitigation Measures				Following Mitigation Measures			
Factor	**Context**	**Duration**	**Severity**	**Mitigation Measures**	**Context**	**Duration**	**Severity**
Land Use							
Conservation	Local	Short-term	Significant.	Coordinate land use planning with DLNR	Local	Short-term	Non Sig.
	Local	Long-term	Significant	Coordinate O&M procedures with DLNR	Local	Long-term	Non Sig.
MECO lines	Local	Short-term	Negligible	Coordinate route design/installation	Local	Short-term	Beneficial
	Local	Long-term	Negligible	Define/coordinate detail site O&M procedures	Local	Long-term	Beneficial
Grazing/ Hunting	Local	Long-term	Negligible	Define/coordinate detail site O&M procedures	Local	Long-term	Negligible
Topography							
Proposed Site	Local	Short-term	None	None Required	n. a.	n. a.	n. a.
		Long-term	None	None Required	n. a.	n. a.	n. a.
Site Access	Local	Short-term	None	None Required	n. a.	n. a.	n. a.
		Long-term	None	None Required	n. a.	n. a.	n. a.
Geology							
Proposed Site	Local	Short-term	None	None Required	n. a.	n. a.	n. a.
		Long-term	None	None Required	n. a.	n. a.	n. a.
Site Access	Local	Short-term	None	None Required	n. a.	n. a.	n. a.
		Long-term	None	None Required	n. a.	n. a.	n. a.
Soils							
Proposed Site	Local	Short-term	Not Sig.	Minimize grading/ replace grass/water	Local	Short-term	Negligible
	Local	Long-term	Not Sig.	Repair new damage/ replace grass/water	Local	Long-term	Negligible
Site Access	Local	Short-term	Not Sig.	Minimize grading/ repair damage/water	Local	Short-term	Negligible
	Local	Long-term	Not Sig.	Grade periodically/ repair damage/water	Local	Long-term	Negligible

*Note: Table 3.1-2 and Table 1.2.2-1 are identical

Table 3.1-2
Summary of Potential Environmental Consequences and Impacts
(Continued)

	Without Mitigation Measures			Following Mitigation Measures			
Factor	Context	Duration	Severity	Mitigation Measures	Context	Duration	Severity
Hydrology and Water Resource	Local Local	Short-term Long-term	None None	None Required None Required	n. a. n. a.	n. a. n. a.	n. a. n. a.
Terrestrial Flora	Local Local	Short-term Long-term	Non Sig. Non Sig.	Coordinate route and site design/installation Define/coordinate detail site O&M procedures	Local Local	Short-term Long-term	Negligible Negligible
Fauna Birds	Local	Short-term Long-term	Significant Significant	Conduct new surveys/ Implement mitigation measures	Local/ Regional	Short-term Long-term	Non Sig. Non Sig.
Mammals	Local	Short-term Long-term	Non Sig. Non Sig.	Implement mitigation measures	Local	Short-term Long-term	Negligible Negligible
Cultural Resources	Local/ Regional	Short-term Long-term	Non Sig. Non Sig.	Implement mitigation measures	Local	Short-term Long-term	Negligible Negligible
Socioeconomics	Local Regional	Short-term Long-term Short-term Long-term	Beneficial Beneficial Beneficial Beneficial	None Required None Required None Required None Required	n. a. n. a. n. a. n. a.	n. a. n. a. n. a. n. a.	n. a. n. a. n. a. n. a.
Infrastructure	Local	Short-term Long-term	Negligible Negligible	None Required None Required	n. a. n. a.	n. a. n. a.	n. a. n. a.
Public Services & Facilities	Local/ Regional	Short-term Long-term	Non Sig. Non Sig.	Implement emergency response procedures	Local/ Regional	Short-term Long-term	Negligible Negligible

3.2 Overview of the Environmental Setting

The proposed 20 MW windfarm would be located on a narrow 200 acre band of land running mauka to makai in the Kaheawa Pastures, Ukumehame ahupua'a (Ukumehame Conservation District Land) approximately four miles mauka of McGregor Point on the south shore of Maui. Site access would be via a main jeep road that starts from the main highway, just east of McGregor point and the Manawainui Gulch, and a spur. The total distance traversed would be approximately 8.4km (5.2mi). The main road climbs steadily from the main highway joining the Old Lahaina Pali Trail at a distance of about 2.9km (1.8mi) just before the road crosses Malalowaiaole Gulch. Leaving he Old Lahaina Pali Trail at about 3.7km (2.3mi), the roads climbs steadily reaching the spur near Puu Anu at approximately 6.8km (4.2mi). The spur [1.6km (1.0mi) long] connects to the upper end of the project site at an elevation of about 915m (3,000ft). Use of this spur shortens the distance traveled by about one mile and avoids two miles of upper, more sensitive areas of the ahupua'a.

The wind turbines would be installed in a single articulated row between and mauka of the two sets of MECO transmission lines where they cross the Kaheawa Pastures en route from the Maalaea Power Plant to Lahaina. The upper two transmission lines cross the Kaheawa Pastures at an elevation of approximately 701m (2,300ft). The lower (third) line crosses the pastures about 579m (1,900ft) and 1.6km (1mi) makai of the upper two lines. Seven of the turbines would be located between the two sets of transmission lines, 20 would be mauka of the upper lines. The uppermost turbines would be at approximately 976m (3,200ft) elevation, the lowermost at approximately 610m (2,000ft).

The terrain on the proposed windfarm site slopes downward (average of 8%) towards the ocean. There are broad-sweeping panoramas of Mt. Haleakala, Kihei, Maalaea and the Maalaea Bay to the east; the Kahoolawe and Molokini islands to the south; and Lahaina and the West Maui Mountains to the west. The key topographic and geologic features are the Kealaloloa Ridge to windward and several puu's. These include Puu Luau [near where the MECO transmission lines at an elevation of about 701m (2,300ft)] and Pohakuloa [at about 488m (1,600ft) elevation at the lower end of the Kaheawa Pastures and makai of the proposed site]. There are no known archaeological sites in the study area.

The site vegetation is a mixed grassland and shrubland type and is dominated by non-native grasses. There are more native species on the lower end of the parcel. The existing access road passes areas of small trees as it ascends to the upper areas. The Forestry and Wildlife Division has released approximately 62 Nene in the area above the proposed site. A number of avian species are known to inhabit the area. The climate is moderately dry with 0.51m (20in) of rainfall a year at the lower elevations 152m (500ft) to 2.03m (80in) at a year 1,067m (3,500ft). The site is excellent exposure to the trade winds, which accelerate over the Kealaloloa Ridge.

3.3 Land Description: Ownership, Designation, Zoning and Regulation

The proposed windfarm site land ownership, land designation, zoning and regulation are described in this section. Details on approvals and permits are discussed in Section 4.

3.3.1 Ownership

The State of Hawaii (SOH) owns the land on which ZPAC proposes to construct and operate a 20 MW windfarm and most of the land on which the existing jeep roads have been constructed. DLNR administers the use of the land for the SOH.

A right-of-entry and term easement would be required from DLNR for access to and use of the site. See Sections 2.4.3 and 3.5 for more details.

3.3.2 Designation, Zoning and Regulation

The State Land Use Commission, pursuant to HRS, Chapter 205, has established land use districts throughout the State. All lands in Hawaii are designated into one of the following four districts: Urban, Rural, Agricultural and Conservation. The proposed site and the proposed new access road are both located in the Ukumehame Conservation District.

Per HRS, Chapter 183, Conservation District lands are further divided into five zones, referred to as subzones (from *least* to *most* restrictive): general, resource, limited, protective and special. The proposed site and the access road are both located in the "general" subzone.

Each subzone has specific, and generally, different uses. The general subzone *incorporates all the permitted uses in the more restrictive subzones.* Note that the proposed windfarm is a permitted use in the more *restrictive* protective subzone. Specifically, referencing the DLNR Administrative Rules, Title 13, Chapter 5 (SOH, 1994), which are based on HRS, Chapter 183 authority (SOH, 1987), there are 12 *permitted* uses in the protective subzone. One of these, P-5 (Public Purpose Uses), includes:

> "Transportation systems, transmission facilities for public utilities, water systems, *energy generation facilities* utilizing the *renewable resources* of the area (e.g., hydroelectric or *wind farms*) and communication systems and other such land uses which are undertaken by non-governmental entities which benefit the public and are consistent with the purpose of the conservation district."

Therefore, it is implied that, subject to review and approval, a windfarm is a permitted use in both the protective and less restrictive general subzones.

All uses of the Conservation District require the approval of a Conservation District Use Permit (CDUP). In the case of the proposed windfarm, the specific permit required is a *Board Permit.* ZPAC must apply, subject to section 13-5-31 of DLNR's rules and review and approval by the Board of Land and Natural Resources.

The details of all required approvals and permits are discussed in Section 4.4.

3.4 Land Use: Existing and Proposed Land Uses

This section includes a discussion of existing conditions, including current and planned land use, and the potential impact of the proposed action on existing and planned land uses. Mitigation measures are proposed and discussed, including an evaluation of the impact consequences before and after mitigation measures. Refer to Table 3.1-2 for a summary of the environmental consequences of the proposed action and mitigation measures program.

3.4.1 Existing Conditions

Current Land Use

The primary uses of the proposed site and the general area are those of the Conservation District, i.e., maintenance of plant and wildlife sanctuaries, protection of restricted watersheds, and preservation of archaeological, geological sites and open space. The State has an ongoing wildlife preservation program in the general area. This program includes the release of native Nenes in an area mauka and west of the proposed windfarm. The Lahaina Pali Trail, part of the State's Na Ala Hele Trails and Access Program and Maui's demonstration trail for the program, traverses the general area. The trail is makai [1,065m (3,500ft) at the closest point] and below [152m (500ft) in elevation] from the proposed windfarm site. The trail reaches its highest point [488m (1,600ft)] near where the trail joins the primary access road and crosses the Malalowaiaole Gulch. The objectives of the State's Na Ala Hele Trails and Access Program are to: (1) enrich recreation for all ages through trails and facilities, (2) establish coastal and mountain trail networks, (3) preserve archaeological and ecological values of trails, (4) encourage a private/ public state trail system, and (5) expand volunteer programs.

Another use of this Conservation District Land, is a transmission line easement for Maui Electric Company Ltd. (MECO). Three transmission lines connect MECO's Maalaea powerplant to their Lahaina substation. These lines cross the Kaheawa Pastures in a southwesterly direction from Maalaea. Two lines cross the pastures at an elevation of approximately [701m (2,300ft)], the third line, makai of the first two, at about [579m (1,900ft)]. Portions of Conservation District Land have been used for grazing of livestock in the past.

Planned Land Use

There are no planned land uses identified in the Maui County General Plan or the West Maui Community Plan for the study area. See Section 4 for a discussion of the relationship of the proposed action to the goals and objectives of the County General Plan and the West Maui Community Plan. After consulting with DLNR and MECO, ZPAC is aware of no new immediate planned uses for the proposed project area. However, there is the possibility that some time in the future an applicant could seek a lease for grazing livestock and DLNR is considering allowing bird hunting in this general area of the Ukumehame District.

3.4.2 Potential Impacts on Current and Planned Land Uses

This section includes a discussion of the impact of the proposed changes in land use, and identification and evaluation of the potential environmental consequences. See Section 4 for a discussion of the consistency of the projects goals and objectives with local, State and Federal, environmental and land use plans and policies. WSB-HAWAII believes the potential land use impacts can be avoided through careful siting of the windfarm and early consultation with landowners, agency representatives and other parties.

Current Land Use

WSB-Hawaii believes the proposed windfarm use is compatible with the current land uses, including the primary directive of Conservation District Lands and MECO's use of the land for its transmission lines.

Conservation District

Some concerns regarding possible impacts on flora and fauna were raised during ZPAC's previous application for access to the site to conduct a wind monitoring program. These were addressed satisfactorily in the project EA (DLNR, 1996) and a CDUP (File No. MA-2778) was issued. Similar concerns have been raised during the preparation and review of the draft EA. Copies of letters from reviewers and ZPAC's responses are included in Section 6. See also Sections 3.7 and 3.8 for a detailed discussion of potential impacts on flora and fauna.

ZPAC initially consulted with the State's Na Ala Hele Trails and Access Program in conjunction with the wind measurement CDUA. Based on those discussions, ZPAC decided to relocate two wind turbine sites (originally planned to be located below the lower transmission lines) to locations above the lower transmission lines. These relocations will reduce the impact to the viewplanes along the trail. See also discussion of visual impacts in Section 3.16.

MECO Transmission Lines

The proposed windfarm is fully compatible with MECO's transmission lines. In fact, proximity to the utility's transmission system is one of the key criteria for ZPAC's selection of the Kaheawa Pastures site for the proposed *windfarm*.

ZPAC has not determined which of MECO's line (s) would be used to interconnect the windfarm. ZPAC would coordinate with MECO to study alternative interconnection strategies. There are potential short-term and long-term hazards inherent to the utility's transmission line and personnel during construction and operation of the windfarm. ZPAC would coordinate its planning and operational activities to ensure compatibility and safety.

Planned Land Use

It is possible that another party may apply to DLNR for livestock grazing rights and or that DLNR may allow bird hunting in the project area. In general, the installation and operation of windfarms have been found to be compatible with the grazing, including both cattle and sheep. ZPAC has direct experience with windfarms sited on ranch lands in California. There is also a history of this dual use in Hawaii, such as the windfarm at Kahua Ranch on the Big Island. Ranch and farm owners in windy areas have found that this dual use is not only compatible, but financially beneficial. The ranch owner can benefit not only by grazing his cattle, but also collecting a fee for the *wind rights* on his property. Thus, ZPAC believes that the existence of a windfarm on Conservation District Land would not preclude livestock grazing (See Figure 3.4.2-1). ZPAC believes that bird hunting would also be a compatible use and would not negatively impact windfarm operation.

Evaluation

WSB-Hawaii believes the proposed action is compatible with the existing and planned uses of this parcel of Conservation District Land, MECO's transmission lines and potential livestock grazing and bird hunting. There are, nevertheless, potential impacts. These impacts extend and include other elements that are discussed in other sections of this FEA. Consequently, an evaluation of the severity of total impact necessarily includes these other elements of the land and its inhabitants or users. See "topography, geology and soils" (Section 3.5), "hydrology and water resources" (Section 3.6), "terrestrial flora" (Section 3.7), "fauna" (Section 3.8), and "visual impact" (Section 3.16).

Therefore, the total impact to Conservation District Land use *can not be less* than the impact to any of these other elements.

Given the above, WSB-HAWAII evaluates the severity of the potential impacts of the proposed action to the following:

(1) Primary Conservation District Land uses – "significant,"

Note: per Section 3.8, the potential impact on fauna is evaluated as significant. The other impacts are evaluated as non significant or less.

(2) MECO's transmission lines -- "negligible,"

(3) Potential livestock grazing and bird hunting uses -- "negligible," and

(4) Total Land Use Impact – "significant."

With mitigation, WSB-HAWAII believes the impacts can be reduced as discussed below.

3.4.3 Mitigation Measures

ZPAC proposes a mitigation program to ensure that the proposed action is fully compatible with the primary uses of the Conservation District, MECO's easements for their Transmission Lines and other potential uses of the land, e.g., livestock grazing and bird hunting.

Conservation District

The mitigation program includes measures to:

(1) minimize hazards and prevent damage to the topography, geology and soils during the construction and operational phases of the proposed action. See Section 3.5 for details;

(2) minimize hazards and prevent damage to the hydrology and water resources during the construction and operational phases of the proposed action. See Section 3.6 for details;

(3) minimize hazards and prevent damage to flora and fauna and their habitats during the construction and operational phases of the proposed action. See Sections 3.7 and 3.8 for details; and

(4) reduce visual impact of the project. See Section 3.16, and (5) to coordinate the on-going planning and operational activities with DLNR and other agencies as appropriate.

MECO Transmission Lines

Similarly, ZPAC proposed to mitigate possible impacts with MECO's transmission lines by:

(1) coordinating on-going planning, construction and operational activities with MECO. It is possible that some activities would be of mutual benefit, e.g., construction of the new site access road and provision of on-site emergency medical capabilities;

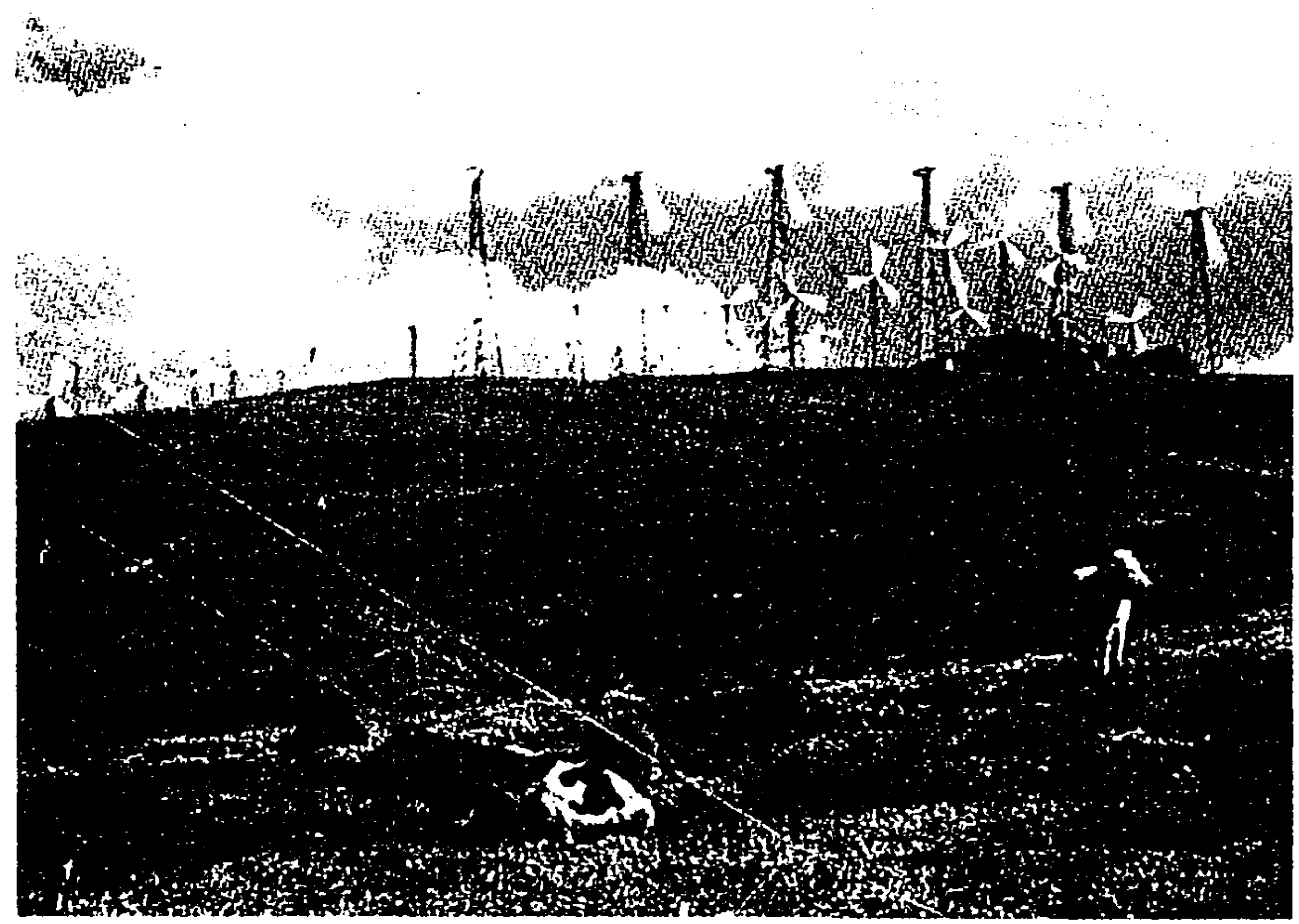

Figure 3.4.2-1. Windfarm in Ranch Country

(2) routing and installing the windfarm's interconnection line to MECO's transmission system to avoid endangered plants and wildlife or their habitats;

(3) exercising caution to minimize damage to all other plants and wildlife; and

(4) installing the windfarm's interconnection line to MECO's transmission system safely to avoid damage to MECO's system and personnel. For example, removal of existing grasses would be held to absolute minimum during the installation of transmission line and maintenance access roads.

Potential Use of the Windfarm Site for Livestock Grazing and Bird Hunting

ZPAC would work with an applicant(s) and DLNR to plan additional use of the windfarm site for grazing and or bird hunting. Specifically, ZPAC would address concerns by DLNR and the applicant, e.g., grazing on portions of the land may *not* be appropriate, if additional study shows endangered plants that might be impacted by livestock grazing. ZPAC wishes to cooperate with an additional tenant(s) and user(s) by planning and collectively managing the use of common areas.

Evaluation

Based on the implementation of the mitigation program as discussed above and in the subsequent sections, WSB-HAWAII evaluates the severity of the potential impacts of the proposed action as follows:

(1) *Primary Conservation District Land uses -- "non significant,"*

Note. This evaluation assumes that all other potential impacts on the key elements of the conservation land use are mitigated to non significant or less.

(2) *MECO's transmission lines -- "beneficial,"*

(3) *Potential livestock grazing uses and bird hunting -- "negligible," and*

(4) *Total Land Use Impact -- "non significant."*

3.5 Topography, Geology and Soils

This section includes a description of the topography, geology and soils in the study area and identification and evaluation of the potential environmental consequences of the proposed action on these resources. Note: the study area includes the windfarm site and the site access. Mitigation measures are proposed and discussed, including an evaluation of the impact consequences before and after the mitigation measures program. Refer to Table 3.1-2 for a summary of the environmental consequences of the proposed action and mitigation measures program.

3.5.1 Existing Conditions

Topography

The study area is located in southeastern portion of the West Maui mountains principally in the Ukumehame ahupua'a. The proposed 20 MW windfarm would be located on Conservation District land on the Kaheawa Pastures approximately 6.4km (4mi) mauka of McGregor Point. The dominant topographic features in the study area are the Kealaloloa Ridge, which is east of the proposed windfarm site; the Manawainui Gulch, which borders the site on the east; the Malalowaiaole Gulch, which is southeast and makai of the site; the Papalaua Gulch which is west of the site; and several puu's. The puu's include Puu Luau (near the existing MECO transmission lines at an elevation of about 701m (2,300ft) and east of the proposed turbine locations], and Pohakuloa [at about 488m (1,600ft) elevation at the lower end of the Kaheawa Pastures and makai of the site]. The Kealaloloa ridge separates the isthmus area of Maui and Maalaea from the coastal plains around Olowalu, the Kaheawa Pastures and Lahaina to the west. The route of MECO's transmission lines extends from Maalaea across the Kaheawa Pastures in a southwesterly direction. The upper two lines cross an elevation of approximately 701m (2,300ft), the lower line at about 579m (1,900ft) and about 1.6km (1.0mi) makai of the upper two lines.

Windfarm Site

The windfarm would be located on a narrow band of land running mauka to makai between the Manawainui Gulch and the Papalaua Gulch. The turbines will be installed in a single articulated row between and above MECO's three transmission lines that extend from the Maalaea Power Plant to Lahaina. Twenty of the 27 turbines would be located mauka of the upper lines. The uppermost turbine would be at approximately 976m (3,200ft) elevation, the lowermost at approximately 610m (2,000ft). The slope of the terrain across the site varies averages about 8%. The landscape is dominated by native grasses and rocks. There are broad-sweeping panoramas of Mt. Haleakala, Kihei and Maalaea Bay to the east, Kahoolawe and Molokini islands to the south, and Lahaina and the West Maui Mountains to the west. There are no significant topographic features on the site itself.

Site Access

Existing. The existing site access is via jeep roads over a total distance of approximately 10km (6.2mi) from the Honoapiilani Highway. The initial climb from main highway is steep (13 to 15% grades in places). The road intersects the Lahaina Pali Trail and crosses the Malalowaiaole Gulch at an elevation of 488m (1,600ft) and 3.4km (2.1mi) from the highway. The road continues northwesterly for another 122m (400ft) in elevation reaching the Kealaloloa Ridge at approximately 4.8km (3.0mi) from the main highway. The slope of the road lessens as it enters the upper ridge, grassland area. The road continues for another 1.6km (1mi) reaching the intersection of another jeep road near Pu'u Anu at approximately 854m (2,800ft) elevation, about 6.8km (4.2mi) from the highway. There are some low-lying bushes and trees along the road which reaches the 1,067m (3,500ft) elevation approximately 8km (5mi) from the main highway.

Access to the proposed site continues via a secondary jeep road which proceeds southwest and then left and down on a spur to the southeast towards the ocean. The road reaches a gate at about 9.2km (5.7mi) from the main highway. The road continues and loses its definition as it turns into an unimproved set of tracks as it reaches upper end of the windfarm site at about 10km (6.2mi) from the main highway.

Proposed Access Route. As discussed previously, ZPAC proposes to utilize the main jeep road up to an elevation of 854m (2,800 ft) near Puu Anu and an alternate spur from there to the site. The spur crosses an upper portion of Manawainui Gulch and reaches the upper end of the proposed wind site at an elevation of 915m (3,000ft). ZPAC would improve the main jeep road and the spur to allow transport of heavy equipment to the site. Refer back to Section 2.4.3 for details.

Geology

"The West Maui mountains were formed by the West Maui volcano, which is part of the Hawaiian Emperor volcanic chain of island of islands and seamounts (MECO, 1994). Together, the West Maui volcano and Haleakala are the two volcanoes which form the island of Maui. The two volcanoes are separated by a flat isthmus composed of lava flows locally covered by dune sand and alluvial deposits. The most common formation in West Maui is basaltic a'a and pahoehoe lava flows of the Wailuku Volcanic Series (Tw) with selected cinder cones, friable vitric tuff and weathered andesitic lava."

Windfarm Site

There are several geologic features on or near the windfarm site. These include Puu Luau [near the existing MECO transmission lines at an elevation of about 701m (2,300ft)] and Pohakuloa [at about 488m (1,600ft) elevation makai of the lower end of the site).

Access Roads

There are no unique or unusual geologic resources or conditions known to exist on or along the existing access roads.

Soils

There are two main soil associations in the Kaheawa Pastures: the *Hoolua-Olelo* and the *Rock land-Rough mountainous land* (USDA, 1972).

Honolua-Olelo Association. "The Honolua-Olelo association is defined as deep, gently sloping to moderately steep, well-drained soils that have a fine-textured subsoil on intermediate uplands, such as on West Maui. These soils developed materials weathered from basic igneous rocks. The natural vegetation is guava, ferns, hilograss, koa, lantana, ohia lehua and pukawe."

"Honolua soils make up about 40 percent of the association, and Olelo soils about 35 percent. Halawa, Naiwa and Oli soils make up the rest. Honolua soils have a surface layer of dark-brown, friable silty clay. Their subsoil is dark reddish-brown to reddish-brown, friable silty clay. Their substratum is soft, weathered basic igneous rock. Olelo soils have surface layer of dark reddish-brown to dusky-red, friable silty clay, and their substratum is also soft, weathered basic igneous rock." This association is used for pineapple, pasture, woodland, wildlife habitat and water supply. Olelo soils are used mainly for pasture, and Honolua soils for pineapple and woodland. Upland game birds make up most of the wildlife population."

Rock land-Rough mountainous land association. The Rock land-Rough mountainous land association is defined as very shallow, steep and very steep, rock land and rough mountain land. The natural vegetation on Rock land is keawe, klu, piligrass and ilima in the lower, drier areas and guava, pukawe and molasses-grass in the higher, wetter areas. Rough mountainous land is thickly vegetated with ferns, guava, hilograss, kukui and ohia lehua."

"This association consists of very shallow soils on intermediate and high uplands on East and West Maui. These soils are steep and very steep. This association makes up about 41 percent of the island." "Rock land makes up about 50 percent of the association and Rough mountainous land about 30 percent. Cinderland, Lava flows, Aa, rock outcrop, Rough broken land, and Rough broken and stony land make up the rest. Rock land consists of areas where rock outcrop covers 60 to 80 percent of the surface and soil is 2 to 10 inches thick over bedrock. Rough mountainous land has very shallow soils, and local relief is generally more than 500 feet. There are many small streams throughout the area."

"This association is used mainly for wildlife habitat and water supply. Small acreages of Rock land are used for pasture. Upland game birds make up most of the wildlife population."

Windfarm Site

The primary soil conditions on the proposed windfarm site are of the Honolua-Olelo association. The soils on the proposed windfarm site are Olelo silty clay (upper portion of the site), Naiwa silty clay loam (middle portion), and Oli silty loam (lower portion).

Access Road

The primary soil conditions along the access road are primarily of the Rock land-Rough mountainous land association. Along the lower portion of the existing road, the soils are Rock land. Along the upper portion of the existing road, there are also sections with Rough Broken land and soils of the Honolua-Olelo Association. Principally, these latter soils are the Olelo silty clay and the silty clay loam. The primary soil in the area proposed for the new access road is Rock land.

3.5.2 Potential Impacts

This section includes the identification and evaluation of potential environmental consequences to local topography, geology and soils during construction and operational activities.

<u>Topography</u> -

There are no significant topographic features on the proposed windfarm site or along the proposed new access road. There are potential hazards due to construction of the new road. The primary hazards are to the soils and primarily during the construction phase. These are discussed below.

<u>Geology</u>

Potential impacts would be avoided by proper siting of the windfarm. Specifically, the individual turbines, intrasite roads, access road and the maintenance facility would be sited to avoid the puu's.

<u>Soils</u>

There are areas, principally in the gulch crossings, where the slope is sufficient for potential soil erosion, but not extreme enough to warrant concern for instability.

Windfarm Site

The intrasite road network would follow existing tracks were possible and would be graded only when necessary. All roads would be approximately 3.5m (12 ft) wide. Excavation would include holes for tower foundation caissons, the site operations and maintenance (O&M) facility and site interconnection substation. Thus, there are potential hazards to the soils on the site. Specifically, removal (clearing) of vegetation and disturbance of the upper layer of soil presents an increased erosion hazard during and immediately following construction. During the operational period of the project, there would continue to be some risk of additional damage to the soils.

Site Access

ZPAC plans to improve the main jeep road from the main highway up to Puu Anu and the spur from there to the proposed windfarm site (See Figure 2.4.2-1). The primary improvements to the main road would be grading and filling with gravel (or other fill material)to smooth the surface and widening of some sections up to a maximum of 4.6m (15ft).

The spur road is not currently in use and requires more extensive improvements. Sections of the existing road which are highly eroded may need to be relocated. Also, since the spur crosses the Manawanui Gulch, ZPAC is consulting with the DLNR Water Resources Division regarding the possible need for a Stream Channel Alteration Permit (SCAP).

The hazards are similar to those on the windfarm site as discussed above. Similarly, during the operational period of the project, there would continue to be some risk of additional damage to the soils along the access road.

Evaluation

Based on the discussion above, WSB-HAWAII evaluates the severity of the potential impacts of the proposed action to the following:

(5) *Topography -- "none,"*

(6) *Geology -- "none," and*

(7) *Soils -- "non significant."*

With mitigation, the severity of the environmental consequences to the soils on the windfarm site and along the site access can be reduced.

3.5.3 Mitigation Measures

In this section, mitigation measures are proposed and discussed. Refer to Table 3.1-2 for a summary of the environmental consequences and mitigation measures program.

Topography

No mitigation measures are required.

Geology

No mitigation measures are required.

Soils

Windfarm Site

Mitigation measures are required both during and immediately following the construction period and during the operation of the windfarm. ZPAC plans to implement the following mitigation program:

Construction Period.

- the number of intrasite roads would be minimized. The main road widths would be held to 4.6m (15ft). Spurs to individual turbine sites would be graded only if needed;
- construction (road grading, grubbing, etc.) would not be carried out in periods of high winds (excess of 40 mph) or in wet conditions (during or after heavy rain periods) to reduce the potential for wind and water erosion,
- the size of the turbine site would be minimized,
- equipment would be used to compact the road and site surfaces to further reduce the potential for wind erosion,

- equipment would be used to compact the road and site surfaces to further reduce the potential for wind erosion,
- all disturbed grass (not in the road or site beds) would be replaced, and
- the roads would be sprayed periodically with water to reduce the potential for dust.

<u>Operational Period</u>

- maintenance crews and vehicles would use the prepared roads and site bases exclusively, i.e., there would be no "shortcutting" across the grassland,
- crews would maintain the roads on a regular schedule and when necessary to repair ruts or erosion, and
- all equipment would be stored inside the O&M facility or on designated graded parking areas only.

Site Access

WSB-HAWAII believes the primary mitigation measure on this proposed action is the avoidance of the upper, more sensitive areas of the ahupua'a. Specifically, improvements would not be required for the roads in the upper areas and potential damage would be avoided. Additional mitigation measures are required both during and immediately following the construction period and during the operation of the windfarm to reduce the hazards and damage to the soils along the access road. ZPAC plans to implement the following mitigation program:

<u>Construction Period</u>.

- extreme care and caution would be exercised during the improvement of the main jeep road and the upper spur to minimize damage to and loss of vegetation,
- any alterations to the upper spur would be designed to minimize the total length required, while maintaining a safe gradient for vehicular travel,
- construction (road grading, addition of materials, etc.) would not be carried out in periods of high winds (excess of 40 mph) or in wet conditions (during or after heavy rain periods) to reduce the potential for wind and water erosion,
- equipment would be used to compact the road surfaces to further reduce the potential for wind and water erosion,
- all disturbed grass (not in the road) would be replaced, and
- the road bases would be sprayed with water as necessary following the initial construction period to reduce the potential for dust.

<u>Operational Period</u>.

- vehicles would be driven in a safe and prudent manner,
- crews would maintain the roads when necessary to repair ruts or erosion,
- all disturbed grass (not in the road) would be replaced or reseeded, and
- the road bases would be sprayed with water to reduce the potential for dust

<u>Evaluation</u>

Based on the implementation of the mitigation program as discussed above, WSB-HAWAII evaluates the severity of the potential impacts of the proposed action to the following:

(1) Topography -- "none,"
(2) Geology -- "none," and
(3) Soils -- "negligible."

3.6 Hydrology and Water Resources

This section includes a description of the hydrology and water resources in the study area and identification and evaluation of the potential environmental consequences of the proposed action on these resources. Note: the study area includes both the windfarm site and the site access. Mitigation measures are proposed and discussed, including an evaluation of the impact consequences before and after the mitigation measures program. Refer to Table 3.1-2 for a summary of the environmental consequences of the proposed action and mitigation measures program.

3.6.1 Existing Conditions

Rainfall in West Maui varies from only 0.51m (20in) at the coast to 10.16m (400in) in the higher elevations. The rainfall on the proposed windfarm site is unknown. The rainfall is estimated to be between 1.27m (50in) at 2,100ft and 1.27m (80in) at 3,000ft elevation inches a year across the site. There are no perennial streams in the study area. There are two intermittent streams which develop during rainy periods in the Malalowaiaole and Manawainui Gulches. There are no 100-year flood zones identified on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps at or near the mouths of the Malalowaiaole and the Manawainui Gulches. There are no tsunami inundation zones in the study area.

As discussed previously, the soils on the proposed site are from the Honolua-Olelo association. These soils drain well and run-off is generally very slow to medium, permeability is moderately rapid, shrink-swell potential is low and erosion potential is slight to moderate.

The average slope of the terrain on the windfarm site is low (8%). However, the existing roads pass areas, e.g., the Malalowaiaole and Manawainui Gulches, where the slopes are much higher slopes (15 to 25%). There are no reservoirs and irrigation ditches in the study area.

3.6.2 Potential Impacts

<u>Discussion</u>

This section includes identification and evaluation of potential environmental consequences to the hydrologic and water resources due to the proposed action. The proposed windfarm site is in an area where there are no hydrologic or water resources to impact. There are no streams, springs or ponds on the proposed site. During construction and operation of the windfarm, all water used on site would be trucked in. ZPAC's has standard operational procedures that protocols for handling and disposal of transmission oils, cleaning fluids and other hazardous materials. A copy of these procedures is included in Section 8.2. Use of these materials is minimized and all disposal will be at approved off-site locations.

As discussed in the previous section, the existing access road crosses the Malalowaiaole Gulch (approximately at 1,600' elevation). ZPAC is evaluating improvement and use of an existing spur that cross the Manawainui Gulch (approximately at 2800' elevation). The proposed modifications may require a Stream Channel Alteration Permit (SCAP) from the DLNR. It is also possible, but not known at this time, whether the action would fall under Department of Army (Corps of Engineers) jurisdiction.

Evaluation

WSB-Hawaii believes that ZPAC's standard operating procedures are sufficient to prevent contamination or damage to hydrologic or water resources on the project site. WSB-Hawaii also believes that if improvements to the roads (including the crossing of the Malalowaiaole and Manawainui gulches) are made using current construction practice in Hawaii, the improvements will result in minimal damage to the hydrologic and water resources in the area. Based on the above, *WSB-HAWAII evaluates the severity of the proposed action on the hydrologic and water resources in the study area to be "non-significant."*

3.6.3 Mitigation Measures

The potential impacts could be reduced be the implementation of the following mitigation measures during construction and operation of the windfarm. Specifically, it is recommended that ZPAC utilize local expertise to plan, coordinate, supervise and complete the improvements to the access road. The key steps to be taken to avoid impacts are to:

- minimize disturbance to the land in order to reduce the potential for soil erosion in and around the gulches,
- add, and replace as necessary, culverts to handle anticipated water flows in the gulches,
- provide channels for rain run-off to prevent erosion of the road bed, and
- use gravel (or other road materials) to maintain the integrity of the road bed.

Given the implementation of these measures and ZPAC's standard operating procedures, *WSB-HAWAII evaluates the severity of the proposed action on the hydrologic and water resources in the study area to be "negligible."*

3.7 Terrestrial Flora

This section includes a description of the terrestrial flora in the study area and identification and evaluation of the potential environmental consequences of the proposed action on these resources. Note: the study area includes both the windfarm site and the site access. Mitigation measures are proposed and discussed, including an evaluation of the impact consequences before and after the mitigation measures program. Refer to Table 3.1-2 for a summary of the environmental consequences of the proposed action and mitigation measures program.

3.7.1 Existing Conditions

The vegetation on the proposed windfarm site is a mixed grassland/shrubland type. In April, 1996, a general botanical survey over the whole study area was conducted by an independent biologist, Arthur Mederios. From that survey, sites for six meteorological stations were confirmed (Mederios, 1996). A second study was conducted in November, 1998 along the upper spur road that is proposed for site access (Mederios, 1998). These reports are attached in Section 8.3.

From the first referenced report, "The vegetation is predominately composed of non-native species, mostly pasture grasses and cattle resistant shrubs. No plant species listed as Endangered by the U. S. Fish and Wildlife Service were encountered at or near any of the six sites. The four uppermost elevation sites" [701m (2,300ft) to 976m (3,200ft) elevations] "were dominated by non-native pasture species, especially grasses such as Rattail grass (Sporobolus africanus) and Kikuyu grass (Pennesetum clandetinum).

The two lower most elevation sites" [579m (1,900ft) to 510m (2,300ft) in elevation] "contain more native vegetation than the uppermost sites." The native plants included a grass (Triseum inadequale), a herb (Waltheria indica) and several shrubs: 'ulei, u'ulei (Osteomeles anthyllidifolia), 'iliahialo'e, sandalwood (Santalum ellipticum), and 'ilima (Sida fallax).

"During the selection of sites 1 and 2, the location was changed on two occasions to minimize damage to native plant species during construction and access." The sensitive areas were subsequently marked and reported to the installation personnel.

From the second referenced report, "Both the eastern and western termini of the proposed road are pastures. However, the interior of the gulch, especially on the steep western slopes above the proposed road has a stretch of fairly intact native leeward shrublands. No plant species were encountered during the survey are listed as Endangered by the U.S. Fish and Wildlife Service."

3.7.2 Potential Impacts

This section includes identification and evaluation of potential environmental consequences to the terrestrial flora in the study area due to the proposed action.

Discussion

The primary hazard is damage to vegetation during the construction and operation of the windfarm. The construction phase would include improvements to the access road network, transport of equipment and materials to the site, construction of the tower foundations, erection of the towers and the wind turbines, and construction of the O&M building and the site substation.

Neither of the botanical surveys uncovered any endangered species. Regarding the project site, Mr. Mederios made the following recommendation: "If this project should proceed to its final construction state, care should be taken near sites 1 and 2 to assure the least damage to native species through careful site selection. Areas of relictual native shrublands can be easily avoided as nearby comparable sites with little vegetation are generally readily accessible."

Regarding the access spur, Mr. Mederios noted, "With one exception, largely the proposed route does not impact native vegetation as it passes through weed or pasture vegetation." Specifically, "The project necessitates direct destruction of a section of native leeward shrubland, including some uncommon native plant species. Other adjacent native shrublands may also become degraded by road construction activities and invasion of non-native plants. Due to impacts on native biota, some type of mitigation appears warranted."

"The proposed road site passes near (~50m) the Manawainui plant sanctuary enclosure, which can have both positive and negative effects for the sanctuary. The positive and negative impacts of the proposed road are likely balanced and perhaps even beneficial for facilitating access to the plant sanctuary for management purposes."

"Mr. Renee Sylva accompanied us on the site and discussed an enclosure/planting technique intending to protect a grove of leguminous shrubs, the *māmane* (Sophora chrysophylla), unique to that area. I agree with his assessment of the biological appropriateness of his suggestion."

Mr. Mederios also notes another potential impact: "Importation of invasive non-native plants and invertebrates during initial road *construction* and in the future due to increased site visitation, in close proximity to the Manawainui plant sanctuary, one of the State of Hawai'i most important dryland forest conservation efforts."

Evaluation

WSB-HAWAII evaluates the severity of the potential impact on the terrestrial flora to be *"non significant."*

3.7.3 Mitigation Measures

The potential impacts can be reduced through the implementation of mitigation measures during construction and operation of the windfarm.

Discussion

Mitigation measures are needed during the construction and operational phases of the windfarm. The following measures are planned by ZPAC:

Construction.

- An additional botanical survey is planned in order to site the wind turbines, intrasite roads and O&M facility to avoid areas of native plants. ZPAC believes that individual sites and can be selected which would minimize the amount of vegetation disturbance;
- An additional survey is planned in order to confirm the improvements needed to the upper access spur from Puu Anu to the project site;
- A plant expert would be hired to supervise the actual construction work in areas in or near where there are native plants; and

- An inspection station would be established at the staging area near the main highway to reduce the possibility of introducing alien plant species to the site. Each vehicle will be inspected and cleaned prior to traveling up the jeep road up to the site.

Operation. Protocols will be incorporated into the overall site operation and maintenance procedures to:

- Reduce the possibility of introducing alien plant species to the site; and
- Ensure that O&M personnel do not damage native plants.

Furthermore, WSB-HAWAII believes that strict adherence to the site O&M procedures outlined in Section 3.5.3 would help mitigate the potential for damage during the operational phase.

Native Plant Propagation Program. ZPAC will work with local plant experts to introduce appropriate native plant species back onto the Kaheawa Pastures.

Evaluation

With these mitigation measures, WSB-HAWAII evaluates the severity of the potential impact on the terrestrial flora to be "negligible."

3.8 Fauna: Birds and Mammals

This section includes a description of the fauna (birds and mammals) in the study area, and identification and evaluation of the potential environmental consequences of the proposed action on these resources. Note: the study area includes both the windfarm site and the site access. Mitigation measures are proposed and discussed, including an evaluation of the impact consequences before and after the mitigation measures program. Refer to Table 3.1-2 for a summary of the environmental consequences of the proposed action and mitigation measures program.

3.8.1 Existing Conditions

The focus of this discussion on the conditions of the proposed windfarm site. The mixed grassland/shrubland vegetation on the proposed windfarm site is habitat to a number of endemic, indigenous and migratory bird species and to an unknown number of mammalian species.

Birds. A number of avian experts were contacted regarding birds on Maui, their habitats and habits.[3] A preliminary bird survey was conducted as part of the wind monitoring program. ZPAC contracted a local avian expert, Eric Nishibayashi (Nishibayashi, 1997) to conduct a survey at the six wind monitoring sites during a three month period from May to July 1996. The *primary purpose* of this survey was to determine if any birds had collided with the wind measurement towers. A copy of his full report is attached in Section 8.4.

The survey indicated no evidence of downed birds. The study also cataloged the bird species present during the survey period and made recommendations for future activity. From the referenced survey, "The report does not represent a study, either in literature or in the field, on the effects or potential impacts of the wind monitoring towers and turbines at Kaheawa/ Ukumehame; however, recommendations for mitigation measures for several native species of birds and one bat that may be negatively impacted by the project are given."

A total of twenty-six survey days were conducted over the three month period. The list of the bird species detected is shown in the Table 3.8.1-1. "Most of these identifications were determined by vocalizations; although several visual observations of birds were made as well. Most notable was a pair of Hawaiian Short Eared owls or Pueo (*Asio flammeus sandwichensis*) at tower no. 1 (May 10, 1996). These birds appeared to be flying acrobatically around the guy wires without coming in contact with them."

None of the identified species is on the U. S. Fish & Wildlife list of endangered, threatened or protected species. However, it is possible that the federally endangered Hawaiian Nene and Dark-rumped Petrel may be in or frequent the area. Mr. Nishibayashi "observed Hawaiian Nene (*Branta/Nesochen sandicensis*)" about 0.8km (0.5mi) from the project area. Similarly, he noted that the "federally endangered Hawaiian Dark-rumped Petrel (*Pterodroma phaeopygia sandwichensis*) have been known to nest at elevations above the project elevation." While generally found on Haleakala, it is possible that the Petrel may nest above the site.

Mammals. There are no known studies to identify mammalian species in the study area. Mr. Nishibayashi noted the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) is known to be a resident in highland areas. However, none were observed during his visits to the area. Local bat experts (Cabrera, 1998 and David, 1998) don't believe the area to be prime bat habitat.

[3] Avian experts contacted include: Fern Duval (DLNR, Forestry and Wildlife Division), Renate Gassman-Duval (Audubon Society, has veterinary experience and has treated down petrels), Linda Paul (President, Hawaii Audubon Society), Robert Pyle (Curatorial Assistant for Birds, Bishop Museum), and Karen Sinclair (NREL).

Table 3.8.1-1
Summary of Bird Survey: Kaheawa Pastures Site

Common Name	Scientific Name	Detections*
Eurasian Skylark	*Alauda arvensis*	22
Ring-necked Pheasant	*Phasianus colchicus*	18
Black Francolin	*Francolinus francolinus*	12
House Finch	*Carpodacus mexicanus*	9
Common Myna	*Arcridotheres tristis*	7
Hawaiian Short-Eared Owl or Pueo	*Asio flammerus sandwichensis*	5
Nutmeg Manikin	*Lonchura punctulata*	4
Gray Francolin	*Francolinus pondicerianus*	3
Northern Cardinal	*Carinalis cardinalis*	1
Spotted Dove	*Streptopelia chinensis*	1

3.8.2 Potential Impacts

This section includes identification and evaluation of potential environmental consequences to the fauna (birds and mammals) in the study area due to the proposed action.

<u>Birds</u>

This discussion includes information gleaned primarily from three sources of information: (1) *Avian Interactions With Wind Energy Facilities: A Summary*, prepared by Colson & Associates for the American Wind Energy Association, January, 1995; (2) *Downed Wildlife Survey at Six Leeward West Maui Wind Monitoring Towers*, prepared by Eric Nishibayashi for Zond-Pacific, March, 1997, and (3) Discussions with several additional avian experts.

<u>AWEA Report</u>. Colson & Associates summarize research on the interactions of birds with wind energy development, including interpretation of the results obtained to date. The report includes discussion of approaches to mitigate adverse impacts and recommendations for future research. The report is not meant to be an exhaustive critique of what has been done.

Quoting from the report, "Positive and negative impacts of wind energy development on birds have been identified. Long-term positive impacts for birds associated with wind energy development include retaining natural habitat and providing vertical manmade structures available for cover, perching, roosting and nesting. In the case of raptors, an expansion of the prey base may have occurred in some areas. Wind energy facilities provide birds with an environment safe from human harassment. Long-term negative impacts associated with wind energy development include loss of habitat, electrocutions, and collisions with turbines, meteorological towers, transmission towers and communications towers."

It is recognized that wind turbine technology has undergone quite an evolution in the past 20 to 25 years. A number of different designs have been introduced ranging from small residential systems (1 to 10 kW and 2 to 5m rotor diameter) to large utility-scale systems of today (500 to 750 kW and 40 to 50m rotor diameter) to even larger multi-MW experimental turbines in the early 1980's, e.g., the MOD-5B at Kahuku on Oahu.

From Colson and Associates, "Wind energy technology has evolved from the large two-bladed, single-unit, horizontal-axis, constant-speed, experimental turbines of the early 1970's to the many smaller horizontal- and vertical axis, three-bladed, cluster arrangements of the designs we see today. Because of these engineering variables and the lack of consistent avian study methodologies performed in previous studies, analyzing results to understand avian interactions is difficult and sometimes misleading. The first wind energy facilities located in the United States did not consider local and seasonal bird migration patterns; therefore, some of these sites are located in areas where birds are abundant and the risk for interactions is high. However, overall incidence of bird mortalities in wind energy facilities is small compared to other human-caused bird mortalities. The effect of wind energy related bird mortalities on local and regional populations is also considered small."

"In a review of over 110 publications, no mortalities of threatened or endangered species have been reported in wind energy facilities. While some protected species have been found in mortality data, the reported incidence of federal or state listed and species of special concern has been negligible to date. To date, most researchers report mortalities are not biologically significant to local, regional, or migratory populations. Whether or not mortalities associated with wind energy development are additive must be carefully addressed because some bird species such as neotropical migrants are facing serious population declines (not necessarily associated with wind energy development)."

"The incidence of bird electrocutions within operating wind energy facilities has been frequently reported in U. S. avian/wind energy studies. This issue, which is different than bird collisions, has been studied extensively by the electrical utility industry and others since the early 1970's. Solutions for resolving bird electrocutions in wind energy facilities are generally simple, cost effective and readily available."

"Bird collisions within wind energy facilities are the leading cause of human-induced mortality in this industry. However, the incidence of birds colliding with wind turbines is relatively rare. To date, few people have documented seeing birds collide with turbines, and the mortality figures are low compared to other human-induced mortalities. Most reported bird mortalities show that birds collide with wind turbine structures."

"The estimated range of bird mortalities resulting from wind energy development in the United States is 0.000 to 0.117 birds per turbine per year (Howell and Noone, 1992). In Europe, the range of mortalities is 0.1000 to 37 birds per turbine per year (Winkelman, 1992). From data gathered so far, several species of raptors and passerines appear to be most susceptible to wind-energy related mortalities in the U. S. and waterfowl and shorebirds appear to most susceptible in Europe. The raptor species most vulnerable to wind turbine collisions in the United States are red-tailed hawks, golden eagles and American kestrels. Examples of waterfowl/shorebird species reported in mortality data from Europe include mallard, pochard, tufted duck, and goldeneye. Recent reports of griffon vulture and eagle owl mortalities at Tarifa Wind Farm in Spain suggest that raptors and other bird groups will appear in more European data as new wind energy facilities are built."

"In European studies, collisions and electrocutions are not the main issue. Some species of waterfowl and shorebirds have altered their flight and use patterns to avoid wind turbine locations. This 'avoidance of habitat' issue is the most significant concern of the European conservationist. The effect of wind turbines on breeding birds is considered negligible; however, some species that use wetland habitats for resting and migrating are disturbed by the presence of wind turbines. Local birds are believed to habituate to the presence of wind turbines."

A number of mitigation measures are discussed in the AWEA report and are summarized in the next section. The report also summarizes the research efforts underway or being planned to investigate the interactions of birds with wind turbines. There are major U. S. studies focused on bird behavior, bird perception, turbine designs, and turbine orientation and location with respect to mortalities. The probability of adverse bird interactions with wind energy facilities appears to be both site-specific and species-specific.

Maui-Specific Discussion. Moving from the "global" perspective to the more site-specific perspective on Maui, this discussion includes: (1) observations and comments from Mr. Nishibayashi and others regarding several of the species identified in the study area and on some additional species of concern, (2) comments provided by DLNR and other reviewer of the DEA, and (3) discussion at meeting between ZPAC and DLNR staff on December 18, 1998 :

- Hawaiian Short-Eared Owl or Pueo (*Asio flammeus sandwichensis*). The primary concern is how Pueo would react to the presence of the turbines. Eric Nishibayashi notes the Pueo has "adjusted to the existing power lines and support poles that span over miles in this habitat as many individuals were observed in the area, and they have been observed using power lines and poles as perches in the areas adjacent to the study area as well (personal observation)...any structure that stands above the ground would become attractive as a perch to the Pueo." He suggests that ZPAC "take steps to eliminate the possibilities of electrocutions and collisions with the wind turbine blades."

  He also expresses concern that the Pueo would "no longer utilize the area in search of food or nests, because of the amount of obstructions or the increased level of human activity." Referring to the Colson and Associates report, he noted that concern of the "loss or avoidance of habitat" increases with the percentage of the habitat that the project would displace. For example, there have been cases of permanent dislocation where a project impacted only 10% of the habitat. As discussed in Section 2.4.4, the dislocated land would be approximately 8.7 acres of the estimated 200 acre narrow band of land the windfarm would situated on. Thus, less than 5% of the habitat would be impacted. He also suggests "not to begin construction of these turbines until well after the breeding season has finished and to halt construction a reasonable time before the next breeding season." The breeding season is in the fall running from October through December (F. Duval, 1998);

- Barn Owl (Tyto Alba). Dr. Duval indicated that barn owls are likely to be on the site, since they inhabit most of Maui. However, Mr. Nishibayashi did not observe any barn owls when he was on site. The barn owl is nocturnal and the survey observations were generally made during the afternoon to dusk;

- Wedge-tailed Shearwater (*Puffinus pacificus*) and Hawaiian Dark-rumped Petrel (*Pterodraoma phaeopygia sandwichensis*). Mr. Nishibayashi noted that the Wedge-tailed Shearwater and the Hawaiian Dark-rumped Petrel (a federally endangered species) are residents of Maui, but were not observed during the survey period. Both are seabirds. Both move inland at dusk or after dark to the nesting areas or colonies, and then begin moving back to sea at first light. (Cooper and Day, 1994). Shearwaters typically nest at lower elevations, while the primary known habitat of the petrel on Maui is at higher, non-vegetated elevations of Haleakala and away from predators (Pyle, 1998). It is not known if petrels actually nest in the West Maui mountains in areas above the proposed site.

The turbines could pose potential collision hazards to birds (particularly fledglings) as they head to or return from the sea in search of food. Typically, these flights would occur during dark periods in late evening or early morning. Cooper and Day found that the Shearwaters were at risk for downings due to collisions with utility power lines on Kauai and Hawaii, and primarily those lines closest to the coast and or those that were lighted. They did not find any evidence of Petrels colliding with power lines. Similarly, Mr. Nishibayashi noted that "lights on the towers may make them more visible to birds flying at night, but that studies in Hawaii (Cooper and Day, 1994, Telfer et al., 1987, and Ainley et al., 1995) have indicated that they may cause some fledglings to become grounded."

During the December 18, 1998 meeting, DLNR staff reinforced the need to study bird activity at the appropriate times to determine if Shearwaters and Petrels are in the area. It was recommended that Zond contact either David Duffy or David Ainley regarding lighting options.

- Pacific Golden Plover (*Pacificus fulva*). The Pacific Golden Plover is a species that migrates to Hawaii from its arctic breeding grounds, leaving Hawaii in April and returning in August. On Oahu, they are typically found on the ground during the day (e.g., Bellows AFB) and move to rooftops or to off-shore islands at night (Pyle, 1998). No individuals were identified during the survey period (May to July). Thus their activity in the project area is unknown. "The habitat is of type preferred by these birds, mostly open areas with low vegetation and large areas of grass." Initially, Mr. Nishibayashi recommended an additional study during the months of August to April to determine their presence and activity in the study area. Note: Plover have been seen during visits to the site since the completion of the surveys conducted by Mr. Nishibayahi. The birds were noted to be foraging in grassy areas, both before and after the major fire in the area during October 1998;
- Hawaiian Goose or Nene (*Branta/Nesochen sandwichensis*). Mr. Nishibayashi noted Nene may be in the area. This is based on his observation of Nene in an area nearby the proposed project site. He believes the Nene could be "negatively impacted by the project. Nene are not agile flyers like seabirds and do not seem to maneuver quickly on the wing. They tend to prefer grassy areas for flocking and foraging – the type of habitat that is proposed for the wind turbines." He notes also that the project area sits just below where the "state has setup a release pen for introduction of Nene in Hanaula. The potential for Nene strikes with guy wires will increase as Nene become more established."

During the December 18, 1998 meeting, DLNR staff discussed the status and plans of the Nene propagation program. Back in the 50's the Nene had been considered to be near extinct, when some were found on the slopes of Haleakala. Man's encroachment with the development of the sugar plantations in Puunene no doubt had caused the Nene to seek other habitats. DLNR established a breed and release program on Haleakala, where 200 Nene are now believed to be permanent residents. The Hanula area in the Ukumehame was identified as a potential new habitat for the Nene – it had the natural resources and was within DLNR's control. A total of 62 birds have been released there since 1994. The program's goal is to sustain a population of 1,000 or more Nene on Maui and have the Nene removed from the endangered species list. DLNR expressed their concern that the Nene would be at risk of colliding with the wind turbines. The discussion also included possible strategies for keeping the birds away from the turbines.

Mammals

No specific studies have been conducted to determine the level of mammalian activity in the area. There are small mammals in the area, e.g., mice and rats, based on examination of Pueo scat during one of ZPAC's site visits. It is possible that larger mammals, e.g., mongoose or feral cats are also in the area. Mice and rats are the natural prey for Pueo, barn owls and other predators in the area. Studies of windfarms on the mainland suggest that windfarm construction can encourage mice or rat populations. This effect increases further if livestock were to graze in the area. Thus, a windfarm in the Kaheawa Pastures could have a positive impact on the habitats for mice and rats, as well as the predators.

In conjunction with the preliminary bird study, Mr. Nishibayashi noted the possibility that bats might be active in the area. Specifically, the "activity of the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) is highest during the Summer months, with foraging activity observed to be highest in the early evening, beginning immediately after sunset (pers. obs.). Most of the surveys reported here were conducted late in the afternoon and no bats were observed." He concludes that no inferences can be made regarding the potential bat activity in the area. Consequently, he recommended an additional study. Two bat experts, Theresa Cabrera (Cabrera, 1998) and Mr. Reggie David (David, 1998), were consulted regarding the possibility of bat presence and activity in the project area. They indicated that the prime habitat for bats on Maui is in East Maui. They were not aware of any bat surveys conducted in the study area. They expressed the opinion that bats were not likely to be present in the project area.

Evaluation

The study area is habitat to a number of avian and mammalian species. The identified avian species include a number of common birds as noted previously and predators such as the Pueo and the Plover. The Nene, the Dark-rumped Petrel and the Wedge-tailed Shearwater are known to be on Maui, but were not observed during the preliminary surveys conducted in the study area. However, Nene have been observed above the site, near the release pen which is approximately a half a mile from the upper end of the proposed site. The Nene and Petrel are listed Federal endangered species[4]. The identified mammalian species include mice and rats by inference from Pueo scat. Other species that may be in the area include the mongoose (one was seen below the site near one of the lower transmission towers), the feral cat and the endangered Hawaiian hoary bat.

The species of primary concern are the Nene, the Dark-rumped Petrel, Wedge-tailed Shearwater, Pueo and the Hawaiian Hoary Bat. There are two primary concerns: (1) the presence of the wind turbines may threaten avian and mammalian habitats, and (2) birds and bats may collide with the wind turbines. The following is WSB-Hawaii's evaluation of these issues, given the information currently available:

- Threat to Avian and Mammalian Habitat. For the species that are found to be utilizing the study area for their habitat, there are two primary factors that influence the potential impacts: (1) the density of the wind turbines, i.e., the higher the density, the more likely that birds will avoid the area, and (2) construction and operation activities which disrupt the soil or provide an attraction to rodents, e.g., not removing construction trash.

[4] Newell's shearwaters, a Federally-endangered species, are residents of Kauai. While related to the Wedge-Tailed Shearwater, they are not known to be on Maui.

Discussion. Note: there has not been a disruption of avian and mammalian habitat at the windfarms on the Big Island and on Oahu. These windfarms all have a higher density than the proposed windfarm. The density of the windfarm can be measured in terms of the disruption of the soil, e.g., covered by structures, tower foundations and roads, and the spacing of the turbines. For this project, soil disruption is small. The turbines are to be installed in a single, articulated row and the turbines will be at least 122m (400ft) apart. With this amount of soil disruption, turbine density and spacing, WSB-Hawaii does not believe the windfarm will cause birds or bats (if they are there) to avoid the area or that there will be a significant impact on mammalian habitat. There might be some avoidance during the construction period. However, it would seem the greater concern is keeping the birds away from the turbines.

- Potential for Avifauna Collisions with the Wind Turbines. A number of factors influence the probability of collisions, including the visibility of the wind turbines during the day and the night, the noise they create, avifauna vision and sonar (bats), flying agility and weather conditions. The wind turbines are relatively large compared to the surrounding terrain and vegetation. The wind turbine towers at 50m (164ft) will be taller than the nearby utility transmission line towers which are from 18m (60ft) to 26m (85ft) in height. The wind turbine blades will rotate at a relatively slow rate (34 rpm). The potential for collisions may be greater for predator species or for species that are nocturnal and or less agile. The overall collision potential increases with the number of birds and in the area and when weather conditions reduce visibility.

Discussion. After almost three years of data collection in the project area, no downed birds have been found. The initial site surveys have shown that the Pueo see and avoid the much smaller anemometer towers that are currently installed in the study area. Thus, it is tempting for us as humans to conclude that birds and bats will readily see and avoid the larger wind turbines and their towers under normal conditions. However, it is inappropriate to use the anemometer towers as surrogates for larger wind turbine towers as the anemometer towers do not have rapidly spinning blades (K. Sinclair, NREL). Unfortunately, there are not sufficient data yet to determine what will cause birds to see and avoid wind turbines and their towers.

In general, it is not known whether rotating blades are visible to birds. Some experts have suggested that birds may not be able to detect the difference between an operating and non-operating wind turbine.

Lighting was discussed during the December 18, 1998 meeting with DLNR staff as a possible means of alerting birds to the presence of the wind turbines. Some form of lighting is generally required by the FAA for structures over 200ft (60m) in height. Subsequent to the meeting, ZPAC was informed by the FAA that a red light on every other tower would be sufficient to meet their lighting requirements. At issue now is what type of lighting would alert but not attract birds.

These concerns were discussed during the December 18, 1998 meeting with DLNR staff. One specific conclusion of meeting was the need to understand better the activity of the Nene in the area. DLNR discussed the known habits of the Nene, e.g., in general, they like to forage in grassland areas, but prefer to nest in areas with more cover. Since their release, however, some specifics are really not known yet about their adaptation to the release area: (a) their preferred nesting and foraging areas, (b) their flyways, and (c) how they are adapting to their new habitat.

It was agreed that additional surveys were needed to confirm the presence and habits of the other species of concern (Petrels, Shearwaters and the Hawaiian Hoary Bat) that may frequent the area. Additional studies are needed to determine with greater certainty the habits and use of the study area by the species of concern.

Based on the above, WSB-Hawaii evaluates the severity of the proposed action on the avian and mammalian resources in the study area to be potentially *"significant."* This evaluation is predicated upon: (1) the assumption that all of the avifauna species discussed may be present in the study area, (2) not enough is yet known regarding the habits and use of the area by the species of concern, and (3) the need to devise measures to mitigate the risk of avifauna collisions and loss of habitat. With mitigation, WSB-Hawaii believes these potential impacts, can be reduced. It is ZPAC's goal to reduce these risks.

3.8.3 Mitigation Measures

As a primary mitigation measure, AWEA recommends siting windfarms to avoid adverse avian and mammalian interactions. This can be done by locating the windfarms based on careful studies and away from critical habitat. Note: since the preparation of the draft EA, ZPAC held a meeting on December 18, 1998 with key members of DLNR Division of Forestry and Wildlife to discuss their concerns about the proposed project and possible mitigation measures. Other organizations, e.g., the Office of Hawaiian Affairs, had similar concerns. Each of the issues raised by commentors on the draft EA are addressed in Section 6 and are incorporated as appropriate in this section. Discussion of specific mitigation measures follows, starting with a review of mitigation approaches being taken by the wind community in general, and then specific recommendations for the proposed project.

Birds

Overall Mitigation Strategies. The American Wind Energy Association (AWEA)report (Colson and Associates, 1995) included recommendations for specific mitigation options. "Future mitigation options will be site-specific and perhaps species-specific. Options should be based on an evaluation of the environmental, engineering, and biological characteristics of a particular site." The more relevant mitigation strategies with WSB-Hawaii comments, include:

- Known bird migration corridors and areas of high bird concentrations should be avoided when siting windfarms, unless site specific analyses indicate otherwise. WSB-Hawaii Comment: The proposed site is not known to be in a bird migration corridor or in an area of high bird concentration;
- For a desired energy capacity, fewer large turbines may be preferred over many smaller turbines to reduce the number of structures in the wind energy facility and/or to permit greater spacing options. WSB-Hawaii Comment: The proposed windfarm employs the use of 27 larger wind turbines deployed in a single row;
- Microhabitats where birds may be flying should be avoided in siting individual wind turbines, meteorological towers and powerlines. These areas may include valleys, ridgetops and swales. WSB-Hawaii Comment: No microhabitats were identified by Eric Nishibayashi. However, additional surveys are needed in order to confirm the presence and habits of key species of concern, e.g., the Nene, Petrels, Shearwaters and the Pueo. With respect to seabirds that may be in the study area, their typical flight paths would be downslope to the ocean and upslope on their return. Their flight paths would be parallel, rather than perpendicular, to the planned single, articulated row of wind turbines. Thus, the proposed turbine row should present less of a hazard than an array of several rows;

- When using lattice towers, they should be modified to reduce perching opportunities. WSB-Hawaii Comment: The proposed lattice towers do not provide horizontal structures. While this may not eliminate the attractiveness of the towers as perching locations, it should reduce the risks of birds perching on the towers;
- With agency approvals, raptor nests found on structures should be moved to suitable habitat away from wind energy facilities. WSB-Hawaii Comment: This recommendation doesn't appear to apply directly. However, agency approval would be sought if it was discovered that Pueo or Nene or other species of concern were nesting underneath turbine towers or on or near other structures on the site (i.e., the O&M building or substation);
- Contributions should be made to rehabilitation facilities that care for and release important bird species that sustain injuries at wind energy facilities. WSB-Hawaii Comment: ZPAC is considering making contributions to facilities that rehabilitate or propagate species of concern, e.g., Nene;
- Underground electrical lines and overhead electrical distribution systems should be designed to prevent future bird electrocutions, and when alternatives for non-site mitigation are not feasible, off-site mitigation to improve or enhance species populations should be considered. WSB-Hawaii Comment: The proposed windfarm will include underground electrical lines and the substation will include industry-practice design features to mitigate the risks of electrocutions;
- When alternatives for on-site mitigation are not feasible, off-site mitigation to improve or enhance species *populations should be considered.* WSB-Hawaii Comment: ZPAC is considering making contributions to the Nene propagation program as a possible mitigation measure.

Mr. Nishibayashi made the following general and specific recommendations by species:

- General. His overall recommendation was to take steps to prevent collisions and electrocutions. WSB-Hawaii Comment: ZPAC has designed its wind turbine and the windfarm to reduce the risks of collision and electrocution. Specifically, a single row of wind turbines will be deployed, which reduces the risks compared to an array with several rows of turbines. Electrical wiring will be buried underground which reduces the risk of collision and electrocution. ZPAC will employ industry standard practices in the design of the substation to reduce electrocution risks. Despite these measures, however, there is still an unknown risk of collision. Additional surveys and studies are needed to define measures to alert birds to the presence of the turbines;
- Pueo. He recommended: (1) phasing site construction to coincide with the non-breeding season, and (2) installing the turbines incrementally to assess the impact of the "clutter that the turbines will bring" and to "determine the maximum density of turbines that can be tolerated here before Pueo become unacceptably displaced." WSB-Hawaii Comment: Construction can be scheduled to avoid the Pueo breeding season. Regarding the issue of clutter, Mr. Nishibayahi indicated that his comments were made assuming that the wind turbines would be installed in multiple rows which would present a much higher density than the single, articulated row. As noted above, the use of a single row should reduce the risk of collisions;

- Shearwater and Petrel. His primary concerns are the hazards the turbines may present to these birds who may nest above the proposed windfarm for breeding and raising fledglings or that these birds may frequent the site from other areas on Maui. Specific recommendations were to: (1) increase the visibility of the guy wires used to secure the anemometer towers by fitting them with PVC pipes, (2) conduct supplemental activity surveys during the breeding season to determine and analyze the shearwater and petrel activity in the area, and (3) conduct periodic surveys for grounded wildlife near turbines and towers. WSB-Hawaii Comment: The experience to date indicates that the birds in the area are not colliding with the meteorological towers. During follow-up discussions with Mr. Nishibayashi and with DLNR staff, additional surveys need to be conducted during the times of the day and year when the seabirds are normally active;

- Pacific Golden Plover. At the time of the original surveys, Plovers were not seen on the site. The surveys were conducted subsequent to the normal departure of the Plovers from the islands in April and prior to their arrival in August. However, since the surveys during ZPAC visits to the site during the months of November and December (1998), Plovers have been seen foraging on the ground near the anemometer towers. WSB-Hawaii Comment: The additional survey should evaluate *mitigation measures* to alert and keep the Plover away from the turbines;

- Nene. Similar recommendations are made to those above to improve the visibility of the meteorological towers. There was a more extensive discussion of the Nene, as indicated above, during the ZPAC meeting with DLNR on December 18, 1998. Possible strategies for alerting the birds and keep them away from the towers include: (a) lighting on the turbines and towers, (b) removal of grass below the towers, (c) introducing native shrubs underneath the towers to discourage foraging. WSB-Hawaii Comment: Additional surveys and study of the Nene's presence and use of the project area and their flyways to other areas of Maui are needed. Mitigative measures are needed to alert the Nene and to keep them away from the wind turbines and their towers. Assuming the project is approved, the surveys would need to be continued after construction. As noted previously, ZPAC is considering making contributions to the Nene propagation program; and

- Grounded Wildlife Protocol. A grounded wildlife protocol is recommended in order to ensure timely and appropriate care for any injured wildlife found at the project site by ZPAC personnel. WSB-Hawaii Comment: WSB-Hawaii concurs and the protocol, including all appropriate contact names, organizations and information should be included in ZPAC's operational plan.

Mammals

The primary concern identified to date is the potential presence and activity of the endangered Hawaiian Hoary Bat in the study area. Mr. Nishibayashi has recommended that bat experts be retained to conduct a survey to identify and assess the bat activity in the area. WSB-Hawaii Comment: Local bat experts (Cabrera and David) have indicated that no specific studies have been conducted in the Ukumehame District. However, the proposed project area is not considered to be prime habitat on Maui for bats. Specifically, bats roost in trees in Hawaii (while bats on the mainland roost primarily in caves). There are no trees on the Kaheawa Pastures. The nearest trees are over a mile away and across the Manawainui Gulch. Nevertheless, it recommended that bat surveys be conducted to identify the presence and activity of bats in the study area.

Evaluation

The potential impacts to avian and mammalian species in the study area has been discussed in Section 3.8.2. WSB-Hawaii notes that ZPAC plans to incorporate the following recommendations into their mitigation measures program to mitigate the potential impacts that have been identified:

Design Activities:

- Install the wind turbines in one single row parallel to the sloping ridgeline to limit the clutter that the arrays would present to the birds. This approach would also reduce the total amount of disturbed land on the project site;
- Install the site electrical distribution lines underground; and
- Design and install the site substation to MECO's transmission lines using industry-standard measures to mitigate bird electrocutions.

Project Planning Activities:

- Continue monitoring the areas surrounding the meteorological towers for evidence of downed birds or bats;
- Work closely with DLNR to plan and conduct additional surveys to identify the presence and use of the area by the species of concern, e.g., Nene, Petrels, Shearwaters and Pueo;
- Devise and plan mitigation measures to alert birds to the presence of and keep them away from the wind turbines; and
- Establish a protocol for timely and appropriate care for any injured wildlife found at the project site by site personnel.

Construction and Operation Activities:

- Continue monitoring for downed birds and bats;
- Schedule construction to avoid the breeding season for the key species of concern;
- Implement the protocol for injured wildlife found on the site;
- Work closely with DLNR to manage the wildlife habitat; and
- Contribute to the Nene propagation program.

WSB-Hawaii believes by implementing these procedures will mitigate the impacts to the birds and mammals on the site. Thus, WSB-Hawaii evaluates the severity of the potential impact on the birds and mammals to be *"non-significant."* It is possible that, despite the mitigation measures developed and the best efforts of ZPAC, some individual birds may be harmed. It is believed that the impact on the local population of the species of concern will not be significant. It is ZPAC's goal that the project would result in a net increase in the Nene population in the area.

3.9 Cultural Resources

This section includes a description of the cultural resources in the study area and identification and evaluation of the potential environmental consequences of the proposed action on these resources. Note: the study area includes the windfarm site and the site access. Mitigation measures are proposed and discussed, including an evaluation of the impact consequences before and after the mitigation measures program. Refer to Table 3.1-2 for a summary of the environmental consequences of the proposed action and mitigation measures program.

3.9.1 Existing Conditions

This section includes a discussion of the cultural resources in the study area, which include potential archaeological sites and the existing Lahaina Pali Trail. Much is known about the prehistoric use of this region of Maui. The name *Ukumehame* translates literally to "pay" (*uku* – pay, fare, toll, tariff) for the "mehame" (a native tree, also *hame*). It is kncwn that the hard wood of the *mehame* was used to craft tools which were used to harvest the fiber from the bark of the *o'lona* tree. This fiber in turn was used for crafting fishing nets, nets for carrying, and ti-leaf raincoats and feather capes. The fruit of the *mehame* is a purple berry which grows in grapelike clusters. This berry was used to dye tapas red. It is believed that the Ukumehame area was once a primary source of the *mehame* tree which had significance in Hawaiian culture. It is believed the alii exacted a tariff on those which harvested the trees (Personal Communication, Lindsey).

Kaheawa translates literally to mean "irrigate the awa." The *awa* is a native Hawaiian plant which was used for restorative or medicinal purposes. After a hard day's work, native Hawaiians would prepare a tea from the leaves of the awa plant. The tea is believed to have facilitated a more restful sleep and rejuvenation of tired muscles. It is believed that the area now referred to as Kaheawa provided a major watershed and the fresh water for areas used to cultivate the awa plants. Since the 1850's, much of the land in this area has been used for grazing. Consequently, WSB-Hawaii will refer to the area as the *Kaheawa Pastures* (Personal Communication, Lindsey).

<u>Archaeological Sites</u>

MECO studied the archaeological sites extensively as part of their transmission line EIS (MECO,1994). Their study included information from a Regional Assessment and an Archaeological Inventory Survey of the preferred alignment (Hammat, 1992). Literature review, maps and records research and field surveys were undertaken. While a large number of sites were found in the study, none were found in the area common to both projects. Only one site was found close by and that was near the Lahaina Pali Trail and out of the study area.

DLNR (Evans,1995), in response to ZPAC's request for a CDUP to conduct wind resource measurements in the study area, indicated -- "We have no known record of historic sites on this parcel, however, it does not appear that this area has undergone an archaeological inventory survey, so historic sites may be present." DLNR went on to recommend that "If new access roads are needed, then an archaeological inventory survey will need to be performed prior to beginning construction."

<u>Old Lahaina Pali Trail</u>

From the MECO EIS, "Located in the Maalaea area is the Old Lahaina Pali Trail, part of the Na Ala Hele Trails & Access Program, established in 1988 to develop a statewide trail and access system. The program identifies a series of 'Priority Trails' and one 'Demonstration Trail' for each major island. The Old Lahaina Pali Trail was selected as Maui's Demonstration Trail."

"The Old Lahaina Pali Trail is part of a trail system that once encircled the island of Maui. The 7.2km (4.5mi) long trail once connected the townships of Lahaina and Wailuku. It lies above the existing Honoapiilani Highway spanning the ahupua'a of Ukumehame between Olowalu on the west and Maalaea to the east. Written references to use of this trail date from the late 1830s to the early 1840s. The trail fell into disuse and disrepair in the 1890s when it was abandoned after construction of a carriage road (now known as *Old Government Road*) to Lahaina and subsequent building of the Honoapiilani Highway during the 1940s and 1950s. Today, the trail lies within State-own lands used for grazing cattle."

"A recent archaeological inventory survey of the trail (Tomanari-Tuggle, 1991) recorded 18 sites adjacent to the trail, including the following functional types: alternate trail routes, water diversion, quarrying, trailside art (petroglyphs), storage and shelters. All sites except two are related to use of the trail." However, none of these sites are in the study area.

3.9.2 Potential Impacts

This section includes identification and evaluation of potential impacts on the cultural resources in the study area due to the proposed action.

<u>Archaeological Sites</u>

ZPAC commissioned an archaeological survey to determine if any culturally-significant sites are present on the proposed windfarm site and along the proposed upper spur route. International Archaeological Research Institute, Inc. (IARII) of Honolulu, Hawaii conducted the survey for ZPAC. The survey included a background literature search and review of historical uses of the area and previous, related archaeological surveys. Field inspections were conducted at the proposed windfarm site on March 20, 1998 and along the proposed upper spur route on November 21, 1998.

The first field inspection included a walking tour of the area proposed for the wind turbines and other windfarm structures. The inspection also included potential routes for a new spur access road from the lower end of the site across the Manawainui Gulch to the main jeep road. The results of the survey (IARII, 1998) are summarized below. The detailed report is included in Section 8.5.

No pre-contact archaeological sites were found. One cattle watering station was found near the upper end of the proposed windfarm site. IARII concluded "As a result of this one-day survey, it is highly unlikely that any archaeological sites are located within the Maui wind turbine project area. This area was probably not used intensively by Hawaiians and thus, would retain little, if any, evidence of prehistoric or early historic activity. Except for the watering trough and pipeline, there are no remains of cattle ranching, the only identified use of this area in historic and modern times. The trough lies almost 100m away from the nearest anemometer tower."

IARII made the following recommendations: "It is recommended that no further archaeological investigations be undertaken in the main project area. Should plans for a new access road across Manawainui gulch be developed, a survey of the alignment should be carried out (since the present survey was limited to only a portion of the west side of the gulch)."

Subsequently, ZPAC decided against proposing a new spur from the lower end of the site and instead began evaluation of possible use of the existing spur from Puu Anu to the upper end of the site. The second field inspection was carried out by IIARI along this route. Per their addendum to the first report (see Section 8.5), no archaeological sites were found.

The DLNR State Historic Preservation Division and the Office of Hawaiian Affairs both noted there could be sub-surface cultural resources that were not identified in the field inspections (see letters in Section 6). Recommendations were made to establish a protocol for halting of construction or other operations that uncover potential archaeological sites. WSB-Hawaii concurs with these recommendations.

ZPAC has discussed the possibility of other cultural uses of the study area (Lindsey, 1998). Mr. Lindsey indicated that he not aware of any cultural uses or practices in the area that would be impacted by the proposed project.

Old Lahaina Pali Trail

The trail traverses the Kaheawa Pastures and is below the lower end of the proposed windfarm site. The trail joins the access road just before the road crosses the Malalowaiaole Gulch at about the 457m (1,500ft) elevation level. While the trail does not cross through the proposed windfarm site, ZPAC initially consulted with the State's Na Ala Hele Trails and Access Program in conjunction with the wind measurement CDUA. There was concern about possible impacts on viewplanes along the trail.

Based on those discussions, ZPAC decided to relocate two wind turbine sites (originally planned to be located below the lower transmission lines) to locations above the lower transmission lines. These relocations will reduce the impact to the viewplanes along the trail. See also discussion of the Na Ala Hele Trails and Access Program in Section 3.4 and visual impacts in Section 3.16.

Evaluation

No culturally-significant sites were identified by IARII from the archaeological survey which included a field inspection. IARII concluded that it is "highly unlikely that any archaeological sites are located within the Maui wind turbine project area." Whether the windfarm impacts the Old Lahaina Pali Trail as a cultural resource would appear to be based on an evaluation of whether there are significant visual impacts. This issue was discussed at the December 18, 1998 meeting between ZPAC and DLNR/DOFAW. DOFAW expressed concern that there would be visual impacts at various viewpoints along the trail. As noted in Section 3.16, ZPAC has not received comments from the community that the project would result in significant visual impacts. There also have not been any expressions of concern regarding other potential cultural impacts. Therefore, the only concern expressed is potential visual impact along the Old Lahaina Pali Trail. Based on the above, WSB-Hawaii evaluates the severity of the impacts to the cultural resources in the study area to be *"non significant."*

3.9.3 Mitigation Measures

ZPAC plans to implement the following mitigation measures:

Design Activity:

- Install the wind turbines to minimize visual impacts to the viewplanes along the Old Lahaina Pali Trail.

Project Planning Activities:

- Conduct a follow-up archaeological survey if the course of the upper spur route is to be altered; and

- Work with the State Historic Preservation Division of DLNR and others to record and preserve all sites that are identified as culturally-significant.

<u>Construction and Operation Activities</u>:

- Incorporate a protocol for halting of construction or other operations that uncover potential archaeological sites. Specifically, if historic remains are inadvertently uncovered during construction, all work will cease in the vicinity and ZPAC will contact both its consultant (IARII) and the State Historic Preservation Division office; and
- Continue to Work with the State Historic Preservation Division of DLNR and others to record and preserve all sites that are identified as culturally-significant.

WSB-HAWAII believes by implementing these procedures will mitigate the impacts to the cultural resources on the site. Thus, WSB-HAWAII evaluates the severity of the potential impact on the cultural resources in the study area to be *"negligible."*

3.10 Socioeconomic Environment

This section includes a description of the socioeconomic environment in the study area and identification and evaluation of the potential environmental consequences of the proposed action. Note: the study area includes both the windfarm site and the site access. Mitigation measures are proposed and discussed, including an evaluation of the impact consequences before and after the mitigation measures program. Refer to Table 3.1-2 for a summary of the environmental consequences of the proposed action and mitigation measures program.

3.10.1 Existing Conditions

Introduction

The study area is located in West Maui, primarily within the Lahaina District, but partly within the Wailuku District. Note: the Manawainui Gulch separates the two districts. There are no known residents in the study area. Population centers are nearby in Lahaina and Maalaea.

Maui County had a 1990 resident population of 101,600 and a defacto population (resident plus visitor) of 139,500. The Lahaina District had a 1990 population of 16,000 representing 15.5 percent of Maui County population, while the Wailuku District, with 52,200 persons in 1990, represented 50.5 percent of the County total. Lahaina Town and Maalaea had 1990 (U. S. Census) populations of 9,073 and 443 respectively (DBEDT, 1995).

Maui County population has grown dramatically since 1970. From 1970 to 1980 the population increased 53.8 percent, as the rapidly-developing visitor industry attracted new residents (MECO, 1994). From 1980 to 1990 the population growth rate decreased some but was still 42% over the ten year period. The projections for the years 2000 and 2010 are for further decreases in the growth rates. The predicted resident population for the year 2000 is 124,000 (a 22% increase from 1990) and 140,900 for 2010 (a 14% increase from 2000). The projected growth rates for West Maui are similar. The projected populations for Lahaina District are 22,800 in the year 2000 and 38,400 in 2010 (DBEDT, 1997).

West Maui's economy has grown steadily resulting in a corresponding increase in demand for electricity. This growth has traditionally been spawned by new resort developments and overall growth in the visitor industry. As discussed in Section 2, the island-wide annual electric load grew at rate of about 5% over the ten year period from 1985 and in 1995. Towards the end of that period, there was a slowdown in growth primarily due to a decline in tourism that started in 1993 and completion of several major developments in West Maui. The slowdown in load growth has continued through 1996 into 1997. MECO has predicted a modest island-wide annual load growth rate of about 3 percent for the period of 1996 through 2009 (MECO,1996). The load growth estimates are based on the projected resort, commercial and residential developments.

The economy of West Maui is largely dependent on the visitor industry. In 1993 the total Maui County visitor expenditures were $2.1 billion. This represents about 24 percent of the statewide visitor expenditures of $8.7 billion during 1993. The total statewide visitor expenditures for 1994 were $10.6 billion. The amount of Maui County visitor expenditures was not available (DBEDT, 1995). Thus, West Maui has emerged as one of the State's major resort destinations.

While very dependent on the visitor industry, agriculture, principally sugar and pineapple, provides a vital contribution to the West Maui economy. In 1994, Maui County had 41,900 acres of cane fields and generated a $58.5 million sugar crop. Pioneer Mill has 6,300 acres of cane fields and produced 43,000 tons (about 15 percent of Maui's total) and employed 279 people in 1992. Pineapples were grown on 10,800 acres and produced a $25.2 million crop (DBEDT, 1995).

Maui County's employment base has increased by 17 percent during the period of 1990 to 1995 from 56,500 to 66,200 jobs. However, the unemployment rate fluctuated during the same period from a low of 4.8 percent in 1990 to a high of 8.6 percent in 1992 and down to 7.3 per cent in 1995. Construction jobs peaked in 1991 at about 3,200 and have decreased by 62.5 percent to 2,000 in 1995.

3.10.2 Potential Impacts

This section includes identification and evaluation of potential impacts of the proposed action on the socioeconomic environment in the study area, the region and the County.

Economic Assessment of Maui County

A number of elements of Maui County's economy could be impacted by the proposed project including the following.

Population and Housing

The construction of the windfarm would require approximately 24 workers. Three quarters of these workers would be expected to be existing Maui County residents. These workers would most likely commute daily to the job site rather than relocating closer to the project area. The remaining workers would be existing supervisory ZPAC employees from the mainland that would obtain temporary housing accommodations on Maui for the duration of the construction phase of the project.

Operational and maintenance (O&M) activities would require three full-time and two part-time employees. Most of these positions are expected to be filled by existing Maui County residents. Thus, the project would have a net positive impact on the County population and housing.

Displacement and Relocation

Since the proposed windfarm is on currently undeveloped land, there would be no displacement of residences or businesses.

Public Services

Gas and electric services would not be required during construction. Communication from the site to other locations would be via cellular phones. Permanent electrical service would be established once the windfarm is interconnected with the utility's transmission system. Excavation would be required for installation of the wind turbine towers, site O&M facility and other foundations. Water would be trucked in as needed for control of dust. Sanitary wastes generated during and after construction would be collected in portable toilets.

Solid wastes generated during construction, not suitable for re-use on-site or recycling, would be transported to the Central Maui Landfill in Puunene. Note: excavated soils would be re-used on site and in repair of the access road. However, there may be miscellaneous construction debris that cannot be reused on site. Adverse impacts on public services and utilities are not expected during construction or operation of the windfarm.

While the windfarm would not continuously generate power, it would increase the reliability of MECO's system. The windfarm is expected to operate at an average capacity factor of 35% or greater. The windfarm would generate valuable electricity when the tradewinds blow or the wind is sufficiently strong from other directions. Thus, the windfarm would reduce the amount of fossil fuels needed at the Maalaea and Kahului powerplants.

Growth Inducement

The windfarm will provide "as available" power to MECO's system. As an "as available power" source, MECO does not consider wind-generated energy or other intermittent sources to have a capacity value. Therefore, this project is not considered growth inducing.

Economic Impacts

The proposed action would generate significant economic activity for the County and the State. The impacts of the $27M windfarm would be both short-term during the construction period and long-term during the expected 25-year lifetime of the project.

The short-term economic activity would include:

- $10 million in site construction contracts, and
- $4 million in State excise tax revenues

The long-term economic activity would include:

- Estimated $7M in fees paid by ZPAC for the use of State land,
- $3.75M in job-related income ($150K per year) plus the resulting income tax revenues,
- $2M in revenues from excise tax paid on operational materials and services,
- $1.35M in property taxes (0.2% year over 25 years),
- Avoidance of $38 million in oil purchases (based on oil at $15/barrell) over the 25 year anticipated windfarm lifetime[5]. This $46M would recirculate in Hawaii, and
- In addition, it estimated that the project will save ratepayers $13M over the 25 year lifetime, based on a 3.5%/year MECO increase in avoided costs.

Thus, the State would benefit from several revenue streams. First, there would be an estimated $7 million in fees paid by ZPAC for the use of the State's land. Second, there would be an estimated $6 million in tax revenues from excise tax paid on construction and operation materials, and income tax paid by the windfarm employees and consultants. Third, the State and its citizens would benefit from an estimated $1.35M in property taxes.

<u>Evaluation</u>

WSB-Hawaii believes that the proposed action would have a net positive impact on the economy of Maui County and the State as a whole. This benefit would come primarily from the direct economic benefits that the project would generate. Therefore, WSB-Hawaii evaluates the severity of the impacts on economy of Maui County to be *"beneficial."*

3.10.3 Mitigation Measures

WSB-Hawaii believes no mitigation measures are required.

[5] Based on an average capacity factor of 35 percent, the estimated annual electrical output would be 61,3200 MWh. From MECO's IRP report, the average heat rate of its generators at Maalaea is 10 mmbtu/MWh. The windfarm would then save 613,200 Mbtu a year. Since the average Btu content of a barrel of oil used by MECO is 6 mmbtu, the windfarm would then save MECO 102,200 barrels of oil a year or over 2.5 million over 25 years. At $18/barrell, the annual savings would be over $1.8 million, the 25 year savings would be almost $46 million.

3.11 Infrastructure

This section includes a description of the infrastructure in the study area and identification and evaluation of the potential environmental consequences of the proposed action on these resources. Note: the study area includes both the windfarm site and the site access. Mitigation measures are proposed and discussed, including an evaluation of the impact consequences before and after the mitigation measures program. Refer to Table 3.1-2 for a summary of the environmental consequences of the proposed action and mitigation measures program.

3.11.1 Existing Conditions

The proposed 20 MW windfarm would be located on a narrow band of land running mauka to makai in the Kaheawa Pastures, Ukumehame ahupua'a (Ukumehame Conservation District Land). This land is undeveloped and its primarily current use is for conservation. DLNR has allowed livestock grazing in the past (See also Section 3.4). DLNR currently provides easements for three MECO transmission lines on the land. The existing infrastructure includes a network of 4-wheel drive jeep roads and the Old Lahaina Pali Trail.

Roads and Traffic

The existing roads are used primarily by DLNR on State business and MECO personnel to inspect and maintain the transmission lines. These roads are used on an intermittent basis. Access is through a locked gate on the mauka side of the Honoapiilani Highway near McGregor Point. Access to the proposed windfarm site is discussed in more detail in Sections 3.4 and 3.5.

Utilities

With the exception of the MECO transmission lines, there are no utilities in the proposed study area.

3.11.2 Potential Impacts

This section includes identification and evaluation of potential environmental consequences to the infrastructure in the study area due to the proposed action.

Roads and Traffic

The potential impacts of the proposed action on the access roads are discussed in Section 3.5. The primary impact is the potential for soil erosion and damage during repair of the existing road and construction of the proposed new spur. Without mitigation, WSB-Hawaii evaluates the severity of the impacts as *non significant*, with mitigation *negligible*. For details of the discussion and evaluation see Sections 3.5.2 and 3.5.3.

There are other potential impacts to the traffic on the main highway. These would occur during the construction phase, e.g., heavy trucks transporting the wind turbines and towers, and concrete trucks for the foundation (See Figure 3.11.2-1).

Utilities

The electric utility service would be established on-site once the windfarm has been intertied to MECO's transmission system. Water and waste removal systems would be installed with the operations and maintenance facility. During construction, all necessary utilities would be brought on site, i.e., portable toilets, bottled water and portable generators as necessary. There would be the normal hazards with transportation and operation of these systems.

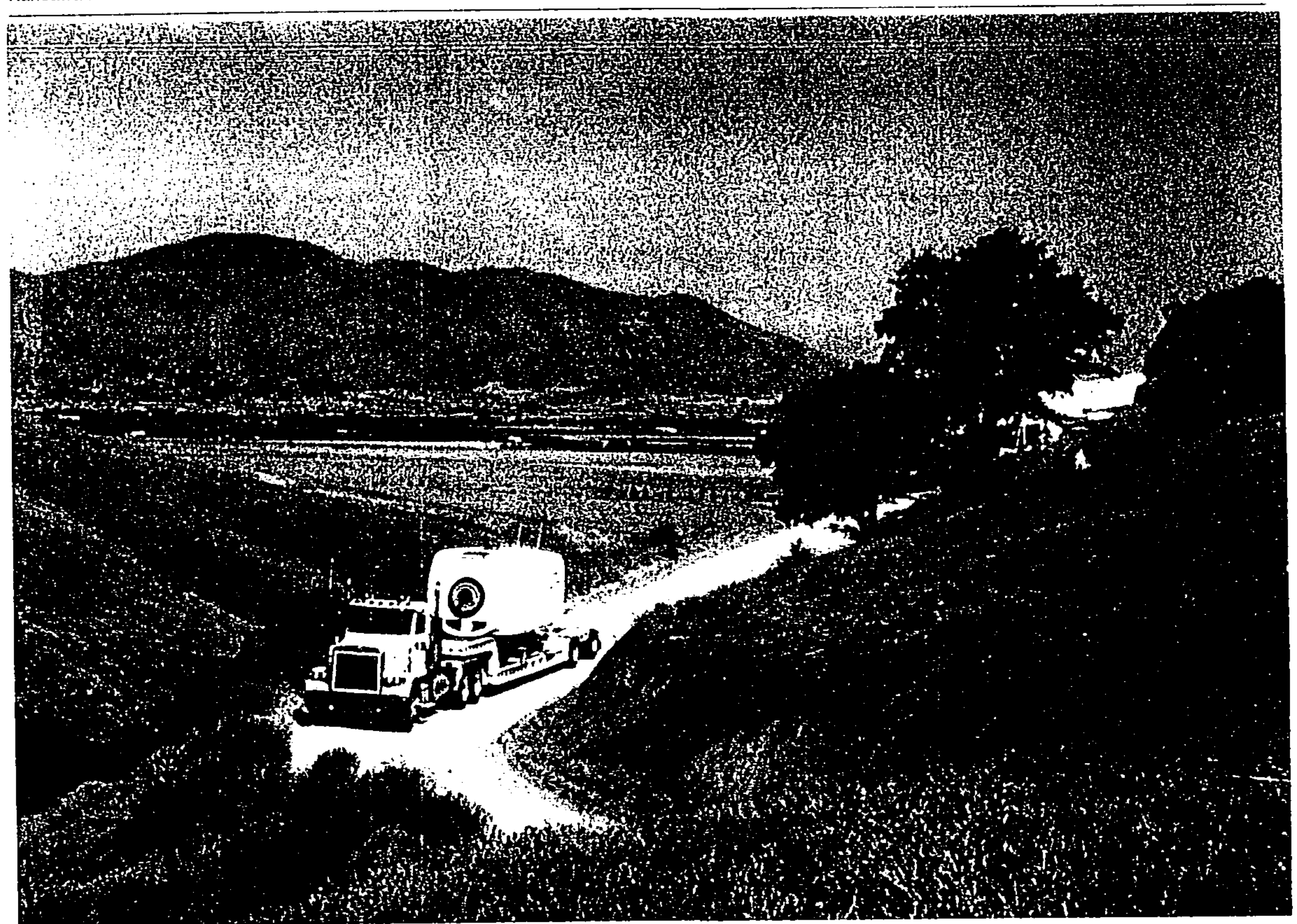

Figure 3.11.2-1. Truck Transport of a Zond Wind Turbine Nacelle

Evaluation

With the implementation of standard safety practices, the hazards are associated with transporting the wind turbines, towers, equipment and construction materials to the site can be minimized in the study area. Similarly, the hazards associated with transporting and operating the portable utility systems can be minimized. Therefore, WSB-Hawaii evaluates the severity of the impacts on roads and traffic and the utilities to be *"negligible."*

3.11.3 Mitigation Measures

WSB-Hawaii believes no mitigation measures are required.

3.12 Public Services and Facilities

This section includes a description of the public services and facilities in the study area and identification and evaluation of the potential environmental consequences of the proposed action on these resources. Note: the study area includes both the windfarm site and the site access. Mitigation measures are proposed and discussed, including an evaluation of the impact consequences before and after the mitigation measures program. Refer to Table 3.1-2 for a summary of the environmental consequences of the proposed action and mitigation measures program.

3.12.1 Existing Conditions

Because of its remote location on Conservation District Land, the proposed windfarm site does not have direct access to health care, police, fire protection and other emergency service facilities. The nearest hospital is the Maui Memorial Hospital, 221 Mahalani Street in Wailuku. The main telephone number is 586-4090. In case of emergencies, paramedic/ ambulance services are available from the Wailuku and Kihei areas. These units are dispatched in response to a standard 911 call.

The Maui Police Headquarters is located at 55 Mahalani Street, Wailuku. In case of emergencies, units are dispatched in response to a standard 911 call. Non-emergency calls are taken at 244-6400.

There are Maui Main Fire Station is in Kahului at 200 Dairy Road. Their phone number is 243-7561. Additional Fire Stations are located in Wailuku, Kihei and Lahaina.

3.12.2 Potential Impacts

Discussion

This section includes identification and evaluation of potential environmental consequences to the public services and facilities in the study area due to the proposed action.

The proposed project is not anticipated to result in a significant impact to the existing public services and facilities. Given the remote location of the proposed windfarm site, there are potential impacts to the site and personnel. These include:

- extra time required for emergency medical, police and fire units to respond to the site for serious events, such as a "heart attack," and
- situations where it may not be feasible for emergency units to respond using standard procedures, such as use of fire trucks to fight an on-site grass fire.

WSB-Hawaii believes that planned, on-site emergency capabilities would mitigate some of these hazards. For example, the site would be equipped with emergency first aid and fire-fighting equipment. This would be adequate for typical, minor incidents, accidents and fires.

Evaluation

In this case, there should be no impact on the public services and facilities. Given the remoteness of the site, there are potential impacts to the windfarm project. WSB-Hawaii evaluates the severity of the potential impacts on the project due to lack of nearby public services and facilities to be *"non significant."* WSB-Hawaii believes these impacts can be reduced with mitigation.

3.12.3 Mitigation Measures

Discussion

ZPAC recommends mitigation of the potential hazards for the more serious emergency events. These include:

- contracting with a local helicopter company for emergency medical evacuation to Maui Memorial Hospital, and
- coordinating with the Maui Fire Departments on emergency response firefighting procedures, such as use of helicopters in case of a grass fire.

WSB-Hawaii also recommends coordination with the key emergency planners at the hospital, fire and police departments during the design phase of the project, including incorporation of recommendations for enhancing on-site capabilities.

Evaluation

WSB-Hawaii believes the potential impacts to the site and site personnel can be reduced significantly. Therefore, WSB-Hawaii evaluates the severity of the potential impacts on the project due to lack of nearby public services and facilities to be *"negligible"* following implementation of the mitigation measures.

3.13 Air Quality and Meteorology

This section includes a description of the air quality and meteorology in the study area and identification and evaluation of the potential environmental consequences of the proposed action on air quality. Note: the study area includes both the windfarm site and the site access. Mitigation measures are proposed and discussed, including an evaluation of the impact consequences before and after the mitigation measures program. Refer to Table 3.1-2 for a summary of the impacts of the proposed action and mitigation measures program.

3.13.1 Existing Conditions

Air quality is influenced primarily by meteorological conditions, the size and topography of the air basin, and the type and amount of pollutants emitted into the atmosphere. In this case, the air basin consists of the island of Maui, of which, the study area is a relatively small portion. The discussion here includes appropriate portions of the "Air Quality and Meteorology" section of the MECO EIS. Quotes are from the MECO EIS unless otherwise noted.

Meteorology

"The climate of Maui is relatively uniform throughout the year, characterized by moderate temperatures with rainy winters and moderately high humidity throughout the year. Prevailing surface winds in the study area are from the east/northeast. These northeasterly tradewinds occur over 70 percent of the time; however, during "kona" conditions the prevailing direction changes to a south/southwesterly direction." The winds at the proposed windfarm site *are stronger due to the acceleration of the air as it flows up from the central valley (tradewinds)* and from the ocean (kona). These conditions increase the viability of the windfarm. "Wind patterns vary on a daily basis, with tradewinds generally being stronger in the afternoon. During the day, winds blow on shore toward the warmer land mass. In the evening, the reverse occurs, as breezes blow toward the relatively warm ocean."

"The slopes of West Maui experience an interesting meteorological phenomenon due to topography and landform. The deep gulches and ravines create a natural wind tunnel that acts to accelerate wind speeds in the downslope direction, thereby increasing wind velocity on the ridges immediately above these gulches (Chui, 1991)."

"Due to the tempering influence of the Pacific Ocean and the tropical latitude of the Hawaiian Islands, the diurnal and seasonal ambient temperature variation is extremely small. During January, the temperature average ranges from a low of 62 degrees Fahrenheit (°F) to a high of 81°F. In August, the warmest month, the average temperature ranges from 71°F to 87°F."

"Most of the rainfall occurs during winter months. Over 80 percent of the annual rainfall occurs during a six-month period between November and April." Annual rainfall is estimated to be between 30 and 50 inches a year at the proposed windfarm site."

Air Quality Standards

"Air quality standards, defined as the ambient air pollutant concentration level not to be exceeded more than once a year during a specified sampling period, have been adopted by the Federal and State governments for six major pollutants: ozone (O_3), nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), fine particulates (PM_{10}) and total suspended particulates (TSP). Both State and Federal air quality standards apply to the study area, although State standards contained in Chapter 59, Title 11, Department of Health, Administrative Rules are generally more stringent."

Existing Air Quality

"The nearest air quality monitoring stations to the study area are at Kihei Sewage Treatment Plant, Maalaea Power Plant and the Lahaina Elementary School. No exceedances of State or Federal standards have occurred at these stations within the past year (Hendricks, Kathy, March 19, 1993. Personal Communication. Department of Health)."

"Existing sources of air emissions in the study area include: sulfur dioxide from the Maalaea Power Plant; dust from wind erosion on steep slopes that have been overgrazed; components of engine exhaust from roadway traffic and agricultural operations; dust and other particulates from periodic cane burning, or cultivating or harvesting crops; and traces of chemical used in pesticides, ripeners and other materials used in aerial spraying of crops. Thus, ambient air quality conditions in the study area include intermittent, temporary increases in pollutant emissions that vary with the time of day, wind conditions and seasonal activities."

3.13.2 Potential Impacts

This section includes identification and evaluation of potential impact on the air quality the study area, the region and the County due to the proposed action.

Discussion

The proposed action would result in positive impacts in the long-term to the air quality in the region, and could potentially result in some negative impacts during the construction phase of the proposed action.

Positive Impacts

Background. With operation of the windfarm, the electricity generated by the wind turbines would offset a portion of fossil fuels needed to generate electricity at the Maalaea Power Plant. The estimated annual electrical output delivered to MECO is 61,320 MWH. This would reduce Maalaea's fuel use by approximately 102,000 barrels of oil per year.

Because of the reduction in the oil use, air emissions from MECO's powerplants would be avoided. The emission are in the form of releases of gases such as carbon monoxide, carbon dioxide, sulfur dioxide, nitrogen dioxide, total suspended particulates (TSP) and volatile organic compounds (VOC). The avoided emissions are estimated as described below.

Methodology for Estimating Avoided MECO Emissions (General). The true avoided emissions would depend on the temporal characteristics of the windfarm power output and the corresponding emission characteristics of the MECO power plants that would be operating, if the windfarm did not exist. To obtain an accurate estimation of the emissions, time-series data of both the windfarm output and powerplant emission characteristics would be required.

Prior to installation of the windfarm, hourly averages of wind data could be used to project windfarm output. If similar time series were available for the MECO powerplants, the multiple sets of data could be compared to determine the powerplant operating conditions and corresponding emission profiles. At present, the required detailed data are not available. Also, WSB-Hawaii believes the expense of acquiring and analyzing the data is not warranted for this project. Instead, WSB-Hawaii proposes that a surrogate method be employed for estimating the emissions. This method, which is based on SOH Department of Health (DOH) maximum emission limitations, is discussed below.

Methodology for Estimating Avoided MECO Emissions (Surrogate). For the purpose of the surrogate emission calculation, the following Maalaea units have been selected: diesel (units 12 and 13, each 12.5 MW) and combined cycle (units 14, 15 and 16). Units 14 and 16 are 20 MW combustion turbines and unit 15 is an 18 MW heat recovery turbine. All of these units are fired by #2 distillate oil (diesel fuel). WSB-Hawaii believes the use of these units as surrogates is reasonable and will result in a conservative estimate of maximum avoided emissions. The rationale is as follows:

(1) Only Maalaea units are used, as the windfarm interconnection would be on the transmission line feeding the West Maui region from the Maalaea area. It is assumed that most of the time, the windfarm output would reduce the West Maui load and the corresponding Maalaea generation requirement. While there may be times when the windfarm operation actually reduces Kahului unit requirements, this approach reduces the total number of generators that need to be analyzed and simplifies the emission calculations;

(2) The Kahului power plant generators are steam turbines and generally have higher levels of emissions than the combined cycle unit at Maalaea. Therefore, WSB-Hawaii believes this approach will result in a conservative estimate of the avoided emissions; and

(3) WSB-Hawaii assumes that 80% of the windfarm output will offset power from the combined cycle unit (primarily baseload) and 20% from the diesel (peaking load). WSB-Hawaii believes the amount of diesel offset could be higher. Therefore, WSB-Hawaii believes this approach will result in a conservative estimate of the avoided emissions, as the diesel units typically have higher emission levels than the combined cycle units.

Data Sources. Detailed emission data were assembled for the surrogate analysis using several sources, including DOH, the Public Service Commission of Nevada (PSC-Nevada) and the Union of Concerned Scientists (UCS). The DOH data include emission requirements (limits) from operating permits for the MECO generators. The permits specify the levels of emissions allowed for various operating conditions and required performance tests for MECO to document compliance (DOH, 1994). Selected data from the PSC-Nevada and UCS data sets are used to compare with the DOH data and to provide estimates of MECO generator carbon dioxide emissions which are not specified by the DOH.

Data Reduction and Analysis. Since the data are reported differently, several steps were required to reduce the data and to compare them in a common format. Subsequently, the emission characteristics of MECO generators are analyzed, given the above assumptions, to estimate the avoided emissions due to the projected performance of the proposed windfarm.

The DOH maximum emission limitations are stated in lb/hr as summarized in Table 3.13.2-1. The fuel type for all the generators is distillate which is #2 fuel oil (diesel). The heat rate, given in Btu/kWh, is an overall indicator of unit efficiency. The lower the number, the higher the efficiency. Emission limits are specified for each generator, including separate requirements for the two individual simple cycle (SC), the combined cycle (CC) and reciprocating (diesel) units. Note that the heat rate is lowest for the CC and that its emission levels are lowest. Note also that the emission levels are lower at higher load factors for the SCs and the CC. The emission levels of the diesels are generally higher than for the SCs and the CC. Finally, the DOH imposes no limitations on carbon dioxide emissions for any of the units. The carbon dioxide emissions for the Maalaea units are inferred from review and analysis of the Nevada and California data.

Table 3.13.2-1. DOH Maximum Allowable Emissions (lb/hr)

Plant	Type	Fuel	Heat R.	CO	CO2	SOx	NOx	TSP	VOC
M14/16 (100% LF)	SC	Distillate	11,000	26.8	n.a.	110	42.3	19.7	0.8
M14/16 (75% LF)	SC	Distillate	11,000	56.4	n.a.	110	42.3	19.7	2.6
M14/15/16 (100% LF)	CC	Distillate	8,140	26.9	n.a.	110	42.3	19.7	0.8
M14/15/16 (75% LF)	CC	Distillate	8,140	50.2	n.a.	110	42.3	19.7	2.0
Maalaea (M12/13)	Recip	Distillate	10,000	70.6	n.a.	58	256.1	39.1	31.6

Legend:
CC = combined cycle
CO = carbon monoxide
CO2 = carbon dioxide
CT = combustion turbine
Distillate = fuel oil #2 (diesel)
Heat Rate = Btu/kWh
LF = load factor (% of rated capacity)
M = Maalaea power plant
n.a. = not applicable
NOx = nitrogen oxides, principally nitrogen dioxide
Recip. = reciprocating engine generator (diesel)
SC = simple cycle
SOx = sulfur oxides, principally sulfur dioxide
TSP = total suspended particulates
VOC = volatile organic compounds

In Table 3.13.2-2, the Maalaea units are compared with similar units described in the PSC-Nevada and UCS data sets. The emission data for the UCS - West generators are averages for the western region of the US (UCS, 1991). The emission data for the Nevada generators are averages for the State of Nevada (PSC-Nevada, 1991). Overall, these generators show similar emission characteristics as their Maalaea counterparts.

The emissions are compared in Table 3.13.2-2 based on lb/mmBtu[6], which is a standard unit for comparing emission levels from generators of different sizes. Another useful method is to compare the emissions per MWH. Note: the Nevada data are reported in lb/mmBtu and the UCS data in lb/MWH, while the Maalaea data are in lb/hr.

Therefore, it was necessary to convert the data sets to common units. For example, to convert the UCS data to lb/mmBtu, the individual emissions were divided by the heat rate in mmBtu. To convert the Maalaea data, the hourly emissions were first divided by the capacity of the individual units and then the heat rate in mmBtu/MWH.

Table 3.13.2-2. Comparison of Emissions (lb/mmBtu)

Plant	Type	Fuel	Heat R.	CO	CO2	SOx	NOx	TSP	VOC
UCS - West	CT	Distillate	11,000	0.24	162	0.63	2.15	0.085	0.088
Maalaea 14 (100%LF)	SC	Distillate	11,000	0.122	n.a.	0.500	0.192	0.090	0.004
Maalaea 14 (75%LF)	SC	Distillate	11,000	0.256	n.a.	0.500	0.192	0.090	0.012
Nevada	CC	Distillate	8,140	0.018	163	0.314	0.491	0.001	0.016
Maalaea 14/15/16 (100%LF)	CC	Distillate	8,140	0.057	n.a.	0.233	0.090	0.042	0.002
Maalaea 14/15/16 (75%LF)	CC	Distillate	8,140	0.106	n.a.	0.233	0.090	0.042	0.004
Nevada	Recip	Distillate	10,000	0.729	162	0.056	0.503	0.239	0.229
Maalaea (M12/13)	Recip	Distillate	10,000	0.565	n.a.	0.464	2.049	0.313	0.253

[6] Lb/mmBtu = pounds per million Btu.

Table 3.13.2-3 shows a comparison of the emissions in pounds per MWH. Table 3.13.2-3 was created by multiplying the emissions in Table 3.13.2-2 by the appropriate heat rate, resulting in the level of emissions in lb/MWH.

Table 3.13.2-3. Comparison of Emissions (lb/MWH)

Plant	Type	Fuel	Heat R.	CO	CO2	SOx	NOx	TSP	VOC
UCS - West	CT	Distillate	11,000	2.64	1,782	6.93	23.65	0.94	0.97
Maalaea 14 (20 MW)	CT	Distillate	11,000	1.34	n.a.	5.50	2.12	0.99	0.04
Nevada	CC	Distillate	8,140	0.15	1,330	2.56	4.00	0.01	0.13
Maalaea 14/15/16 (58 MW)	CC	Distillate	8,140	0.46	n.a.	1.90	0.73	0.34	0.01
Nevada	Recip	Distillate	10,000	7.29	1,620	0.56	5.03	2.39	2.29
Maalaea (M12/13)	Recip	Distillate	10,000	5.65	n.a.	4.64	20.49	3.13	2.53

Avoided MECO Emissions. As noted previously, the combined cycle and diesel units are used as the surrogates for calculating the avoided MECO emissions. The goal was to achieve a conservative estimate of the maximum avoided emissions. Specifically, it is assumed that the windfarm would offset emissions at the rates indicated in Table 3.13.2-3, i.e., the units are operating at maximum efficiency (100% LF) and therefore at their lowest emission rate. The following additional assumptions are made: the average windfarm output is 7 MW (35% capacity factor); 80% of this would offset output from the combined cycle unit, 20% from the diesel, and the values for carbon dioxide emissions for the Maalaea combined cycle and diesel units are equal to those from the Nevada combined cycle and diesel units respectively. Given these assumptions, the resulting hourly emissions are indicated in Table 3.13.2-4, the annual avoided emissions are indicated in Table 3.13.2-5 and the 25-year avoided emissions in Table 3.13.2-6.

Table 3.13.2-4. MECO Avoided Hourly Emissions (lb)

Plant	Type	Fuel	Heat R.	CO	CO2	SOx	NOx	TSP	VOC
Maalaea 14/15/16 (58 MW)	CC	Distillate	8,140	2.60	7,448	10.62	4.08	1.90	0.08
Maalaea 12/13 (25 MW)	Recip	Distillate	10,000	7.91	2,268	6.50	28.68	4.38	3.54
Totals:				10.51	9,716	17.12	32.76	6.28	3.62

Table 3.13.2-5. MECO Avoided Annual Emissions (lb)

Plant	Type	Fuel	Heat R.	CO	CO2	SOx	NOx	TSP	VOC
Maalaea 14 (58 MW)	CC	Distillate	8,140	22,752	65,244,480	93,037	35,777	16,662	677
Maalaea 12/13 (25 MW)	Recip	Distillate	10,000	69,267	19,867,680	56,905	251,265	38,362	31,003
Totals:				92,019	85,112,160	149,942	287,042	55,024	31,680

Table 3.13.2-6. MECO Avoided 25-Year Emissions (lb)

Plant	Type	Fuel	Heat R.	CO	CO2	SOx	NOx	TSP	VOC
Maalaea 14 (58 MW)	CC	Distillate	8,140	568,796	1,631,112,000	2,325,931	894,426	416,553	16,916
Maalaea (M12/13)	Recip	Distillate	10,000	1,731,677	496,692,000	1,422,624	6,281,621	959,045	775,085
Totals:				2,300,473	2,127,804,000	3,748,555	7,176,047	1,375,598	792,001

Negative Impacts

As discussed previously in Section 3.5, there are potential soil erosion hazards during construction and operation. These could result in dust and potential negative impact to the local ambient air quality.

__Evaluation__

There are both positive and negative potential impacts on the ambient air quality in the study area and in the region. The positive impacts are due to the avoidance of fossil fuel emissions, the negative impacts are due to the potential for dust to be released to the atmosphere during construction and operation. WSB-Hawaii evaluates the overall severity of the short-term impacts as *"non-significant"* and the severity of the long-term impacts as *"beneficial."* With mitigation, the severity of the impacts can be reduced.

3.13.3 Mitigation Measures

__Discussion__

Mitigative measures are required to reduce the potential occurrence of dust releases to the atmosphere during construction and operation. The measures are the same as for mitigating the potential for soil erosions. They are discussed in Section 3.5.3.

__Evaluation__

Based on the implementation of the proposed mitigation measures, WSB-Hawaii evaluates the severity of the short-term impacts as *"negligible."* The long-term impacts remain *"beneficial."*

3.14 Noise

This section includes a description of the noise standards, sources of existing ambient noise and potential impacts in the study area The potential noise (acoustic emissions) of the proposed windfarm are reviewed in the context of the applicable noise standards and the experience of windfarm projects in Hawaii, the U. S. mainland and worldwide. Note: the study area includes both the windfarm site and the site access. Refer to Table 3.1-2 for a summary of the environmental consequences of the proposed action and mitigation measures program.

3.14.1 Existing Conditions

The MECO EIS provided a good introduction to sound and noise standards. Portions of that introduction are included in this section with ambient conditions in the study area.

Introduction

From the MECO EIS, "Sound is measured in decibels (dB), a logarithmic ratio between pressures caused by a given sound and a standard sound pressure. The human ear is not equally sensitive to all frequencies in the sound spectrum. It is standard practice to present sound levels using an "A-weighted" scale that takes into account the way human ears perceive sounds. A-weighted sound levels are noted in dB (A). Light wind or rain is approximately 10 dB (A); a normal conversation is between 50 dB (A) and 60 dB (A). Sound levels of 45 dB (A) may interfere with sleep. Constant sound levels of 85 dB (A) or greater can temporarily impair hearing and 130 dB (A) or greater causes pain and permanent damage."

Noise Standards

"The State Department of Health (DOH), Environmental Health Services Division (EHS) has established acceptable noise levels for different environments, based on zoning designations." Formal rules incorporating these standards have been established for Oahu and the neighbor islands, including Maui (Tome, 1997). For example, maximum allowable sustained noise levels (over a 24-hour period) for the Conservation District is the same as for Urban (Residential Neighborhoods). Maximum limits are 55 dB (A) during daytime (7:00 a.m. to 10:00 p.m.) and 45 dB (A) during nighttime (10:00 a.m. to 7:00 a.m.). If construction activity (e.g., jackhammer, bulldozer, etc.) is expected to exceed the appropriate limits, a noise permit would be needed from the DOH. The permit would allow such activity during restricted, daytime periods.

Ambient Noise Conditions

There are several ambient sources of noise in the study area. These include the wind, rain, falling rocks, birds and mammals. Man has contributed and does contribute to the ambient noise level in several ways, e.g., hiking along the Old Lahaina Pali Trail, driving a vehicle on a jeep road and constructing projects, such as a transmission line.

Most of man's activities in the study area result in intermittent sources of noise. Some can result in continuous sources. As noted before, construction provides intermittent sources which can result in exceedance of existing noise ordinances. In the study area, MECO's transmission lines are the only existing source of man-made noise that is continuous. The level of this noise is believed to very low, if not inaudible to humans (MECO, 1994). Ambient noise conditions in the study area have not been documented, but it is believed that the ambient noise levels are low and do not exceed the State and County noise standards and ordinances.

3.14.2 Potential Impacts

This section includes identification and evaluation of potential noise impacts in the study area and the region due to the proposed action. These impacts could occur during construction and operation of the windfarm.

Construction

Discussion

WSB-Hawaii believes potential noise during windfarm construction is similar to many other small to medium sized construction projects, including building a highway, a house or small apartment building. Refer to Table 3.14.2-1 for list of common sound levels.

The primary sources of noise would include:

- trucks transporting to the site --
  - cement and other construction materials,
  - wind turbines and towers, and
  - hydraulic cranes, bulldozers, backhoes and other heavy equipment.
- Operation of heavy equipment –
  - bulldozers (access road construction),
  - backhoe (trenches and foundation excavation), and
  - hydraulic crane (tower, turbine and building construction)

The transport of the equipment and materials would be on state highways and the access road. WSB-Hawaii believes that the traffic noise would not exceed normal limits. Also, due to the remote location of the site, site construction noise should not be an issue.

Evaluation

Due to the remote location of the access roads and the proposed windfarm, WSB-Hawaii does not believe construction noise would be heard at the nearest residence or public facility. WSB-Hawaii evaluates the severity of these potential impacts on the study area to be *"negligible."* See the next section for mitigation measures during transport to the site.

Operation

Discussion

Wind turbines are machines and they do make noise. Some are noisier than others. The primary sources of the noise are the aerodynamic *whoosh* the blades make as they rush through the air, the *whir* of gears inside the gearbox and the hum of the electrical generator. Over 20,000 wind turbines have been installed worldwide as of 1995 (Gipe, 1995). The number of complaints about noise have been very small. Of 3,500 turbines in Denmark, less than 2 percent have resulted in noise complaints. Nearly all of these came from persons living within 700 feet of the wind turbine (s). There have been two key instances where noise generated by windfarms has been a problem in California. These occurred in the early 1980's when a number of siting errors were made, including siting turbines too close to residences. These problems were solved through relocation of turbines in one case and replacement with less noisy wind turbines in the other.

Table 3.14.2-1
Examples of Sound Levels[7]

Item	Sound Level (dBA)[8]
Threshold of Hearing	0
Light rain or wind	10
Human voice – soft whisper at 5 ft	30
Average home	50
Light auto traffic	50
Wind in trees	55
Large transformer	55
Small (10-kW) wind turbine	57
Vacuum cleaner	70
Freeway traffic at 100 ft	70
Freight train at 100 ft	70
Truck, pickup, or 4-wheel drive	77
Truck, flat-bed	78
Inside sports car	80
Dozer	82
Crane, mobile (15 to 20 ton)	83
Pneumatic tools	85
Crane, mobile (50 ton)	88
Helicopter at 100 ft	98
Jackhammer	100
Jet takeoff at 200 ft	120
Ship siren at 100 ft	130
Threshold of pain	140

[7] Compiled from Pile Design and Construction Practice, M. J. Tomlinson; Handbook of Noise Measurement, General Radio; and Bergey Windpower.
[8] A-weighted sound level at 50 ft unless specified otherwise.

Noise Requirements and Standards. During the past 20 years of wind turbine design and windfarm development, much has been learned about how to design the turbines to reduce their acoustic output. In addition, the wind industry has worked closely with government agencies, utilities and environmental groups to develop appropriate acoustic emission standards. These include a "Procedure for Measurement of Acoustic Emissions from Wind Turbine Generator Systems. Volume I: First Tier," (a U. S. standard developed by the American Wind Energy Association). This standard, developed to measure the noise from one wind turbine, has been used by County agencies in California and other states to support local enforcement of noise ordinances.

Mr. Gipe notes that community noise standards vary quite a bit in Europe and the U. S. In some parts of Europe, where the population density is high, noise restrictions can be strict For example, in the Netherlands, the noise at the property line of a wind turbine installation in residential areas must meet 45 dB (A), day and 35 dB (A), night. Germany is less strict [55 dB (A), day; 40 dB (A), night].

Kern County, California has a fixed requirement of 45 dB (A) for both residential and rural zones. In this case, the limit cannot be exceeded during any 5-minute period. Palm Springs is less restrictive for residential [50 dB (A), day or night] and rural [60 dB (A), day or night]. In Hawaii, the State and County noise requirements (as noted previously) are generally 55 dB (A) [day] and 45 dB (A) [night] in rural and conservation areas.

The AWEA standard has subsequently been incorporated into an international standard under the auspices of the International Electrotechnical Commission (IEC), Geneva, Switzerland. The international activity has been expanded and continues with the objective of developing international standards for acoustic emissions from windfarms.

Design and Siting Guidelines. The following are guidelines for avoiding or minimizing noise problems installations. These represent learning through the combined efforts of industry, government, utilities, environmentalists and other interested parties:

- wind turbine design characteristics:
    - upwind turbines are less noisy. Downwind turbines are subject to the "tower shadow" effect, which can result in a low frequency "thump" each time a blade passes behind the tower. WSB-Hawaii Comment: the Z-48 is an *upwind turbine,*
    - wind turbines that operate at lower tip speeds (the velocity at the tip of the rotating blade) are generally less noisy. For example, a 3-bladed turbine generally operates at a lower tip speed than a 2-blader of the same rotor diameter. The 3-blader is generally less noisy. WSB-Hawaii Comment: the Z-48 is a *3-bladed wind turbine,*
    - fixed speed rotors which stall at high wind speeds are noisier than variable speed rotors or wind turbines with blade pitch control. WSB-Hawaii Comment: the Z-48 is a *variable speed machine with blade pitch control,*
    - the blade designs are also important. New wind turbine specific designs that improve power output are generally less noisy than earlier designs borrowed from the aircraft and helicopter industry. Noise can be reduced further by careful attention to the tip area and reducing the trailing edge thickness. WSB-Hawaii Comment: the Z-48 blades are of an *advanced NREL design* for higher performance and reduced noise, and

- gearboxes and generators are noisy. Planetary gears are generally noisier than helical gears. Specific gears and couplings can be custom-designed to reduce noise. A lower generator operating speed can be selected. The nacelle housing the gearbox and generator can muffle the noise if it is tightly enclosed and lined with sound-damping materials. WSB-Hawaii Comment: the Z-48 employs a *helical gearbox* and *sound-damping materials in the nacelle.*

- windfarm siting characteristics
  - wind turbines should be installed away from residences or other locations where people would hear them on a regular basis, WSB-Hawaii Comment: the proposed site is at least two miles from the nearest residence,
  - certain topographic or terrain features that can enhance or propagate noise should be avoided. Normally, vegetation and hilly terrain will attenuate sound. However, a valley may channel sound over longer distances than normal and the wind turbine noise is not masked by ambient winds. WSB-Hawaii Comment: in addition to being remote, the proposed site is on moderately hilly, grassland/shrubland terrain which will tend to attenuate the noise from the wind turbines, and
  - sites where meteorological effects (temperature, wind shear) offset natural attenuation of noise should be avoided. These effects may vary with the season, weather patterns and time of day. WSB-Hawaii Comment: there are no known special meteorological effects at the proposed site which would *offset the natural attenuation of the noise from the wind turbines.*

Acoustic Emissions of a Single Wind Turbine and Windfarm. All wind turbines create a specific amount of sound power [measured in dB] which then propagates to its surroundings. The farther from the turbine or array, the less the noise in general. The sound power of utility-scale commercial wind turbines (300 kW to 750 kW) varies from about 95 dB to 110 dB. Differences of 3 dB indicate half as much or twice as much sound power. That is, a wind turbine with a sound pressure level of 100 dB has twice the inherent sound power (noise) as a 97 dB wind turbine, and half that of a 103 dB turbine. Mr. Gipe notes that wind turbines in the 1990's are generally less noisy than those designed in the 1970's.

Sound radiates spherically from a point source, such as a helicopter. Theoretically, for every doubling of the distance from the source, the measured noise level decreases 6 dB (A) . Since wind turbines stay fixed near the ground, the sound propagates differently and has been found to decay at 3 to 6 dB (A) per doubling of the distance over a flat reflective surface, such as a lake. Theoretical predictions of the sound propagation can be made using the wind turbines sound pressure level and the distance from the turbine to a second location. As discussed previously, terrain and meteorological conditions can effect the propagation of the noise.

Groups of wind turbines complicate the calculations further. An observer may have to be greater than 1.6km (1mi) for an array to appear as a point source. For each doubling of the number of turbines, the acoustic power doubles which increases the noise levels 3 dB. At closer distances, the array begins to act like a line source. The decay rate for a line source is 3 dB per doubling of the distance, not 6 dB for true spherical propagation.

Mr. Gipe provided noise estimates from Danish wind turbine manufacturers. "Noise from a typical medium-sized (300 to 500 kW) wind turbine will drop to 45 dB (A) within 150m (500ft). The aggregate noise from a small windfarm of 30 such turbines will drop to 45 dB (A) within 500m (1,800 ft)."

Impact of the Proposed Windfarm. ZPAC proposes to use 27 of its Z-48 wind turbines in a single, articulated row, as opposed to the more traditional array. Each of these turbines has a 48m (157ft) rotor diameter and a 750 kW generator. Like other larger wind turbines, the Z-48 is a bit noisier than the medium-size turbines discussed above. The sound power level for this turbine is 102 dB (Mikhail, Personal Communication). It is estimated that the noise (sound pressure level) for a single turbine would decay to 45 dB (A) within 170 m (558 ft)[9].

As discussed previously, the noise output of an entire windfarm depends on whether the observer sees the windfarm as a single point (from a large distance) or as a straight line (from a closer distance). In general, an observer would have to be able to see the wind turbines in order to hear them, i.e., any terrain between the observer and the wind turbines would tend to mask or absorb the sounds. Consequently, WSB-Hawaii believes an observer below the wind turbines, such as a hiker on the Old Lahaina Pali Trail, would not be able to see or hear the turbines. From across the Maalaea Bay at Kihei, an observer would be 10km (6.2) miles or more away. This would be sufficient distance for the windfarm to appear as a single point. However, at that distance, the estimated noise level of the windfarm would be less than 25 dB (A) and masked by the ambient noise level.

Finally, the proposed windfarm is greater than 3.2km (2mi) away from the nearest residence. These residences are also at or near sea level and well below the elevation of the windfarm. Consequently, residents would not be able see or hear the wind turbines. See also discussion in Section 3.16 (Visual Impact) regarding observation points from which the turbines might be seen.

There are other potential noise-receptors in the study area, i.e., any birds and mammals that may on or near the proposed windfarm site. There are no known studies as to how birds and mammals may be affected by noise, such as generated by wind turbines.

WSB-Hawaii is not aware of any data to suggest that the noise from wind turbines is objectionable to birds and mammals. There is anecdotal data to support the opposite. For example, birds have also been known to nest on wind turbine towers and near airport runways which have much higher levels of noise. While little is known about the impacts on smaller mammals, larger mammals, such as cattle, adapt well to the presence of wind turbines.

Evaluation

Due to the remote location of the proposed windfarm, WSB-Hawaii does not believe noise from the operating wind turbines would be heard at the nearest residence or public facility including the Old Lahaina Pali Trail. WSB-Hawaii believes that the noise from the windfarm would not impact the birds and mammals that may be on the windfarm or nearby. Therefore, WSB-Hawaii evaluates the severity of these potential windfarm noise impacts to be *"none."*

3.14.3 Mitigation Measures

This section includes a discussion of the mitigation measures that would be implemented during the transport to the site and construction and operational phases of the proposed project.

Transport to the Site and Construction

WSB-Hawaii recommends that industry standard procedures be implemented during the transport to the site to eliminate potential noise impacts. These procedures include:

[9] The sound pressure level (LP) in dB (A) = sound power level (LW) - 20log10(R) - 11.99. R = the slant distance from the wind turbine to the point on the ground where LP is to be estimated. LW = 102 dB.

- driving all vehicles within posted speed limits on the roads and highways, and in a safe and prudent manner on the access roads to the site, and
- limiting transport of equipment and materials to daylight hours.

Operation

WSB-Hawaii does not believe mitigation measures are required for the operation of the windfarm.

Evaluation

Based on implementation of the proposed mitigation measures, *WSB-Hawaii evaluates the severity of all potential noise impacts on the study area to be "none."*

3.15 Electrical and Magnetic Fields

This section includes a description of the potential electrical and magnetic fields (EMF) in the study area and identification and evaluation of the potential environmental consequences of additional EMF generated by the proposed action. Note: the study area includes both the windfarm site and the site access. Mitigation measures are proposed and discussed, including an evaluation of the impact consequences before and after the mitigation measures program. Refer to Table 3.1-2 for a summary of the environmental consequences of the proposed action and mitigation measures program.

3.15.1 Existing Conditions

In recent years there has been growing interest and concern about the potential effects associated with EMF in our society. Most recently, concern has been directed at possible impacts on human health due to the EMF generated by utility transmission and distribution lines. There are also concerns about EMF generated by common home appliances, such as vacuum cleaners, electric ranges and ovens, TVs and electric tools.

Three utility transmission lines cross through the study area and are sources of EMF. The impacts of these transmission lines as well have been studied and documented previously in the MECO EIS. Appropriate information from the MECO EIS is incorporated herein. Quotes are from the MECO EIS unless otherwise noted.

This section includes a brief overview of EMF fundamentals, an introduction to health effects of EM, electrical and magnetic field standards, and an assessment of existing EMF levels in the study area.

<u>Electric and Magnetic Field Fundamentals</u>

Electric fields and magnetic fields are common phenomena in today's society.

Electric Fields

Electric fields are a result of the voltage, or electric potential, on an object. Any object with an electric charge on it has a voltage at its surface caused by the accumulation of more electrons on that surface compared with another object or surface. The voltage effect is not limited to the surface, 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). The electric field is stronger near a charged object and decreases rapidly with distance from an object."

Electric fields are generated from a number of sources. "Static electric fields can result from friction generated when taking off a sweater or walking across a carpet. Most household appliances and other devices that operate on electricity create electric fields. The electric field is a result of the voltage on the appliance. The field decreases rapidly with distance. Fields from point-source household appliances generally decrease more rapidly with distance than fields from lines sources such as power lines. Appliances need not be in operation to create an electric field; an electric field occurs whenever an appliance is connected to an electrical outlet." Typical values, measured at 12 inches, for some common appliances are shown in Table 3-15.1-1.

Table 3.15.1-1
Typical Electric Field Values for Household Appliances[1]

Appliance	Electric Field (kilovolts/m)[2]
Electric blanket	0.25[3]
Broiler	0.13
Refrigerator	0.09
Iron	0.06
Hand Mixer	0.05
Phonograph	0.04
Coffee Pot	0.03
[1]Compiled from Gauger, 1985. [2]measured at 12 inches. [3]1 to 10 KV/m next to blanket wires (Enertech Consultants, 1985)	

Table 3.15.1-2
Typical Magnetic Field Values for Household Appliances[4]

	Magnetic Field (mG)	
Appliance	12 inches 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	350 to 250	10,000 to 20,000
Mixer	6 to 100	500 to 7,000
Blender, Popper, Processor	6 to 20	250 to 1,250
Vacuum Cleaner	20 to 2,000	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
[4]Compiled from Gauger, 1985; Silva et. al., January, 1989.		

Magnetic Fields

Magnetic fields are generated by substances that are naturally magnetic or from devices that electric current flowing in a conductor, such as any appliance or equipment that has an electric motor. "The most commonly used unit for measuring magnetic fields is the Gauss, which is a measure of the magnetic flux density (intensity of magnetic field attraction per unit area). The unit mG (or milliGauss) is equal to one-thousandth of a Gauss. As a reference, the earth has a natural static direct current (dc) magnetic field of about 0.36 Gauss, or 360 mG, in the Hawaiian islands (Merrill and McElhinny, 1983)."

"Transmission lines, distribution lines, switching stations and substations also have magnetic fields, but the characteristics are different from earth's direct current fields because the power line field is due to alternating currents (ac). The magnetic fields under transmission and distribution lines, and near substations, are relatively low when compared to measurements near many household appliances and other equipment. The magnetic field near an appliance decreases rapidly with distance from the device. The magnetic field decrease with distance from electrical substation equipment (such as transformers and capacitor banks) as it does with appliances. Magnetic fields also decrease with distance from line sources, such as transmission lines, but not as rapidly as with substation equipment or appliances. A transmission line field is spatially more persistent. Since the magnetic field is caused by the flow of an electric current, a device must be operated to create a magnetic field." See Table 3.15.1-2 for magnetic field values of typical household appliances and electrical equipment. "A study of typical household appliances conducted for the Electric Power Research Institute (Silva et.al.,1989) found that the mean magnetic field levels in residential homes was about 0.9 mG (at one meter above ground level)."

The MECO EIS includes a summary of everyday magnetic field levels at selected Oahu and Big Island locations. These measurements were taken at a number of commercial and government locations. The measurements varied from 0.2 to 300 mG. Measurements generally below 100 mG. The measurements on the Big Island were generally lower for similar locations.

<u>**Health Effects of Electric and Magnetic Fields**</u>

Health effects from EMF have been studied since the 1960's. The MECO EIS provides a very good discussion of the important studies and findings current to the date of the EIS. These and two more recent studies are summarized below.

Overview

The studies from the "1960's and early 1970's found no obvious harmful effects from typical transmission line electric and magnetic fields. Some studies during this period did report the potential for harmful effects. More recent studies (since about 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 underway to obtain more definitive information on this subject. Although most of the research has been prompted by concern about the effects of the large, extra-high-voltage, 765KV transmission lines, some recent research results are of interest in assessing potential health concerns related to smaller, 69KV lines and other electrical facilities."

New York State Power Lines Project

This $5 million project, funded by the New York State, included 16 studies and follow-up projects in 1985 and 1987. The activity focused on the EMF from 765KV lines and included epidemiology, laboratory animal and cellular research studies. There was no direct evidence or damage linking EMF to inherited effects or cancer.

Denver Study

Funded as part of the New York Project, this study focused the incidence of cancer among children living in homes near different power lines, including those with lower capacity. The study included methodologies to screen out the impacts of inherent (household) EMF from the impacts due to the transmission lines, and a "wiring configuration" protocol to categorize the likely magnetic field exposure 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 results appeared to indicate a higher incidence of cancer. However, there was no apparent correlation with either low-power (household appliances off) or high-power (many household appliances on) conditions. There was concern that other possible causative factors were involved, such as traffic density.

Seattle Study. Also part of the New York Project, this study was similar to the Denver study, e.g., had similar protocols. However, no links were established from EMF exposure to incidence of cancer. It was also noted that "research has not found any biological mechanisms that could explain the role of magnetic fields in the development of cancer," and "that methodological uncertainties exist in quantifying magnetic field exposure levels."

Los Angeles Study

This study was conducted in 1990 with EPRI funding and attempted to replicate the Denver study. The results generally confirmed those from the Denver study. Specifically, "There was an increased risk of cancer with certain wiring codes, but not with direct field measurements." While the field measurements were the most sophisticated to date, researchers were perplexed by the results. For some, yet unknown reasons the wiring codes are a better predictor of long-term average magnetic field exposure than the 24-hour measurements that were conducted on this study.

Swedish Studies

Two epidemiological studies were conducted in Sweden in 1992. The first involved exposure of residences within 300 meters of 220KV and 400KV transmission lines. The second involved an occupational study of adult males. The first found a "statistical association between childhood leukemia and calculated historical fields" and the "distance from the power lines." No correlation, however, were found between EMF and brain tumors. Similar to the other studies, there no correlation was found with actual field measurements. Consequently, these results are consistent with the Denver study.

The second study included a breakdown of personal exposure by job category. The results indicated a "statistical association between a certain subtype of leukemia and estimated magnetic field exposure." It was noted that the field measurements were used to develop the estimated exposure.

Office of Technology Assessment Background Paper

In 1989 a background paper on the biological effects of EMF was prepared for the Congressional Office of Technology Assessment, Washington, DC, by Carnegie Mellon University. The paper summarizes the sources and nature of EMF exposure and the basic areas for research, which includes cellular experiments, whole animal experiments, exposure assessment and epidemiological studies.

The paper states "the emerging evidence no longer allows one to categorically assert that there are no risks. But it (the evidence) does not provide a basis for asserting that there are significant risks." OTA suggests that if exposure turns out to be 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."

Regarding the public policy issues and what should be done, the OTA back off from the extreme ends of "do nothing" and "aggressively regulate," and recommends a middle-ground, "prudence avoidance" strategy. This strategy suggests we limit field exposures with small investments of time and money, but that we shy away from drastic or expensive measures until it is proven that there are significant risks to EMF exposure.

Continuing Research

The MECO EIS highlights several areas where research is continuing: basic laboratory research to determine whether physiological changes result from exposure to electric or magnetic fields and how much changes might affect health; and risks to exposure from home sources of EMF. These sources include televisions, electric blankets, hair dryers and other appliances, and electric wiring in house walls.

More Recent Studies

WSB-Hawaii identified two additional studies applicable to this EIS. The first is a study of 560 adults living near 50-Hz 110KV and 220KV transmission lines in Auckland, New Zealand (Beale, I. L, et. al.). In this study, "significantly elevated adjusted risk ratios were found for asthma, arthritis, type-II diabetes and combined chronic health problems. The results are consistent with the hypothesis that 50-Hz environmental magnetic fields may affect human immune function."

The second is a major study reported in the July 3, 1997 issue *New England Journal of Medicine.* The study found no evidence that electromagnetic fields from power lines can increase a child's risk of acute lymphoblastic leukemia. This study, headed by researchers at the National Cancer Institute in conjunction with hospitals and investigators of the Children's Cancer Group, has been described as one of the most comprehensive studies yet performed on the subject of EMFs and childhood leukemia.

Electric and Magnetic Field Standards

General

From the MECO EIS, "Currently, there are no electric and magnetic field standards for switching stations or substation facilities. However, there are guidelines and standards regarding field levels from overhead power lines (which could originate or terminate at a substation facility). General transmission line safety standards are imposed by PUC General Order No. 6 (Rules for Overhead Electric Line Construction) and the National Electric Code." MECO notes that their third 69KV line will comply with these codes and standards. MECO also notes that "there are no national or federal government standards in the United States for electric or magnetic field exposure."

DOH Policy

MECO referred to a 1991 policy from the SOH DOH relating to EMF from electric power facilities:

"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."*

MECO indicates that they have "adopted a strategy consistent with the prudent avoidance approach in the routing and design of the Maalaea-Lahaina Third 69KV Transmission Line Project. This is consistent with the OTA recommendations discussed above.

Other States

MECO also reviewed the guidelines and standards developed by other States. Specifically seven states have guidelines for electric field limits and two (North Dakota and Florida) have a magnetic field standards. The values range from:

(1) an electric field strength from 1 KV/m (maximum at the edge of a transmission row) to 9 KV/m (maximum in a transmission line row), and

(2) a magnetic flux density from 150 mG (230 KV line) to 250 mG (500KV line) at the edge of the transmission line row.

International

Finally, MECO discusses guidelines developed by the International Non-Ionizing Radiation Committee of the International Radiation Protection Association (IRPA). These guidelines, entitled <u>Interim Guidelines on Limits of Exposure to 50/60 Hz Electric and Magnetic Fields</u>, specify:

(1) an electric field strength exposure of 5 KV/m (up to 24 hours/day) and 10 KV/m (few hours/day), and

(2) a magnetic flux density exposure of 1,000 mG (up to 24 hours/day) and 10,000 mG (few hours/day).

<u>Existing EMF Levels in the Study Area</u>

There are no known measurements of electric or magnetic fields in the study area. Note: the MECO EIS includes a detailed discussion of MECO's existing transmission lines and switching stations. Some comparisons were made with transmission lines on the mainland, which can have voltages 765KV. In Hawaii, the transmission lines are generally lower in voltage due to the shorter transmission distances. For example, there are 138KV lines on Oahu, Maui and the Big Island. The Maalaea-Lahaina transmission lines are 69KV. In other areas, the transmission line voltages are as low as 23 KV.

Transmission Lines

The MECO EIS discusses the potential impact of the third 69KV transmission line project. The project actually includes three separate lines: "(1) the Maalaea-Lahaina third 69KV line between the Maalaea Power Plant and the Lahainaluna Switching Station (Segment 1 through Segment 22 of the preferred alignment); (2) the Lahainaluna-Puukolii line between the Lahainaluna Switching Station and the existing Puukolii transmission line (Segment 23); and (3) the Lahainaluna-Lahaina line between the Lahainaluna Switching Station and the existing Lahaina line (also segment 23). The Maalaea-Lahaina third 69KV line would be a single-circuit line. The Lahainaluna-Puukolii and Lahainaluna-Lahaina lines would be double circuit." All three lines have a "minimum ground clearance of 35 feet at midspan, with an attachment height of 45 feet at the poles and span length ranging from 400 to 600 feet." The EIS provides estimates of the EMF which would be generated from this "third line" as summarized below.

Electric Fields. The results of the study conducted by Enertech Consultants include predictions for the three lines: (1) from the Maalaea power plant to the Lahainaluna switching station (single-circuit) and (2) Lahaina and Puukolii (double circuit). Of these three lines, only a small portion of the Maalaea-Lahainaluna line (essentially segments 6 and 7) passes through the study area. The electric field values estimated for this line range from approximately 0.001 KV/m at a distance of about 525 feet from centerline to a maximum value of 0.506 KV/m underneath the conductors near midspan." The predictions are somewhat higher for the other two lines. MECO notes in their EIS that these electric field values are less than the other State and IRPA guidelines and standards discussed above.

Magnetic Fields. Similarly, the Enertech consultants provided predictions for the generation of magnetic fields from the third transmission line. In this case, the magnetic fields varies with amount of current flowing through the lines. Several cases were examined, including normal and two emergency load conditions.

For the Maalaea-Lahainaluna line, the maximum magnetic field at the centerline varied from 14.09 mG (normal load) to 20.89 mG (emergency load). The magnetic field decayed to 0.12 mG (normal load) and 0.18 mG (emergency load) at 800 feet from the centerline. Again, the predictions for the other segment were somewhat higher. Similarly, MECO notes in their EIS that these magnetic field values are less than the other State and IRPA guidelines and standards discussed above.

Substations and Switching Stations

While there are no switching stations in the study area, relevant information provided in the MECO EIS is inserted here as background information for the discussion of the windfarm interconnection substation in the section below.

Overview. From the MECO EIS, "High-voltage substation and switching stations are an important element in the electric energy distribution system. Substations receive higher-voltage electrical power electrical power from incoming transmission lines and convert it to lower-voltage electrical power for distribution to commercial and residential customers. Substations are classified by the voltage of the incoming transmission lines and outgoing distribution lines. Switching stations are a type of substation which distribute electrical power between similar voltage transmission lines."

"Substations are also locations where safety devices can be installed to quickly disconnect electric circuits or equipment in the event of a fault (short circuit or other problem). The voltage of the outgoing distribution lines can be regulated at a substation and system operation is monitored at substations. Substations can have a number of components, including power transformers (for changing voltage), switches, circuit breakers, lightning arrestors, and relay and metering equipment. The energized portions of a substation are generally connected by rigid metal tubing called buswork. A typical substation has two or more incoming supply transmission lines for reliability. The layout of a substation is planned so that power lines or components can be taken out of service for maintenance without affecting the continuity of service to the utility or customers."

Electric Fields. "Electric fields around switching stations are usually between 0.001 KV/m and 0.05 KV/m due to electric field shielding. The grounded metallic equip-ment housings and switching station walls constitute effective electric field shields, thereby reducing electric fields from internal equipment and buswork. Typically, the major source of electric fields outside of switching stations are the overhead transmission lines associated with the facility."

Magnetic Fields. Magnetic field predictions were made for Lahainaluna Switching Station under normal load and two emergency load conditions. "The maximum magnetic field occurs within the switchyard in the area of the 69KV buswork, and the dominant source of magnetic fields outside the switching station are the incoming 69KV lines." Within the switchyard, the values range from 0.0 to 47.2 mG (normal load) to 0.0 to 77.5 mG (emergency load). At the station perimeter , the values range from 0.0 to 10.7 mG (normal load) to 0.0 to 15.9 mG (emergency load). "Fields from the internal 69KV buswork are primarily contained within the switching station boundaries. The highest calculated magnetic field levels occur underneath the Maalaea-Lahaina third 69KV line where it enters the switchyard."

WSB-Hawaii Assessment

The existing EMF in the study area is generated by the MECO transmission lines. Although there no know field measurements in the study area, the estimated EMF has been well-documented by MECO in their EIS. Specifically, the EMF has been estimated to decay to levels well below that of the average home within 500 to 800 feet of the transmission lines. MECO also notes that the electric and magnetic fields estimated from their third transmission line is far below the guidelines and standards developed in the other States and by the IRPA as discussed above. As a reference, WSB-Hawaii evaluates the impact of the existing EMF in the study area to be *"negligible."*

3.15.2 Potential Impacts

This section includes a general discussion of health effects of electric and magnetic fields, electric and magnetic field standards, and evaluation of potential EMF impact in the study area due to proposed action.

EMF Impacts from the Proposed Windfarm in the Study Area

There are several sources of EMF from the proposed windfarm. They include the electrical generators in the wind turbines, the intrasite electrical collection/distribution network, the windfarm interconnection station, and electrical equipment (tools, lighting fixtures and wiring in the O&M facility).

Electrical Generators

The electrical generator for the Z-48 wind turbine provides 480 AC, 3-phase output. The generator is rated at 750 kW, which results in a nominal 3-phase current of 903 amps. These generators would be installed on top of 50m(164ft) tall towers. No measurements have been made of the EMF emitted by its electrical generator. However, the EMF from these generators can be compared with EMF emitted by other point sources and also line sources. From the previous discussion, it was noted that the EMF generated from point and line sources can be relatively high at short distances, but the electric and magnetic fields decay rapidly with distance. As a point source, the wind turbine's electrical generator operates at higher voltages and currents than typical household appliances and tools, but at much lower voltages than transmission lines. The operating currents are similar. Overall, WSB-Hawaii expects the resulting EMF at the base of the 50m (164ft) towers would be negligible.

Intrasite Electrical Collection Network

The network consists of the 27 individual wind turbines, step-up transformers at each turbine site and the intrasite collection lines. The electrical output from each turbine would be transformed to 12KV the base of the tower and transmitted to the site interconnection substation via a network of shielded, underground lines (see detail description in Section 2). There is some EMF potential from the transformers and the intrasite collection line, but this is expected to be negligible. The reasons for this are: (1) the grounded metallic enclosures of the transformers provide effective electric and magnetic field shields, and (2) the shielded collection lines would be buried a minimum of 3 feet underground.

Windfarm Interconnection Sub-Station

The electrical interconnection to the MECO utility system would be made at the interconnection substation (See Section 2 for details of the installation). The substation would provide for transformation of the wind-generated power from the 12KV collection network voltage to the utility's 69KV transmission line voltage. The design of this station is similar to typical MECO utility substations, with the exception that the normal operational mode is the opposite, i.e., power is stepped-up rather than down.

Consequently, WSB-Hawaii believes the EMF characteristics of the windfarm interconnection substation would be similar in nature to that of MECO's Lahainaluna Switching Station. Given that, the EMF characteristics would be dominated by the 69KV transmission lines which would be connected to the windfarm interconnection substation as discussed previously. Assuming that industry-accepted design practices are employed, the EMF generated by the substation would be contained primarily within its boundaries. Therefore, the windfarm substation is not expected to add any net EMF to the study area.

O&M Facility

The O&M facility would contain a number of electric motors and other devices that are common to this type of facility. Given the insulating qualities of the building, ZPAC believes the EMF generated by these devices would be shielded and have a negligible impact on the study area.

<u>WSB-Hawaii Evaluation</u>

WSB-Hawaii evaluates the potential impact on the study due to the EMF generated by the proposed action would be *"negligible"* for the following reasons:

(1) EMF emitted from the electrical generators of the wind turbines would decay from the top of the towers to negligible levels at the base of the towers,

(2) EMF emitted from the individual turbine-sited, step-up transformers would be effectively shielded,

(3) EMF emitted from the intrasite collection-distribution network would be significantly reduced by the shielding of the cables and by burying the lines underground, and

(4) EMF emitted from the windfarm interconnection substation would be significantly reduced with shielding and would not add any net EMF to the existing MECO transmission lines in the study area.

3.15.3 Mitigation Measures

Discussion

WSB-Hawaii believes the proposed windfarm design and layout does not present an EMF health hazard to windfarm personnel and the general public. EMF research has been and continues to be focused on the potential impacts of high-voltage power lines, which are significantly higher than the operating power systems of the proposed windfarm.

There is still much controversy as to which factors may or may not impact human health, and, specifically, what actions should be taken, if any, to regulate EMF emissions. WSB-Hawaii concurs with those that would take the "prudent avoidance" approach. This appears to be the best course of action, until further evidence warrants a more stringent course. WSB-Hawaii believes that the proposed windfarm design and layout is consistent with the prudent avoidance approach. Specifically,

(1) all key components are shielded or placed at sufficient distances to reduce the net EMF emissions,

(2) the windfarm itself is remotely located which removes all EMF exposure to the general public, and

(3) WSB-Hawaii is taking steps to develop O&M procedures to educate its personnel and visitors to the site regarding EMF issue.

Evaluation

Given the above, WSB-Hawaii does not believe additional mitigation is necessary. WSB-Hawaii evaluates the potential impact on the study due to the EMF generated by the proposed action would be *"negligible."*

3.16 Visual Impact

This section includes a background discussion of visual impact as an issue in windfarm development, a visual description of the proposed windfarm project, and identification and evaluation of the potential impact off the windfarm on the visual resources in the study area. Note: the study area includes both the windfarm site and the site access. Mitigation measures are proposed and discussed, including an evaluation of the impact consequences before and after the mitigation measures program. Refer to Table 3.1-2 for a summary of the environmental consequences of the proposed action and mitigation measures program.

3.16.1 Background

Like many manmade objects, wind turbines are visible and conspicuous to the observer. They can stand out in a field or on a hill in contrast to the existing landscape. In an industrial landscape, the wind turbines may blend in and not be intrusive to the viewer. In a rural landscape, the wind turbines may or may not be intrusive to the viewer. For the most part, windfarm development has been accepted by local communities in the U. S., Europe and other areas. Visual impact has been an important issue, but generally has not precluded development. In short, when projects are proposed, visual amenity can be an important issue determining whether the community accepts the project and whether the project is approved by regulatory authorities. Some windfarm projects have been redesigned to improve their visual amenity.

Paul Gipe discusses aesthetic issues relevant to wind turbines in his book *Wind Energy Comes of Age* (Gipe, 1995). Important sections from his book are included where appropriate herein. Quotations are from Gipe unless otherwise noted. This section includes an introduction to aesthetics and wind turbines from an historical perspective, the impact of the pioneering windfarms of California, opinion surveys, visual design of wind turbines and windfarms, and visual impact guidelines.

<u>Introduction to Aesthetics and Wind Turbines</u>

Whether or not wind turbines are ugly or pleasing to the eye is a question of aesthetics. Some feel that aesthetics is the "determining factor in whether wind energy ultimately fulfills its potential." What or who determines what is aesthetically correct? "Contrary to popular belief, there is no universally consistent and invariable view of what is or is not pleasing to the eye. One of the best examples of this is public reaction to the Eiffel Tower."

Gustave Eiffel's plan to erect a great tower in the heart of Paris for the 1889 *Exposition Universelle* was met with vociferous objection from a wide range of groups and individuals. Opponents shepherded their forces and thrust their arguments before government officials and the public. As luck would have it, the plan was ultimately approved and the tower was constructed. Whatever the majority of Parisians thought of it aesthetically, the tower was immediately popular. In time, Eiffel won over his critics. Who could imagine Paris today without the Eiffel Tower? Who could imagine the objection today, if someone proposed its demolition?

New uses of the land are often controversial and acceptance can take time. Historically, wind energy has been accepted as an appropriate use, e.g., the four-bladed, wooden windmills used to grind grain in Holland and the multi-bladed waterpumpers of the early mid-western United States. In the late 1970's a new class of wind turbines emerged in the California windfarms. Development has spread to other parts of the U. S., Europe and other overseas locations. Much has been learned about the importance of aesthetics and visual impact.

The Impact of the Pioneering Windfarms of California

Encouraged by federal and state incentives, development of windfarms in California was rapid and occurred primarily in three major pass areas: Altamont (near San Francisco), Tehachapi (near Bakersfield) and San Gorgonio (near Palm Springs). Individual windfarms were highly visible to the public. Many were located alongside heavily traveled freeways. In the Altamont, the turbines were installed along ridge lines and on sloping grasslands that were and continue to be used for grazing cattle. In Tehachapi, the terrain is high desert and generally more extreme in slope. In San Gorgonio, most of the turbines were installed on the flat desert floor, with some on hills and ridges near the mouth of the pass. Altamont and San Gorgonio are very near to heavily-populated urban areas, suburban extensions of San Francisco and Los Angeles, while Tehachapi is more rural. The town of Tehachapi, located in a scenic valley of the Tehachapi mountains, has a population of 6,000.

Initial development was approved by local officials and proceeded without much thought as to the aesthetics of the wind turbines and windfarm layouts. Many developers did not solicit comments from local communities regarding aesthetics. Thus, engineering and economic considerations prevailed. Often, the objective was to reduce land use costs per turbine by installing as many turbines as possible on a given parcel. The result was layouts of wind turbines in closely-spaced, multiple-row arrays and in linear strings along ridgelines. Note: since smaller turbines (50 to 100 kW) were in use then, an array of 20 MW meant 200 or more wind turbines, whereas the proposed 20 MW windfarm requires only 27 Z-48 turbines.

The dominant use of the multiple-row arrays resulted in a sense of "visual clutter" to some observers. Compared to the Altamont, visual clutter was more dramatic in the Tehachapi area where a number of contiguous, closely-spaced arrays were installed with different types of wind turbines. In San Gorgonio the valley floor was filled with row after row of turbines. In some cases, the turbines varied in design and size and were installed on towers of different heights. To some, these San Gorgonio windfarms became a bad example of visual clutter.

Opinion Surveys

Surveys of public opinion were conducted starting in the late 80's. The reactions of early observers to these developments was highly varied.

Nation-Wide Surveys

Phyllis Bosley solicited comments from 19 key environmental action groups, including the Sierra Club (Bosley, 1989). Respondents were asked to compare wind with solar, fossil fuels and nuclear power. Bosley found that Sierra Club selected wind as the *most environmentally superior* energy resource. While *visual pollution* was identified as a potential drawback to wind energy, 90% of the national environmental groups responded that *wind energy was worth its environmental impact*. There was some opposition to wind energy at the local level. This opposition appeared to be based on the respondents' conclusion that wind energy *simply does not work* (Bosley, 1990). "That wind turbines must work to be worthwhile is a recurring theme in opinion surveys, whether in California or in Europe."

California: Altamont Pass

An important survey of the Altamont Pass area was conducted by the University of California at Davis (R. Thayer and C. Freeman, 1987). They found "people believe that wind energy symbolizes *progress*, an *alternative to fossil fuels* and the *use of safe and natural energy*."

"Those who liked wind turbines weighed their symbolic value heavily, whereas those who disliked them responded to more *basic visual attributes such as conspicuousness, clutter, and unattractiveness*, says Robert Thayer the study's principal author. The U. C.-Davis team also found that those favoring wind energy *were willing to forgive the visual intrusion of the wind turbines on the existing landscape for the presumably higher goals of the project, whereas dislikers were not.* In the Altamont survey and the others that followed, Thayer found that it is this *visual intrusion* or the *loss of visual amenity* that elicits the greatest concern."

"Although wind plants create other environmental impacts, the principal impact is clearly visible for all to see. There are no containment buildings around wind plants to shield their inner workings from view. Ironically, this is one of wind energy's principal assets: the costs associated with it are not obscured, buried, or shoved off onto future generations."

Thayer found visibility of the wind turbines a "double-edged sword. Wind turbines visually express their function and provide the viewer with immediate feedback on their operation." To some, the effect of spinning displays the usefulness of the wind turbines, and vice versa, the observer often reacts negatively if the wind turbines are not spinning. Many turbines of the early turbines had design flaws and broke down; some were fixed, many were not. Today's more reliable wind turbines are more cost-effective and more visually aesthetic. However, even the best wind turbines will not be spinning when the wind does not blow or does not blow sufficient to start up the turbines. Even at the best sites, this may be 25 to 50% of the time.

California: San Gorgonio Pass

Development in the San Gorgonio Pass near Palm Springs occurred at a very rapid pace during the early to mid-1980's. "Wind turbines were *erected with absolutely no regard for their collective aesthetic impact* and seldom with any consideration of their impact on established desert neighborhoods. There is no worse example of wind energy than in the San Gorgonio Pass." There was strong reactions to the windfarm developments in the local media and some efforts by local politicians to restrict further development. "Thus the stage was set for the most telling public opinion survey conducted to date. Conducted by contractors to Riverside County in 1986, the survey, because of its conclusions, remains controversial to this day."

"All of those surveyed were from Palm Springs and the small communities near the wind plants in the San Gorgonio Pass. Most (58%) lived within 0.8km (0.5mi) of the wind turbines; the remainder lived 2 to 5 miles (3 to 8 km) away. Of those nearest the wind plants, three-fourths could see the turbines." The results were surprising. "While the researchers acknowledged that there was *some opposition to the development of wind power at this site, particularly in terms of aesthetic degradation*, they concluded that 'the majority of respondents favored the development."

"Nearly three-fourths said that the wind plants had not degraded the environment around their homes. On the question of aesthetics, *there was a fairly even distribution of opinion*, said the authors: 36% thought they were attractive and 45% thought they were not" (Pasqualetti and Butler, 1987).

"Despite the controversy at the time, the study concluded that *overall, the public reaction to wind development in the San Gorgonio Pass has been positive, albeit at some recognized cost to local aesthetics.* As expected, opposition to the wind turbines was most strongly held *by those who could see them from their houses.* Thus the opinions of those surveyed contradicted the prevailing negative impression given by local opponents."

Europe

Surveys have been conducted in England, Wales, Holland, Sweden and elsewhere in Europe. In 1990, a public opinion survey (Young, 1993) was conducted in advance of a proposed 10 turbine project near the hamlet of Delabole in Cornwall, England Researchers polled nearby residents of Delabole and Camelford in Cornwall and residents of Exeter (the nearest major city) in Devon regarding their attitudes on environmental issues, wind energy in general and the proposed project. The poll was repeated two years later, after the ten, 400 kW wind turbines had been installed. Of the Cornish residents, two-thirds identified themselves as "green," while in Exeter, three-fourths. Before the project two-thirds of the Cornish residents were in favor of the project, in Exeter the support was even greater. There were concerns expressed about visual impact. In Cornwall, nearly half of those polled thought the turbines would spoil the landscape, in Exeter about 29%. After the turbines were installed, opinions changed in Cornwall – only 28% of those polled now thought the turbines spoiled the landscape, agreeing with their neighbors in Exeter. The overall project approval rose to 85% in both areas. It would appear that acceptance grew as people become more familiar with the wind project. Subsequent surveys in Wales found similar results.

Surveys elsewhere in Europe reached similar results. In a survey for the European Community, Dutch researchers found that 80% of respondents favored wind energy (Westra and Arkesteijn, 1992). Responses on aesthetic issues were found to be dependent on whether the respondent was already familiar with wind turbines. Approval was approximately two-thirds for those familiar with wind turbines, while about 54% for those not familiar (Tasker, 1990). Tasker also found that acceptance decreased with the increasing number of turbines in the windfarm or cluster. Projects with more than 50 turbines were only acceptable to about 15% of *the respondents. Given that there is less open space in most European countries than in the* U. S., larger arrays could easily lead to *visual clutter.* With less land per windfarm, use of large wind turbines is more efficient. This is clearly one of the reasons why European manufacturers have continued to develop larger wind turbines, i.e., 1 MW and larger.

NIMBY Response

In addition to the findings above, other surveys point to a very strong NIMBY ("Not in My Back Yard") response to wind turbines. In a study conducted by U. C. - Davis in Solano County, wind energy was compared with biomass, nuclear and fossil sources (Thayer, 1989). For each source, the respondents were asked to place themselves into one of these four categories: acceptor, NIMBY, rejector and neutral.

Wind was found to be the preferred power source, i.e., highest number of acceptors (65%). "Only 9% thought wind plants were completely unacceptable, whereas opinion was more polarized about nuclear and fossil fuels. One-fourth found fossil fuel-fired plants unacceptable in the county; nearly half found nuclear plants unacceptable. But wind drew the largest NIMBY response." The NIMBY response for wind was about 20%, followed closely by biomass (19%), fossil (13%) and nuclear (13%).

Of the acceptors, more "were willing to accept wind plants closer to their homes, within 2 to 5 miles (3 to 8 km), than any of the other technologies. In contrast, the minimal distance for nuclear power plant was 20 to 100 miles (30 to 150 km)."

For each of the four technologies, Thayer also asked respondents to rate the following six factors: health and safety, reliability, environmental impacts, cost, dependence on foreign oil and visual impact. For wind, health & safety and environmental impacts were the most important; *visual impact* was the determined to be the least important. Wind was found to be more *visually acceptable* than the other three." This result puzzled researchers because nuclear plants are known for their clean lines and the absence of the cluttering conveyors and smokestacks common to coal-fired plants. Thayer suggests that the prominent cooling towers associated with nuclear plants have come to symbolize the controversy surrounding them, and this influences perceptions of the plants. Conversely, the Solano survey and others that Thayer has conducted in northern California reveal an ambivalence toward wind's aesthetic impact. On the one hand, wind is an energy technology preferred by most respondents, and its place on the landscape has some positive symbolic value."

WSB-Hawaii Assessment

Public opinion surveys have shown strong support for wind energy (up to 80% or more), although as noted above there can be a fairly high ratio of NIMBY's in the supporters. Visual impact has often been sited as a concern. In most cases, concerns regarding visual impact are strongest in the planning stage, i.e., an activist takes the position that the turbines might "spoil" the landscape. In the cases where this has happened, there have been some follow-up surveys taken after wind projects are operational. These surveys generally show stronger support for the project and less concern about visual impact. For example, people that thought that the wind turbines would be too noisy or intrusive change their mind when they find out they really aren't noisy and they can complement the existing landscape. Windfarm developers have learned to address concerns about visual impact during the planning stage and follow-up with concerned individuals during the operational period. The developers can take care in selecting and siting their wind turbines as discussed in more detail below.

Visual Design of Wind Turbines and Windfarms

Introduction

The Europeans were the first to pay more attention to the aesthetics of their wind turbine designs and projects. Developers sought to avoid negative aspects of the early California model. Much has been learned about the visual design of wind turbines and windfarms in the late 80's and the 90's, both from the European experience and from newer windfarm developments in the U. S. With this growing body of knowledge, there is the hope that guidelines for reducing the visual impact of wind turbines and windfarms will emerge from the fray.

Visual and Engineering Design of Wind Turbines

The Berkeley inventor, Peter Sharp, suggested "wind turbines need to be regarded from an architectural and not just an engineering perspective." Engineering is necessary to ensure performance and cost effectiveness. "But when mechanical efficiency and economy become the sole driving force behind wind turbine design, that design – in its broadest sense – invariably suffers. Designers who fail to balance the three visual elements of a wind turbine (rotor, nacelle, and tower) or ignore appearance altogether miss a key component of design that will determine wind energy's ultimate success, its public acceptance, just as much as the efficiency of the airfoils used. Thoughtfully designed turbines increase acceptance." (Arkesteijn and Havinga, 1992).

Can wind turbine designs, including their support towers, be integrated so that the overall result is elegant? The following is a discussion of the trends in wind turbine design.

Lattice vs. Tubular Towers. The tower serves to hold the turbine aloft in the wind. Like the Eiffel tower, many wind turbine towers are tapered from a larger base to a smaller tower top interface to the turbine. Structurally, lattice (or truss) towers are more efficient and generally cheaper. While more expensive, some feel tubular (or pole) towers are more aesthetic. Thus, there is a trend towards use of tapered, tubular designs, which also provide other benefits, such as shelter for maintenance personnel from inclement weather.

Rotor Design. Rotor design aesthetic considerations center on the number of blades (usually two or three). The type of the hub (fixed vs. teetered) and the position of the rotor to the tower (upwind vs. downwind) are less important. Some designers prefer two-bladed designs, in part due to their higher rotation speeds compared to three-bladed turbines of the same diameter. However, there is evidence the public prefers three-bladed designs primarily for these reasons: (1) the lower rotor speeds of three-bladers is more pleasing (or less annoying); (2) two-bladers produce an unusual optical effect that disturb some observers. Specifically, the rotor appears to change speed as each blade passes the tower; and (3) 3-bladers generate a greater sense of balance to many observers (Robotham, 1993).

Nacelles and Nose Cones. The nacelle encloses the drive train and the bedplate on which it rests, protecting both from the environmental elements. Nacelles provide several utilitarian purposes, including shelter on larger turbines for workers who service the turbines and masking or reducing the geartrain noise. Nose cones have no specific purpose other than to cover the rotor hub. Nacelles can be designed to create smooth, elegant, horizontal lines that blend with the nose cones to break up the vertical lines of the rotor and the tower. Those designs without nacelles appear to flaunt engineering economy over aesthetics and have a blunt, harsher appearance.

Colors and Materials. Color and material choices can influence the appearance of a wind turbine in a number of ways. Selection of the paint color can help the turbine and tower blend with the existing landscape. For example, beige or tan colors are good for desert landscapes, while off-white colors seems to work best elsewhere. Blade materials are most *often wood or fiberglass.* The outer coating for either may be shiny and reflective when new, but generally the coatings wear and dull over time. Care can be taken to design and fabricate the buildings and other site structures with materials and colors that harmonize with the traditional structures on the landscape.

Overall System Design. Mr. Gipe argues that aesthetically-pleasing designs integrate tapered-towers in proportion to the nacelles and their nose cones (See Figure 3.16.1-1). As noted, three-bladed designs may be preferred over two-bladed. The ratio or proportion of the tower height to rotor diameter is also important. For example, turbines on towers approximately the same height as the turbine rotor diameter appear more in proportion. In contrast, larger rotors on smaller towers, or the reverse, often appear out of proportion and less pleasing to the eye. The horizontal lines of the nacelle help break up the verticality of the overall design. The placement of individual turbines in an array and with respect to other windfarm structures is also important. The trends in wind turbine aesthetics are summarized in Table 3.16.1-1.

Table 3.16.1-1

Trends in Wind Turbine Aesthetics
Three-bladed designs *may* be preferred because: • they have a greater sense of balance and harmony • the motion of two-bladers is annoying to some observers Use of nacelles and nose cones is preferred as they: • break up vertical lines of tower and rotor • provide smoother, more elegant horizontal lines System Integration details are important including: • tower choice -- tapered pole or tubular is preferred • proportionality – rotor diameter ≅ or < 1.5 times the rotor diameter • Colors and materials for the turbine, tower and ancillary structures should blend with the landscape and existing structures

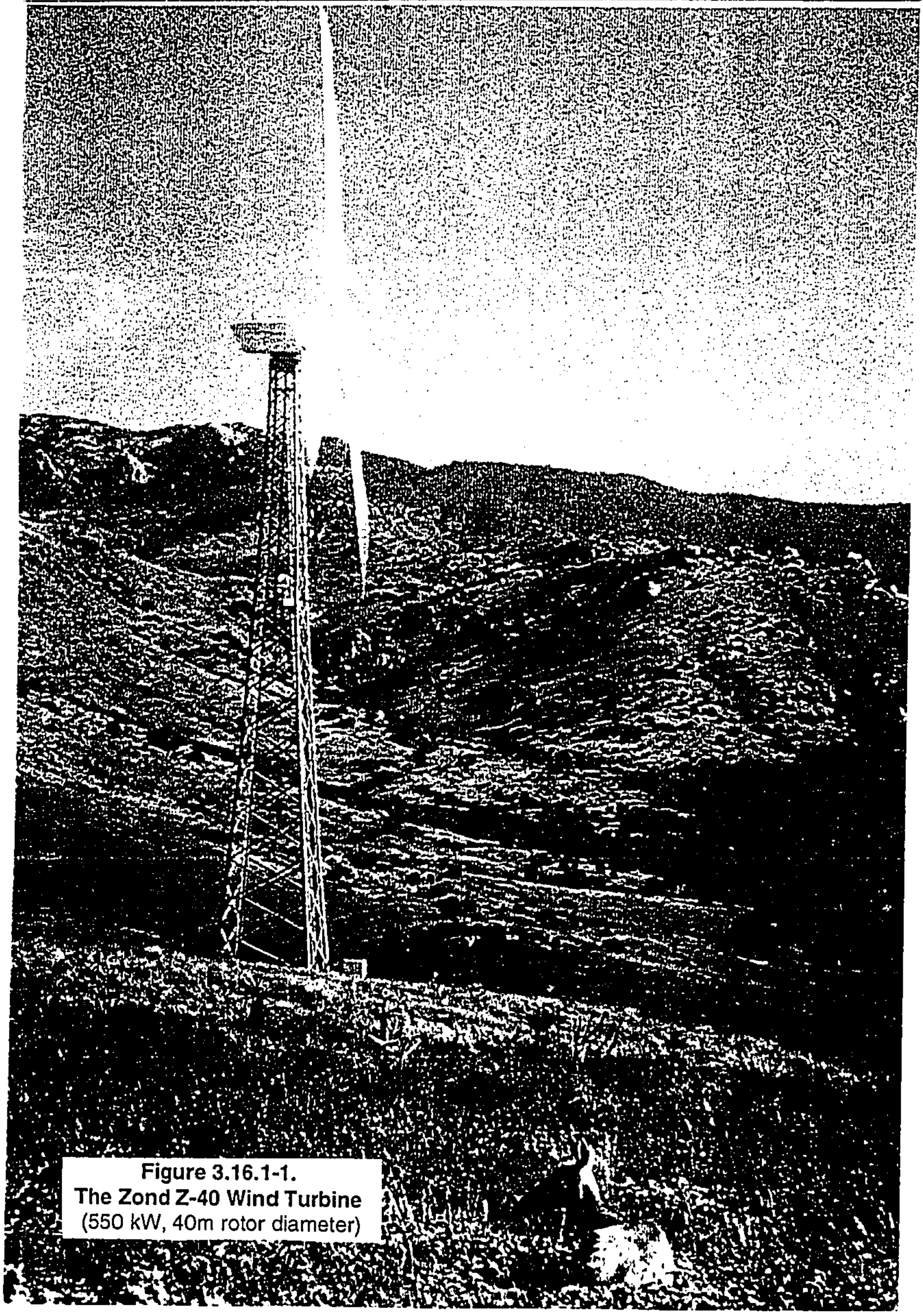

Figure 3.16.1-1.
The Zond Z-40 Wind Turbine
(550 kW, 40m rotor diameter)

Visual Design of Windfarms

Too many of the early California windfarms were cluttered to too many observers. The clutter resulted not only from the design and layout of the wind turbines, but also the design and layout of roads, power lines and ancillary buildings on the windfarm sites. In fact, some windfarm operators did not practice good housekeeping. For example, it was not unusual to see failed turbine parts left lying on-site in scrap heaps commonly referred to as *boneyards.*

The opinion surveys have told us that the appearance of a windfarm depends on the the observer, his vantage point, the type of landscape and the placement of the wind turbines on the landscape. We know that visual clutter is a problem. So how can a windfarm developer design and implement his project to enhance aesthetics and reduce the visual impact?

Many observers now feel that maintaining order and visual unity is the single most important means to lessening the visual impact of windfarms. "How we view wind turbines on the landscape, whether in the foreground or on a distant mountainside, strongly reflects our desire for visual *tidiness*, a result of our need to create order out of chaos.

The following factors should be considered in the visual design of windfarms.

<u>Motion</u>. "Because the natural landscape is nearly motionless, the human eye can detect movement at great distances. Motion powerfully attracts and holds the observer's attention, providing contrast with the motionless landscape. Even when wind turbines are well designed and placed optimally on the landscape, *the movement of the blades is certain to catch the eye,* say landscape architects who studied the visual impact of wind turbines in Wales." Otherwise, the turbines may be not be seen. "This motion makes the wind turbines a visually interesting addition to the landscape. Viewers may or may not find distant wind power plants beautiful or attractive, but they frequently label them as interesting...Motion also signifies usefulness: the wind turbines are working, doing what they are meant to do" (Landscape Impact Assessment, 1992).

<u>Turbine and Reliability</u>. "There are few more demonstrations of how well wind energy works than to see Zond's *wind wall* in Tehachapi on a blustery day. If watching 400 turbines dancing on the hillside is unconvincing, a drive over the pass to SeaWest's Mojave site can be instructive. There on the gently sloping flank of Cameron Ridge stand another 1060 turbines, nearly every one of them in operation."

<u>Turbine operation characteristics</u>. Operating, *spinning* turbines are more aesthetically pleasing. Some decisions the designer makes can impact how much time the turbines spin. For example, most turbines *self-start* when the wind is sufficient, but others have to be motored to start. Most three-bladers are self-starting, while some two-bladers are not. Self-starting turbines start and keep spinning at lower wind speeds. Many turbines are shutdown in high winds to prevent failures, while some (e.g., blade-pitch angle control) keep spinning.

<u>Density</u>. European windfarms are smaller in scale than those in California. Most arrays in Denmark are now between 10 and 35 turbines and in Germany, 4 to 15. Many turbines are sited individually." Of Denmark's 3500 wind turbines operating in 1993, only one-fourth were in wind plant arrays." This is in contrast to the much larger California arrays discussed previously. "As more turbines are added to an array, the influence zone expands. For example, more than 1,000 turbines are clearly visible from the town of Tehachapi 4 miles (7 km) distant. *Such a high level of visibility,* says U. C.-Davis's Thayer, *virtually guarantees that large wind power developments will invoke strong reactions among viewers"* (Thayer and Freeman, 1987). European surveyors have found similar responses, and suggest that clusters of 15 turbines are much easier to site. "The public appears better able to digest wind turbine arrays in distinct visual portions of uniform density."

Visual Uniformity. "Next to keeping the wind turbines spinning, the most significant measure for improving public acceptance is visual uniformity. Even when large numbers of turbines are concentrated in a single array or there are several large arrays in one locale, visual uniformity can create a harmony in an otherwise disturbing vista. Visual uniformity simply means that the rotor, nacelle, and tower of each machine look alike, forming one visual unit. CalPoly's landscape architects recommended that developers use only one kind of turbine in each project, to reduce the visual clutter they found at California sites." (Fulton, Koch and Moffat, 1984).

Other Aesthetic Considerations. Other aesthetics considerations include design and layout of ancillary structures, fencing, roads and lights. Ancillary structures include substations, transformers, power lines and maintenance buildings. The Welsh Landscape Study "recommended placing substations, transformers and other ancillary structures off the horizontal line of the hilly sites found in Wales, and screening them with existing features common throughout Britain, such as hedges and stone fences.

"To some Californian environmentalists, such as Howard Wilshire of the U. S. Geological Survey, roads and the erosion they cause are the principal environmental impact of wind development" (Wilshire and Prose, 1986). The CalPoly team of architects also found terracing for service roads visually disruptive" (Fulton, Koch and Moffat, 1984).

"There is no simpler way to minimize this impact than to minimize the construction of roads or to eliminate them altogether. In the Welsh Study, the architects "recommended that developers use existing farm tracks wherever possible, justify the need for all new roads, and limit the width of permanent roads to 3 to 3.5 m (10 to 12 ft). These roads, said the landscape architects, should follow field boundaries as much as possible to minimize visual impact" (Landscape Impact Assessment, 1992). Furthermore, the CalPoly team "suggests that after construction is complete, developers promptly reseed the graded areas to enhance the site visually and reduce erosion. They further recommend that the surface of infrequently used roads be revegetated to lower visual contrast between the road and undisturbed terrain" (Fulton, Koch and Moffat, 1984).

"The CalPoly architects recommend sites in open grasslands, treeless plateaus, or over forested sites with low vegetation because of the felling that would be necessary to build the access roads into forested areas".

"No wind turbine should call attention to itself with flashing lights like some garish billboard along the Las Vegas strip." However, if the total height of a wind turbine exceeds 60m (200ft), the Federal Aviation Administration will probably might require the use of flashing red lights or special painting to warn aircraft of the wind turbine's presence.

Guidelines for Reducing the Visual Impact of Windfarms

"There may not be a way to eliminate all objections to the appearance of wind turbines on the landscape, but the consensus is growing on how to minimize these objections. The guidelines can be as simple as those of Energy Connection's Arkestijn, who summarizes the lessons he has learned from developing projects in the Netherlands: Build an aesthetically attractive project, and keep the turbines turning." (Westra and Arkesteijn, 1992). "Or as simple as that used by the Lostør district council in Denmark: All turbines should look alike, and they should all rotate the same way." (Gubbins, 1992).

It is clear that much has been learned about designing wind turbines and projects from a visual perspective. The early experience in California often resulted in an emphasis on engineering decisions at the expense of aesthetics. Recent industry practice now suggest aesthetic guidelines (Gipe, 1995) as summarized in Table 3.16.1-2.

Table 3.16.1-2

Aesthetic Guidelines for Windfarms
Ensure visual uniformity (direction of rotation, type of turbine and tower and height)
Avoid fencing
Minimize or eliminate roads
Bury intraproject power lines
Limit or remove ancillary structures from site
Remove inoperative turbines
Avoid steep slopes
Control erosion and promptly revegetate
Remove litter and scrap
Clean dirty turbines and towers

Mr. Gipe suggests: "The public holds wind energy to a higher standard than other technologies. Wind must compete economically, yet be environmentally benign. The public does not question whether or not a conventional power plant works or why oil-field pump jacks stand idle most of the time. But they do ask such questions of wind turbines. For the same reason, those in the wind industry must meet more stringent environmental standards than those of conventional power plants, because the public expects them to do so."

"As Danish industrial designer Jacob Jensen advises, for ultimate success the goal of manufacturers and developers alike must be that wind energy represents in the public eye *a beautiful human manifestation."* When well-designed wind turbines are sited with sensitivity, many agree with Robert Thayer at U.C.-Davis, who believes that *wind energy could achieve a serene, utilitarian beauty common to other working landscapes*" (Thayer and Hansen, 1989).

3.16.2 Visual Description of the Proposed 20 MW Windfarm

A visual description of the Zond Z-48 wind turbine and the proposed 20 MW windfarm is presented in this section.

The Zond Z-48 Wind Turbine

The Z-48 wind turbines are manufactured by Zond Systems, a division of Enron Wind Corporation, in Tehachapi, California. WSB-Hawaii believes the Z-48 design has evolved in part due to recognition and concern for aesthetics. WSB-Hawaii believes the Z-48 is aesthetically-pleasing (see Figure 3.16.2-1). The attention to aesthetic detail is summarized in Table 3.16.2-1.

The Proposed 20 MW Windfarm

Zond Systems has designed and installed windfarms since the early 1980's in Tehachapi. Over 2,500 of the wind turbines, producing over 250 MW, in its California installations are still running. Zond currently has orders for over 400 MW on new windfarms installations. These include 300 MW in Minnesota, 50 MW in China, 40 MW in Honduras and 50 MW in India. Contracts are being negotiated for two other installations in Hawaii totaling 41 MW.

WSB-Hawaii believes the layout and design of the proposed 20 MW windfarm on the Kaheawa Pastures represents a mature expression of aesthetic considerations based on ZPAC's learning from its existing and planned installations and a thorough review of the experience of other U. S. and European developers (See Figure 3.16.2-2). WSB-Hawaii believes the proposed windfarm exceeds the guidelines discussed in the previous section. The key aesthetic design features of the windfarm design and layout are summarized in Table 3.16.2-2.

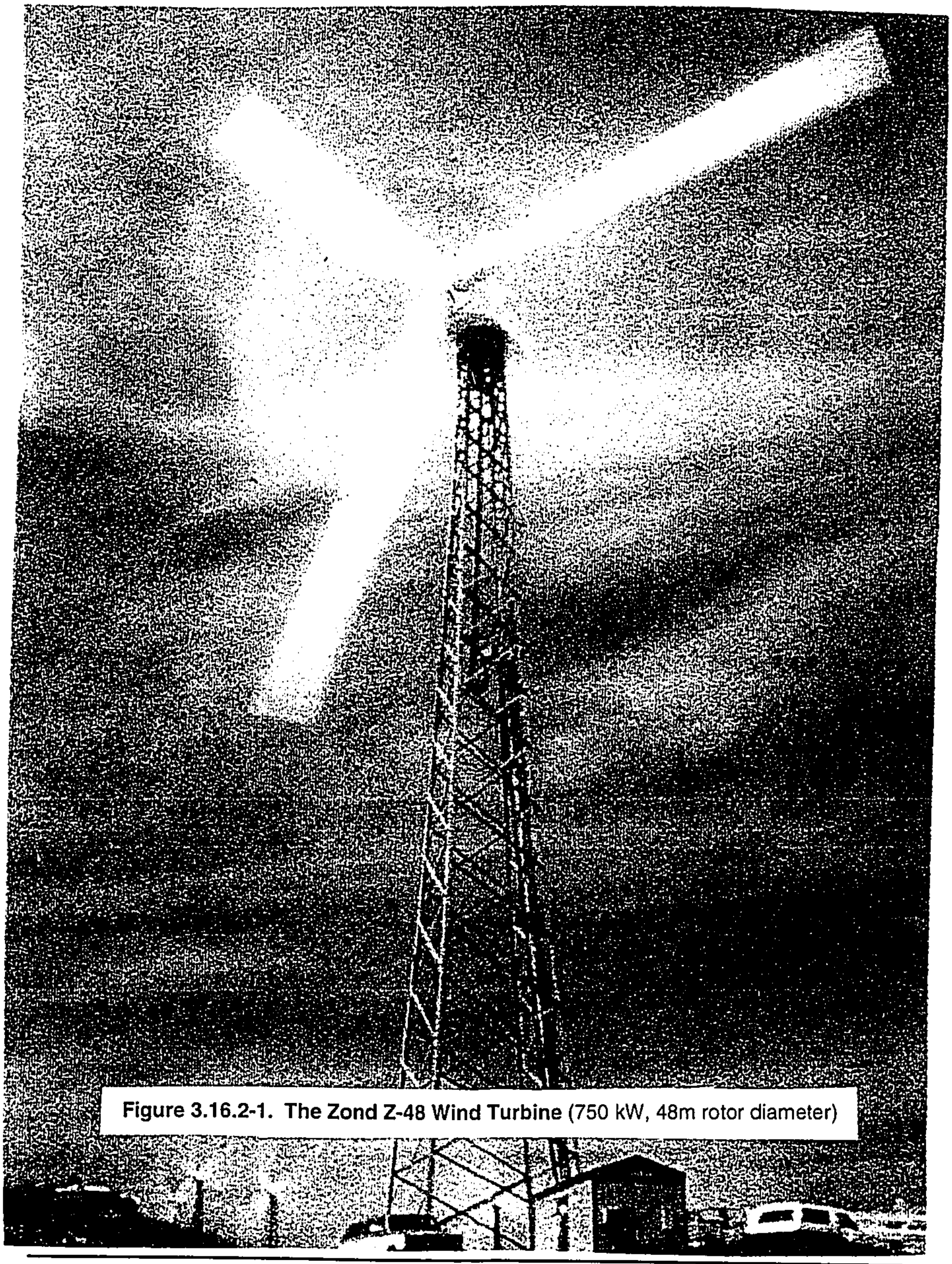

Figure 3.16.2-1. The Zond Z-48 Wind Turbine (750 kW, 48m rotor diameter)

Table 3.16.2-1

Key Aesthetic Design Features of the Zond Z-48	
Feature	**Comments**
Tapered-lattice, tubular 50m tower	Surveys typically favor tapered over constant diameter towers and tubular over truss (or lattice) towers. Lattice towers can also be pleasing as they provide a *more open, lighter* appearance. The color of the tower is a dull gray.
Three-bladed, 48m diameter, rotor	Survey responders consistently favor three-bladed over two-bladed rotors. The three-bladed rotor spins and operates over a wider wind speed range. Spinning wind turbine are considered more aesthetically pleasing. The blades are an off-white color.
Nacelle and nose cone	The Z-48 includes both a nacelle and nose cone. These provide a pleasing horizontal line to the wind turbine which help break up the vertical lines of the tower and turbine. The nacelle and nose cone are the same off-white color as the blades.
Overall Design:	Equal tower and rotor diameter dimensions provide a pleasing sense of balance to the observer, i.e., a shorter tower would appear "squatty", while a taller tower would produce a stronger vertical impact.

Table 3.16.2-2

Key Aesthetic Design Features of the Proposed 20 MW Windfarm	
Feature	**Comments**
Array Layout: 27 Z-48 turbines in a single articulated row with a minimum of 122m (400ft) spacing between turbines	This windfarm design promotes visual uniformity by: • use of one turbine and tower design; same rotor diameter, same tower height, same colors • the turbine row follows the predominant ridgeline • the turbines are spaced uniformly This windfarm design reduces visual clutter by: • limiting the number of turbines • deploying them in a single row
Infrastructure (Roads)	The number of roads and their size is minimized to reduce visual clutter and reduce erosion potential
Infrastructure (O&M Building)	The O&M building would be a pre-fabricated structure painted with typical, earth-tone colors consistent with Hawaii rural (farm and ranch) structures
Infrastructure (Electrical)	The power lines of the intrasite collection network will be buried. The interconnection substation will be designed to be consistent with the existing utility transmission system.
Overall	The remote location reduces the potential for visual impact. The turbines will be sited to minimize adverse impacts to viewplanes along the Old Lahaina Pali Trail.

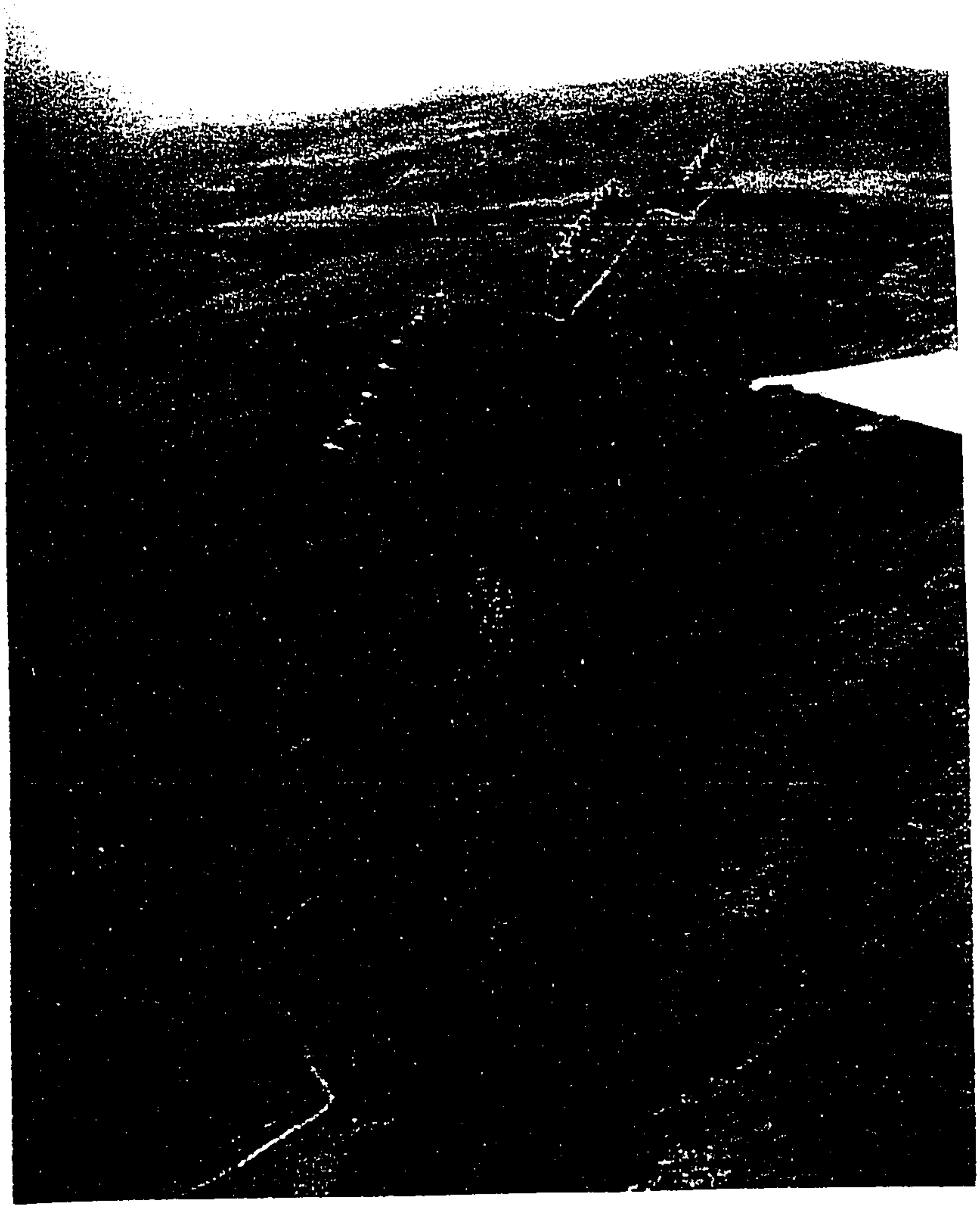

Figure 3.16.2-2. Aerial View: Proposed 20 MW Windfarm

3.16.3 Potential Impacts

This section includes identification and evaluation of potential visual impacts in the study area, region and County due to the proposed action.

Introduction

Key Factors. As shown in previous studies, Observers tend to evaluate the visual impact of windfarms on these three factors in step-wise manner: (1) visual intrusion – all projects are generally visible -- *is a specific project visually intrusive* (?); (2) visual amenity – if the project is viewed as visually intrusive, *is there a loss of visual amenity* (?); and (3) project utility – *does the project provide positive benefits to the community*? Positive views of project utility tend to reinforce positive visual impressions. For some observers, a positive view of project utility may mitigate a negative visual impression(s) of the project. The evaluation of these factors is difficult to quantify and is necessarily subjective.

Importance and Ranking of the Factors. The first factor is the most important. If Observers do not feel the presence of the wind turbines would be intrusive, then, by definition, there are no negative visual impacts. If the presence of the wind turbines is seen as potentially intrusive, then the second factor becomes more important. Specifically, If the turbines are seen as potentially intrusive to some observers, a perceived loss of visual amenity becomes the crucial question. If there is *not* a perceived loss of visual amenity, the observers may agree that the project's merits (Factor 3) outweigh its *visual intrusion*. If there is a perceived loss of visual amenity, the burden of proof is on the developer to provide appropriate mitigative measures, such as selecting a more aesthetically-pleasing wind turbine or modifying the windfarm design and layout to be more aesthetic-pleasing. If the project's merits are strongly positive, the merits may outweigh the potential loss of visual amenity.

General Trends. Previous studies have shown that most wind energy supporters tend to see windfarms as aesthetically pleasing or they may have a neutral to slightly negative visual impression of them. Consequently, supporters would not sense a loss of visual amenity, or if there was a question of a potential loss, this might be offset by the supporters' positive views of the merits of the project.

On the other hand, wind energy opposers might list negative visual impact as a primary reason or one of several reasons for opposing a project. In this case, the opposers might find the project to be visually intrusive. They would also be concerned about a loss of visual amenity. In some cases, all arguments of positive project benefits are not seen to be relevant. The burden of proof again falls on the developer to pursue possible mitigative measures and to seek guidance from the project approval authority.

How to Evaluate The Potential Visual Impact of This Project? WSB-Hawaii believes the visual impact of the proposed 20 MW windfarm is best evaluated by the community, including not only those who would view the project daily but also those that might view it only once. More importantly, how does one evaluate a project that does not exist? First, ZPAC decided to solicit comments on the potential for visual impact from key representatives of government agencies, environmental and community groups and private citizens. Their comments are summarized below. Second, ZPAC recently became aware of the potential for generating computer-simulated photographs of the proposed windfarm. These type of photographs have good potential as a tool in the visual impact analysis process, in general, and may help some reviewers to resolved visual impact issues with respect to the proposed project. The photographs have just been completed and are presented below, followed by a discussion and evaluation of visual impact of the proposed project.

Initial Public Response

ZPAC has discussed the proposed 20 MW windfarm with a number of government agencies, environmental and community groups and citizens. Government agencies contacted include USDOI, FAA, the National Park Service, the US Army Corps of Engineers, DLNR, DBEDT, DOH, DOT and the County of Maui. Within DLNR, ZPAC also contacted the DLNR's Na Ala Hele Trails and Access Program. The environmental and community groups include the Hawaii Audubon Society, the Sierra Club, the Environmental Conservation Council, the Union of Concerned Scientists, the National Wildlife Federation, the American Lung Association and Maui Tomorrow. Refer to Section 6 for a list of the Parties contacted.

Reaction has been generally positive and supportive, subject to further review of the project details. Some specific comments are paraphrased and discussed below:

- How big are the wind turbines, what would they look like and would I be able to see them from the main highway?
- How many would there be and would there be any utility lines?
- I have concerns if they are "behemoths" and stick out against landscape; and
- Would I be able to see them from the Lahaina Pali Trail?

The response to the these questions is summarized below:

- <u>How big, what do they look like and would I be able to see them</u>? The turbines are big. *They have three blades with a rotor diameter of 48m (157ft).* They would be installed on 50m (164ft) lattice towers. Overall, the turbines would not be visible to the community except at a distance of over four miles from the southeast across the bay or at sea (See photographs below). They would not be visible from main highway due to the steep contour of the land near the highway;
- <u>How many would there be and will there be utility lines</u>? There would be 27 turbines spread out in one, articulated row. The row would be approximately 2,500m (8,200ft) long and would follow the Kealaloloa ridgeline. The intrasite electrical interconnection network will be buried and not visible. The windfarm's interconnection substation will be installed above ground, but is not as tall and would probably be less visible than the wind turbines;
- <u>Are they going to be really big and "stick out" against the landscape</u>? From most viewpoints below the windfarm, the wind turbines will be seen against the landscape. The exceptions will be certain viewpoints above the highway. These views would normally be seen only by ZPAC maintenance or DLNR personnel. The turbines would be installed on lattice towers, which provide an open, lighter appearance. Thus, WSB-Hawaii believes the wind turbines would not "stick out" against the landscape. Furthermore, it is not likely that observers would see them, unless they were specifically looking for them; and
- <u>Would I be able to see them from the Old Lahaina Pali Trail</u>? ZPAC initially consulted with the State's Na Ala Hele Trails and Access Program in conjunction with the wind measurement CDUA. Based on those discussions, ZPAC decided to relocate two wind turbine sites (originally planned to be located below the lower transmission lines) to locations above the lower transmission lines. These relocations will reduce the impact to the viewplanes along the trail.

Computer-Simulated Photographs

Recently, ZPAC became aware of technology for producing computer-simulated photographs. There are at least two approaches that are currently being developed and used by industry. Both approaches employ the capability of creating computer images of wind turbines, other structures and roads. Essentially, these simulations are similar to "clip art" images used in many word processing or presentation software packages. The first approach uses downloaded satellite photographic images of the proposed windfarm area. The second approach uses actual photographs taken on the ground from several viewpoints and from aircraft flying near the proposed windfarm area. In both cases, the wind turbine images are reduced to the appropriate scale and are superimposed on these photographs.

The experience to date has been better with the second approach. Specifically, the resolution of the satellite photographs has not been as good. The use of ground and aircraft-based photographs provides a good visualization. WSB-Hawaii believes these four computer-simulated photographs provide a good basis for discussion of visual impact issues.

Some reviewers indicated they would like to see additional information before making further comments on the potential visual impact of the proposed project. WSB-Hawaii believes these photographs meet this objective.

Computer-Simulated Photograph #1 (Aerial View from South). This is a view an observer might see if he were seated on the port side (left side as you face forward) of an aircraft that is approaching the Kahului Airport from the south. The view is at a point where the windfarm is below the observer. *In the photograph, the wind turbines are visible* against the Kaheawa Pastures. WSB-Hawaii Comment: The turbine towers appear darker than they probably would in a real photograph and in real life.

Computer-Simulated Photograph #2 (Ground View from Northeast). This is a view an observer might see if he was at the upper end of the windfarm and looking in a southwesterly direction. This view would most likely be seen only by O&M personnel, utility, DLNR personnel or others authorized to be in the Conservation Land. WSB-Hawaii Comment: Similar to the comment above, the turbine towers appear darker than they probably would in a real photograph or in real life, depending on the time of the day. The color of the tower structural members would be a gray-silver. With the sun behind the observer, the turbines would appear lighter and vice versa.

Computer-Simulated Photograph #3 (Ground View from Kihei). This is a view an observer might see from near the Maui Lu Resort. The view is approximately from the southwest at a distance of more than 10km (6.2mi). WSB-Hawaii Comment: From this viewpoint, the wind turbines are barely visible against the horizon.

Computer-Simulated Photograph #4 (Aerial View from Direction of Kihei). This is a another view from the port side of an aircraft that is approaching the Kahului Airport from the south. The view is pretty much on the same line as for photograph #3. WSB-Hawaii Comment: As before, the turbine towers appear darker than they probably would in a real photograph or in real life.

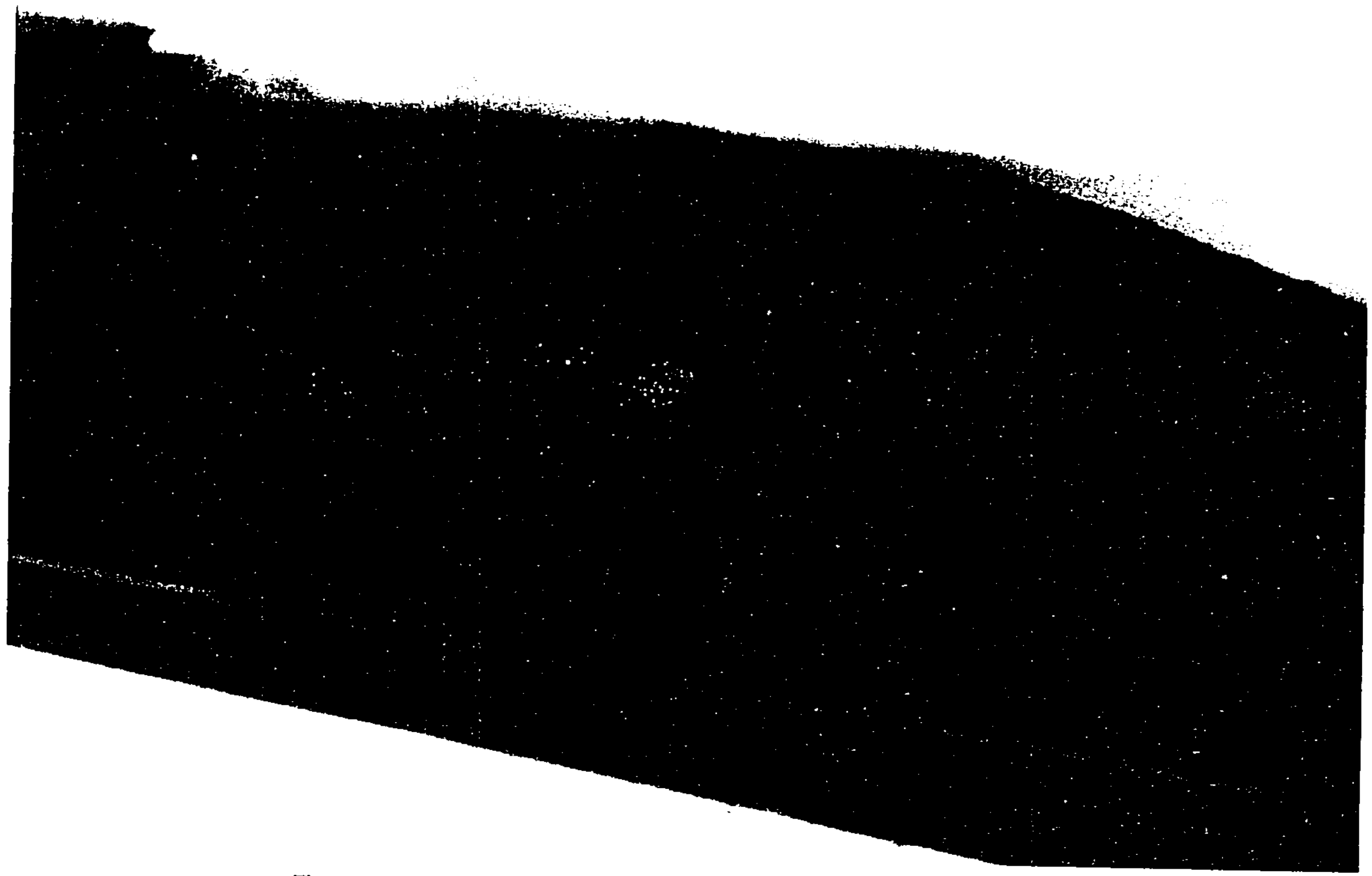

Figure 3.16.3-1. Aerial View from the South: Proposed 20 MW Windfarm

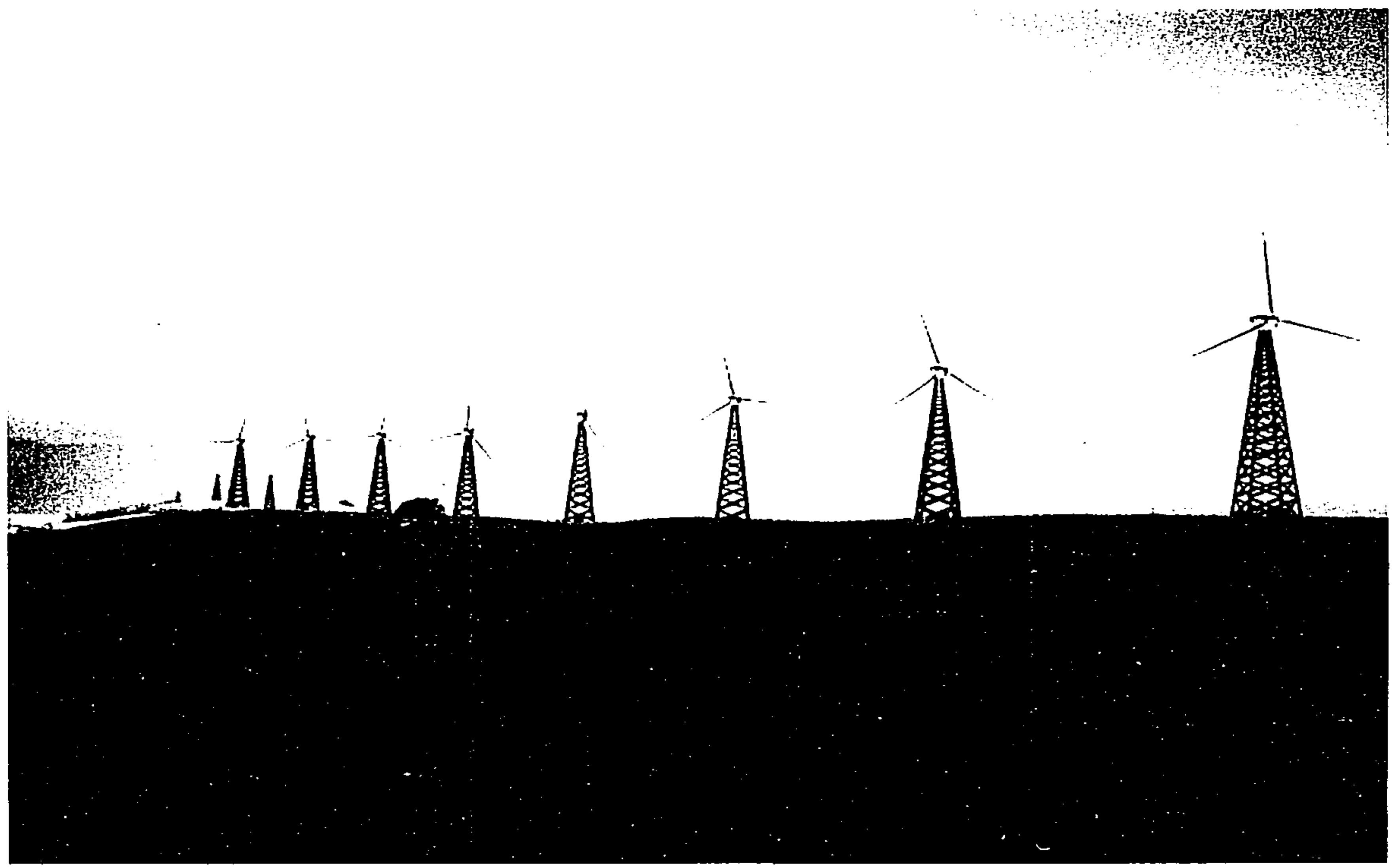

Figure 3.16.3-2. Ground Level View from the Northeast: Proposed 20 MW Windfarm

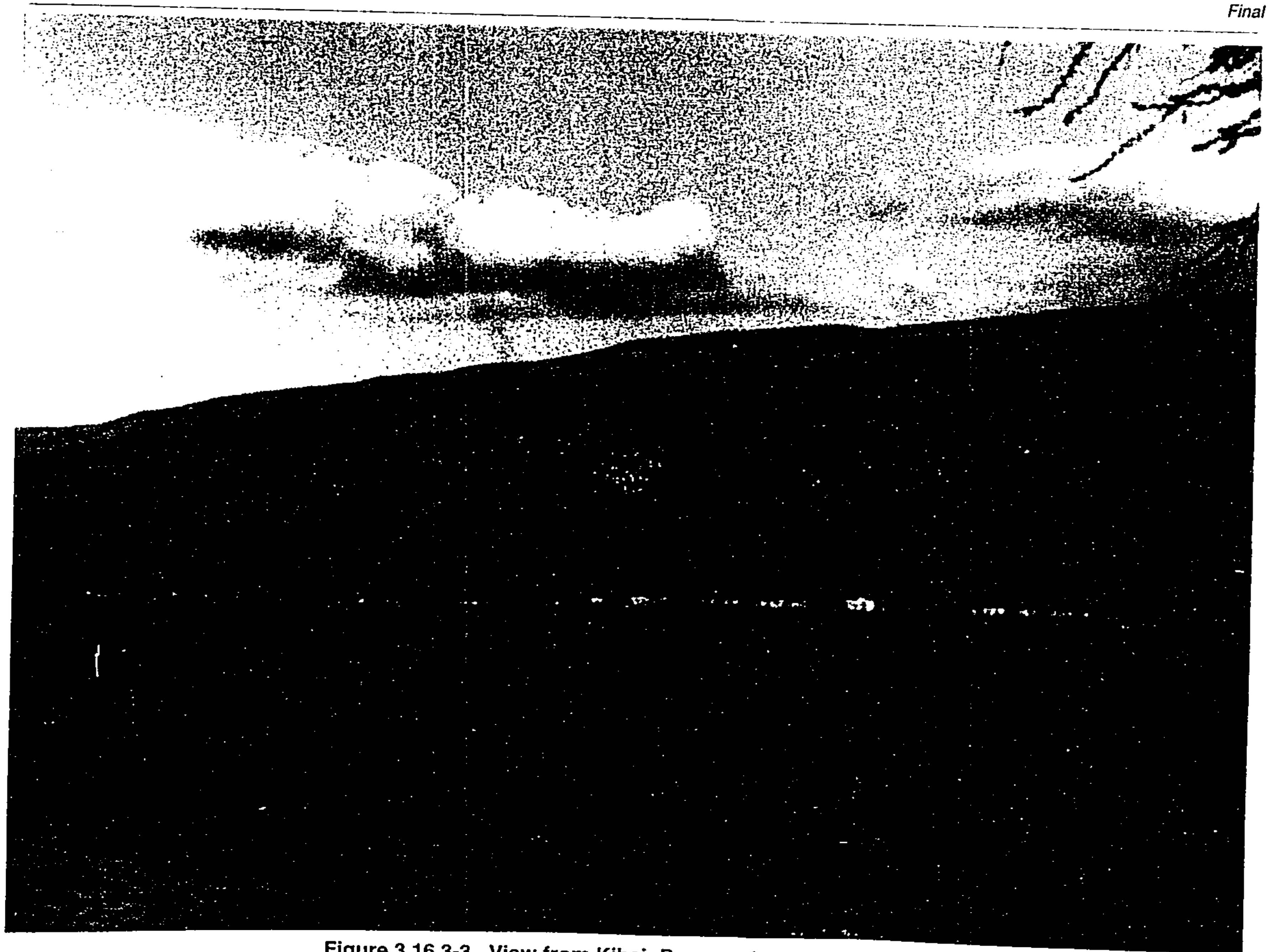

Figure 3.16.3-3. View from Kihei: Proposed 20 MW Windfarm

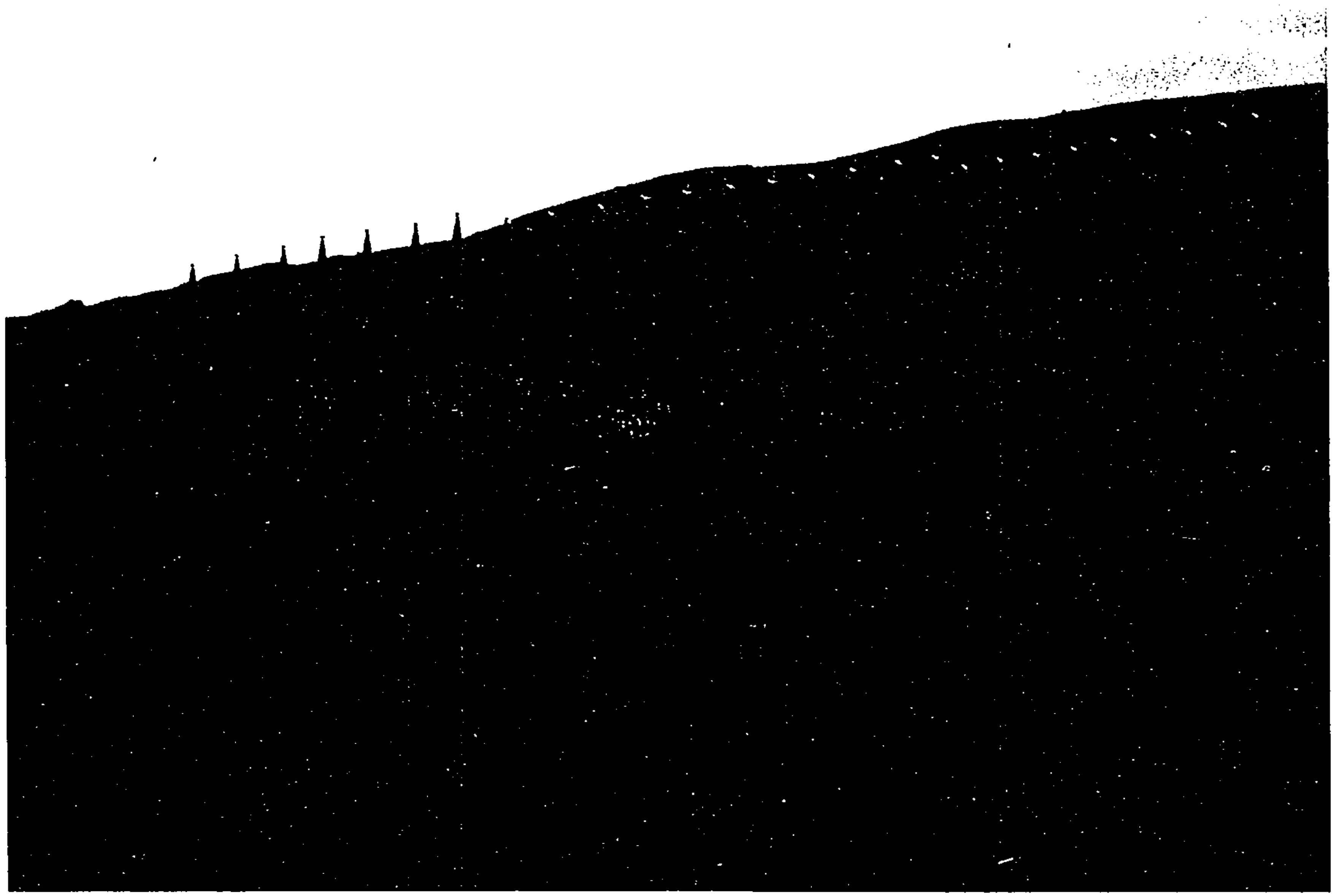

Figure 3.16.3-4. Aerial View from Direction of Kihei: Proposed 20 MW Windfarm

Discussion

WSB-Hawaii believes that it has designed the Zond Z-48 wind turbine with concern for aesthetics as discussed previously. WSB-Hawaii also believes that ZPAC has designed the proposed windfarm project in line with emerging industry aesthetics guidelines to minimize visual impacts. The potential impacts are as follows.

Visual Intrusion

Wind turbines and windfarm arrays can become intrusive to observers when the turbines *stick out* or become *dominant* objects on the existing landscape. The wind turbines take attention away from existing topographic features and other manmade objects. ZPAC has taken steps to promote visual uniformity and reduce visual clutter and to integrate the windfarm with the existing landscape.

Despite these precautions, it is possible that some observers may still feel that the windfarm is intrusive. This will depend, in part, on the observer's vantage point. Because of the remote siting of the windfarm on Conservation Land, there will be a limited number of vantage points from which non project-related observers would be able to see the windfarm.

First, it is not likely that the closest residents will see windfarm on a daily basis. Due to the remote siting of the windfarm, no one lives within 2.25mi (3.6km) of the windfarm or works on a daily basis in the study area. The closest inhabitants are along the coast near towards Maalaea and an elevation more than 610m (2,000ft) lower than the proposed site.

Second, the windfarm would not be visible from along the main highway from Maalaea to Lahaina or from Maalaea. The windfarm may be visible from vantage points across Maalaea Bay in Kihei and farther up the slopes of Mt. Haleakala. From the vantage points, which would be over 10km (6.2mi) away, the average person would probably not even see the windfarm, unless they were specifically looking for it (Refer to Figure 3.16.3-3).

Third, there may be impacts to the viewplanes along the Old Lahaina Pali Trail. Concerns were expressed by Mr. Mike Baker of the DLNR Na Ala Hele Trails and Access Program at the December 18, 1998 ZPAC meeting with DLNR staff. ZPAC's goal is to site the wind turbines to reduce any adverse impacts. For example, hikers on the trail will not be able to see all of the wind turbines. Hikers might be able to see parts of up to six to eight towers and wind turbines from various points along a mile or section of the trail from near where the trail crosses the Manawainui Gulch to where the trail joins the main jeep road. Mr. Baker indicated that approximately 50 people hike the trail per month.

Fourth, the windfarm may be visible to passengers and crew on the correct side of aircraft in landing or takeoff patterns from the Kahului airport or to personnel on helicopter flights around the island. Again, these potential observers may not actually notice the wind turbines unless they are specifically looking for them (See Figures 3.16.2-2, 3.16.3-1, and 3.16.3-4.

Visual Amenity

Some observers may object to the windfarm if they feel that its presence results in a loss of *visual amenity*. WSB-Hawaii recognizes this possibility, but feels that this concern would be more likely if many people lived near the turbines or saw the turbines on a regular basis. This is not the case. As discussed above, the number of people that would actually see the turbines would most likely be small compared to the community at large. In fact, WSB-Hawaii believes that the people most likely to see the turbines, other than site or DLNR personnel, would be hikers on the Old Lahaina Pali Trail.

Project Utility and Benefits

How the observer views the utility of the project and its potential benefits could influence his overall assessment of visual impact. Assume first that an observer already views the project as aesthetically pleasing. WSB-Hawaii believes that if he recognizes the utility and benefits of the project, this would enhance his already positive response. If for some reason, the observer does not recognize these benefits, he may become indifferent as to the issue of visual impact. In the worse case, as discussed previously, if too many wind turbines do not run, are broken and are not fixed, the observer may have a negative response.

Assume now an observer views the windfarm as visual intrusive or that the project would result in a loss of visual amenity. If this observer recognizes the overall project utility and benefit, this may cause him to alter his assessment of the overall visual impact.

Given the overall positive response to date, WSB-Hawaii believes the potential positive benefits of the proposed project are being recognized and tend serve to offset some concerns about visual impact. Note: at the Public Hearing conducted by DLNR on January 13, 1999 at the Kihei Elementary School in Kihei, no one expressed concern that the project would have a visual impact on the community.

Evaluation

WSB-Hawaii is basing its evaluation of three key factors; visual intrusion, visual amenity and project utility and benefits. Based on the preliminary discussions ZPAC has conducted, comments received from DEA reviewers, and the comments received at the January 13, 1999 Public Hearing, WSB-Hawaii does not believe that most observers would find the windfarm to be visually intrusive or that its presence would result in a loss of visual amenity to the community. The community appears to recognize the utility of the project and its potential benefits. In fact, at the Public Hearing one commentor asked if it were possible to accelerate the schedule for constructing the windfarm. WSB-Hawaii believes it is possible that most observers, regardless of their vantage point, might view the windfarm as visually aesthetic.

Based on the above, WSB-Hawaii believes that the overall visual resource impacts would be "*non significant*." With mitigation, the impacts could be reduced further as discussed below. Refer to Table 3.1-2 for a summary of the environmental consequences of the proposed action and mitigation measures program.

3.16.4 Mitigation Measures

Discussion

WSB-Hawaii recommends that ZPAC follow-up directly with all the Parties that have concerns about visual impact of the project as a result of their review of this FEA. ZPAC has indicated it will work closely with all Parties to address and resolve all concerns.

Evaluation

Based on these mitigative measures, ZPAC anticipates that concerns can be addressed and there will be less concern regarding visual impact. Therefore, ZPAC evaluates the overall impact of the project on the community to be "*negligible*" following the implementation of the mitigative measures.

3.17 Community Acceptance

This section includes an introduction to the issues relevant to community acceptance of windfarms, identification and evaluation of the community acceptance issues relevant to the proposed 20 MW windfarm, and a discussion of the need for mitigation measures, including an evaluation of the impact consequences of the proposed project (Refer to Table 3.1-2 for a summary of the environmental consequences of the proposed action).

3.17.1 Introduction

Development of a windfarm is much like any other power plant. The developer must gain access to a suitable site, plan and engineer the project, acquire permits and approvals for construction and operation, secure financing, and, if a non-utility entity, negotiate a power purchase agreement to secure a market for the electricity that the windfarm would harvest.

Experience with previous windfarm development suggests windfarm developers seek public interest and comment as early in the planning process as possible. In any case, the public most certainly will be involved during the permitting phase. While the opinion surveys have shown strong public support for wind energy, there may be concerns about specific projects.

Overall, the approving officials will seek to answer the basic question -- is the proposed windfarm an appropriate use of the land on which it is to be sited? The answer depends, in large part, on the designation and zoning of the land. For example, if the land is private and zoned agricultural, wind energy is a pre-permitted use in Hawaii. If the proposed site is on State conservation lands, wind energy use is permitted, subject to an application for and approval of a Conservation District Use Permit (CDUP). The application for the CDUP requires a thorough *review of all potential environmental impacts via the EA/EIS process.*

The issues required to be addressed in the EA/EIS will impact whether the community accepts or opposes a specific project. All members of the community should ask if the proposed project is an appropriate use of the land. The community as a whole may also ask: (1) are the project's proposed benefits worth their costs? and (2) would the windfarm be a good neighbor?

Note: WSB-Hawaii defines the community as a whole to include the approving agency, other government agencies, community groups, the utility company, the site landowner, other landowners and neighbors, environmental groups and the general public. WSB-Hawaii believes each applicant has the obligation to discuss the project with all interested Parties in the community. Consequently, each interested Party would evaluate and determine whether they would support or oppose the project.

Typically, the EA preparer identifies, discusses, and evaluates key issues relevant to a proposed action. This process is oriented towards identifying and resolving potential negative impacts (or costs) to the proposed action. WSB-Hawaii believes the process can also reveal potential *positive* impacts (or benefits) of the proposed action.

The *generic* benefits and costs of proposed windfarm development are summarized below. This summary incorporates discussion of these issues as presented in Sections 3.4 through 3.16 and also benefits and costs identified by the National Wind Coordination Committee (National Wind Coordination Committee, 1997).

Experience has shown that windfarms can provide a number of benefits to a community when the windfarms have been *properly* sited, designed, constructed and implemented. These potential *benefits* include:

- generation of electricity at competitive prices for resale by local utilities;
- protection of utilities and ratepayers from risks associated with changing fuel prices, new environmental regulations, uncertain load growth and other unpredictable costs;
- the proposed land use is compatible with other uses, e.g., livestock grazing and agriculture, hunting;
- creation of new business and jobs, keeping energy dollars circulating in local economies and reducing reliance on imported energy. This improves local, state or regional trade balances; and
- reduction of utility-generated air pollutant emissions through avoidance of fossil fuel use, helping utility's meet environmental regulations and satisfy their customers' desire for clean power sources.

Experience has also shown that windfarms can result in *costs* to the community if the windfarms have *not been properly* sited, designed, constructed or operated. These potential costs include:

- preclusion of other important uses of the land;
- damage to local soils, e.g., erosion due to improper design, construction and maintenance of roads;
- impacts on local flora and their habitats, e.g., sensitive plants that are not identified and avoided, and disturbed flora that are not relocated or replaced;
- impacts on birds and other wildlife and their habitats, e.g., wind turbines may pose a threat to birds and/or their habitat;
- impacts on cultural resources, e.g., archaeological sites, possible restriction on entry and right of way to other users of the site;
- acoustic emissions (noise) which may disturb neighbors, or workers and other users of the site; and
- visually intrusion to some observers or a perception of a loss of visual amenity.

Experience of windfarm developers to date suggests that it takes a concerted and conscientious effort during the planning, implementation and operational phases of windfarm projects to maximize the potential benefits while minimizing the costs. While it is desirable to eliminate all the costs (negative impacts), this may not be possible. WSB-Hawaii believes the overall process can be optimized by soliciting public comment early in the process and by addressing and resolving all public concerns. This process starts in the initial planning phase and continues throughout the construction and operation of the windfarm.

3.17.2 Potential Impacts

This section includes a discussion of the issues that impact community acceptance, identification and discussion of potential benefits and costs, and a preliminary evaluation of community acceptance of the proposed 20 MW windfarm project.

Discussion

This discussion includes introductory comments on community awareness on Maui and preliminary community attitudes and concerns about the proposed project.

Community Awareness

Community awareness regarding energy projects has steadily increased over the last decade on Maui (Personal Communication: Kal Kobayashi). More people are becoming knowledgeable and concerned regarding the impact of fossil fuel sources on the environment. They are also becoming more aware of alternatives to fossil fuels. In part, this is due to County and State public outreach programs to inform the public of energy-efficiency and renewable alternatives. It is also part of a nation-wide growing awareness about impacts on the global climate due to human activity.

Consequently, there is increasing scrutiny of new energy project proposals. When a new source of power is needed, people are becoming more concerned about the type of power plant, where it would be constructed, and how it would impact the local community and environment.

Community Attitudes and Concerns

ZPAC has discussed the proposed 20 MW windfarm with a number of government agencies, environmental and community groups and citizens. The government agencies contacted include the USDOI, the FAA, the National Park Service, the US Army Corps of Engineers, the State of Hawaii DLNR, DBEDT, DOH, DOT and the County of Maui. Within DLNR, ZPAC also contacted the DLNR's *Na Ala Hele Trails and Access Program. The* environmental and community groups include the Hawaii Audubon Society, the Sierra Club, the Environmental Conservation Council, the Union of Concerned Scientists, the National Wildlife Federation, the Life of the Land, the American Lung Association and Maui Tomorrow. A number of these Parties were also contacted during the preparation of the EA for the installation of wind monitoring equipment. Refer to Section 6 for a list of the Parties contacted. and specific comments on the DEA.

Overall, reaction to the proposed project has been positive and supportive. However, some concerns have been expressed four key areas. See Section 6 for copies of the comments from the reviewers of the DEA and ZPAC's response to those comments. The key issues raised include concern about the potential impacts on flora (especially native plants), birds (especially endangered species such as the Nene) and other wildlife, cultural resources (archaeological sites and the Old Lahaina Pali Trail) and visual resources. Each of these issues has been discussed in the previous sections of this FEA. ZPAC has proposed mitigative measures to reduce the severity of the negative impacts that have been identified. These measures must be weighed in terms of the project's overall benefits and costs.

Benefits and Costs

WSB-Hawaii believes the thorough discussion, evaluation and assessment of the issues presented in Section 3 have identified both the positive impacts (or benefits) and the potential negative impacts (or costs) of the proposed action. WSB-Hawaii believes the key issues have been identified and addressed in this EA. The potential benefits and costs are summarized below.

Benefits

Wind projects can provide a number of benefits. These have been discussed from the project development perspective in Sections 2.5 and from the environmental perspective in Section 3. WSB-Hawaii believes the potential benefits of the proposed project include:

- an appropriate use of the Conservation District land in the Ukumehame ahupua'a, that would provide a direct revenue benefit to the state and be compatible with other existing or potential uses of the land.
- and estimated $7M in land use revenues to the State over the projected 25 year lifetime of the windfarm (see Sections 3.4 and 3.10);
- sale of electricity to MECO for resale to their Maui customers. The project will help MECO show its support for cost-effective renewable sources;
- diversification of Maui's generation mix and reduction of vulnerability to fuel supply disruptions and price "spikes," such as what occurred during the Persian Gulf War. Improvement of Maui's energy security and supports the State energy goal ir reducing the State's dependence on imported energy sources.
- The cost of the wind energy is known and subject only to negotiated cost of living increases. WSB-Hawaii estimates that the project would save the ratepayers $13M over the projected windfarm lifetime (see Section 3.10);
- increasing the use of indigenous fuel sources, which is another important State energy goal. WSB-Hawaii estimates that $38M (102,000 barrels a year at $15/barrel) would be saved over the windfarm lifetime. This $38M would recirculate on Maui and in Hawaii (see Section 3.10);
- creation of significant economic activity on Maui, e.g., $10M in construction contracts, $3.75M total in job-related income, both from temporary and permanent positions, over the windfarm lifetime (see Section 3.10);
- an estimated $6M in tax revenues from excise tax paid on construction and operation materials and income tax paid by the windfarm employees and consultants over the windfarm lifetime (see Section 3.10);
- protection of Maui's environment through the avoidance of fossil-fuel use and its resulting air emissions. WSB-Hawaii estimates that the project would avoid almost **86 million** pounds of pollutants/year, including over 92 **thousand** pounds of carbon monoxide, over 85 **million** pounds of carbon dioxide, over 287 **thousand** pounds of nitrogen oxides, almost 150 **thousand** pounds of sulfur oxides, over 55 **thousand** pounds of particulates, and almost 32 **thousand** pounds of volatile organic compounds (see Section 3.13);
- protection from possible new environmental regulations, e.g., reduces the risk associated with possible taxes on carbon emissions or mandated carbon emission reductions (see Section 3.13); and
- contributions to a native plant and the Nene propagation programs.

Costs

There are some potential costs (or negative impacts). These have been discussed in detail in Sections 3.4 through 3.16. The more important of these are impacts on:

- flora and their habitat – ZPAC plans to conduct follow-up surveys before finalizing turbine site and ancillary building locations and road routes, and to support a native plant propagation program – see section 3-7;

- avifauna species and their habitat – ZPAC's goal is avoid injury to avifauna and damage to their habitat. ZPAC proposes to continue monitoring for downed birds near the meteorological towers, plan and coordinate additional surveys with DLNR/DOFAW, develop additional mitigation measures, including contributions to the Nene propagation program. See section 3.8 for more details;
- cultural resources – MECO's survey and archaeological survey conducted by IARII for ZPAC have not uncovered any archaeological sites in the study area. ZPAC plans an additional survey if any portions of the upper spur are to be relocated. ZPAC's O&M manual would include a protocol should any historic remains be inadvertently uncovered during construction. The DLNR Na Ala Hele Trails and Access Program has expressed the concern that the project will impact viewplanes along the Old Lahaina Pali trail. See section 3.9 for more details; and
- visual resources – The community as a whole has not expressed the concern that the project will result in significant visual impacts. ZPAC has provided computer-simulated photographs which depict the proposed windfarm from a number of viewpoints. WSB-Hawaii that only a small number of people, principally hikers, will actually see the wind turbines. See section 3.16 for more details.

Note: WSB-Hawaii recognizes that not all potential costs have been highlighted in this section, but believes they have been adequately addressed throughout this document. It is possible that some readers may identify issues or concerns that have not been addressed. WSB-Hawaii recommends that ZPAC continue to solicit inputs regarding any unidentified issue from any interested Party and to discuss any concerns.

Evaluation

WSB-Hawaii believes that community acceptance of the proposed project starts with the overall question of land use. As developers pursue project opportunities, the question is first broached with landowners and approving agencies. Ultimately, to gain approval by the appropriate agency, the developer must gain support for the project by the community.

As discussed previously in Section 3.4, the question of land use involves a number of elements that may be impacted directly by the proposed action, e.g., "topography, geology and soils" (Section 3.5), "hydrology and water resources" (Section 3.6), "terrestrial flora" (Section 3.7) and "fauna" (Section 3.8).

Similarly, the question of community acceptance involves all of elements that may be impacted, e.g., those noted in the previous paragraph, plus the remainder of those discussed herein, e.g., "Air Quality and Meteorology" (Section 3.13), "Noise" (Section 3.14), "Cultural Resources" (Section 3.9), "Socioeconomics" (Section 3.10), "infrastructure" (Section 3.11), "Public Services and Facilities" (Section 3.12), "Electrical Magnetic Fields" (Section 3.15), and "Visual Impact" (Section 3.16).

As a means of evaluating the community acceptance, WSB-Hawaii believes the responses to the three key questions noted at the beginning of this section are relevant:

- Question #1 -- is the proposed project an appropriate use of the land? Yes. WSB-Hawaii believes the proposed action is supported by the community as an appropriate and acceptable use of Conservation District Land. The Maui County Plan indicates use of Conservation District Land for wind energy and other renewable energy projects as a goal (See Section 4.3.1). This evaluation assumes that the proposed mitigative measures are accepted as sufficient to ameliorate the potential impacts;

- Question #2 -- are the project's proposed benefits worth their costs? Yes. As discussed above and in Sections 3.10 (Socioeconomics) and 3.13 (Air Quality), there are a number of quantifiable energy, economic and environmental benefits accruable to the proposed project. WSB-Hawaii believes these benefits far exceed the potential costs that have been identifies. In part, this evaluation assumes that the mitigative measures are accepted as sufficient to ameliorate the potential costs; and
- Question #3 -- would the windfarm be a good neighbor? Yes. WSB-Hawaii believes the community would see and value ZPAC as a good neighbor, based on the initial inputs received from government and private parties, and ZPAC's project design and implementation approach, including their proposed mitigative measures program.

Finally, an evaluation of the severity of total impact on community acceptance must include all elements discussed herein. Specifically, the severity can *not* be less than the severity for any of these elements. Therefore, WSB-Hawaii evaluates the severity of the potential impacts of the proposed action on community acceptance to be *"significant."* With mitigation, WSB-Hawaii believes the impacts could be reduced further as discussed below.

3.17.3 Mitigation Measures

Discussion

All of the potential impacts have been discussed in the previous sections. Specifically, WSB-Hawaii has not identified any new potential negative impacts that have not been discussed previously. In all cases, WSB-Hawaii has concluded that the mitigative measures program would reduce the severity of the impacts such that the specific impacts would be *negligible, none, or beneficial.*

ZPAC plans to continue to discuss the proposed project with the community and to solicit comments. WSB-Hawaii anticipates that there could be additional questions and concerns from the community on the project proposal. WSB-Hawaii recommends that ZPAC work closely with all Parties to address and resolve all concerns.

Evaluation

Based on implementation of these mitigative measures as summarized in the previous subsection and discussed in detail throughout this document, WSB-Hawaii evaluates the overall impact of the project on the community to be *"non-significant."*

4. Relationship to Land Use Plans, Policies and Controls

This section describes the relationship of the proposed 20 MW windfarm project to the goals and objectives of Federal, State and County plans, policies and land controls that pertain to development of wind energy.

4.1. Federal

There are no known Federal *plans* that directly relate to or influence the proposed action. The three known Federal *policies* which do relate to and influence the proposed action are:

- FAA Rules. The Federal Aviation Administration (FAA) requires Sponsors of a Construction Project to file a "Notice of Construction or Alteration" when the Project has certain characteristics. For example, one such characteristic is when the construction includes a structure of more than 61m (200ft) in height above the ground level at its site. ZPAC has filed a notice with the FAA, since the height of each of the wind turbine blades (pointed when vertically upward) exceeds 61m (200ft).

  The FAA has subsequently determined that the proposed project would not be an obstruction to air navigation under Part 77 of Federal Aviation Regulations. Since the height of the turbines including the blades would exceed 61m (200ft), lighting is required to alert pilots. For this project, the FAA has approved lighting with a steady burning red obstruction light on the top of every other turbine nacelle.

- DOI U. S. Fish and Wildlife Service. The DOI Fish and Wildlife Service, administers the Federal Endangered Species Act of 1973. DOI normally becomes involved in projects where Federal lands and or funds are to be used. This is not the case for this project. DOI could also become involved if it, or another federal agency, took an action that could materially affect the project.

  In the case of this project, there is a potential trigger associated with the FAA's review of the "Notice of Proposed Construction or Alteration" filed by ZPAC. If the FAA determined that their action could impact an endangered specie, they would initiate a Section 7 consultation pursuant to the Endangered Species Act. However, the FAA did not make this determination (See Section 4.1). A copy of the FAA form is included in Section 6.

- Army Corps of Engineers. ZPAC has proposed to improve and utilize a spur road that extends from near Puu Anu to the upper area of the project site. This spur crosses the upper portion of the Manawanui Gulch. Subject to further review of the proposed use of the upper spur for site access, the Army Corps of Engineers could become involved, if they determine that this upper portion of Manawainui Gulch falls under their jurisdiction. If this is the case, the Corps of Engineers would coordinate with DLNR's Water Resource Division. See Sections 3.6.1 for additional discussion.

4.2. State

The Hawaii statutes, plans, policies and programs that apply to the proposed 20 MW windfarm project include: the State Constitution; State Land Use and Conservation and Resources Laws; the Hawaii State Plan; the Hawaii Energy Plans and Policies; the Na Ala Hele Trails and Access Program; and the Coastal Zone Management Program

4.2.1. State Constitution

The proposed windfarm is consistent with Article XI, Section 1, of the State Constitution:

> "For the benefit of present and future generations, the State and its political subdivisions shall conserve and protect Hawaii's natural beauty and all natural resources, including land, water, air, minerals and energy sources, and shall promote the development and utilization of these resources in a manner consistent with their conservation and in furtherance of the self-sufficiency of the State."

Specifically, the windfarm would help protect the environment through the avoidance of fossil fuel use. This means that less pollutants would be emitted on Maui. WSB-Hawaii believes the windfarm can be designed, constructed and operated that would not significantly impact the natural beauty of the proposed site. See Sections 3.10 and 3.16 for more details.

4.2.2. State Land Use Law (HRS Chapter 205) and Conservation and Resources Law (HRS Chapter 183)

The proposed windfarm site lies within the Ukumehame ahupua'a of West Maui. Per HRS Chapter 205, the land is designated Conservation District and is owned by the State. The State's custodial agency is the Department of Land and Natural Resources (DLNR).

Use of the land requires submittal of a Conservation District Use Application (CDUA) for review and approval by the Board of Land and Natural Resources (BLNR) and issuance of a *Board Permit*. Per HRS Chapter 183, Use of Conservation District land also triggers the need for an environmental assessment (EA) and, if necessary, and Environmental Impact Statement (EIS). The EA is submitted and approved as part of the CDUA. The approval of the Board Permit is contingent, in part, upon acceptance of the EA (or EIS) by DLNR.

The proposed windfarm site and the proposed new access road lie within the "General" subzone of the Conservation District. WSB-Hawaii believes the proposed windfarm is a use consistent with the objectives of the more restrictive Conservation District Protective Subzone (See discussion in Section 3.3.2). Specifically, Section 13.5.22 of DLNR Conservation District Rules, identifies "energy generation facilities utilizing the renewable resources of the area (e.g., hydroelectric or wind farms" as a permittable "Public Purpose Use" in the "Protective" subzone. The land use is subject to issuance of a "Board Permit."

4.2.3. Hawaii State Plan (HRS Chapter 226, Revised 1989)

The Hawaii State Plan provides a long-range guide for Hawaii's future. It includes State goals, objectives and policies, and specifies a state-wide planning system to implement them. The construction and operation of the proposed 20 MW windfarm is consistent with and supports many of the State's long-term goals and policies. The most relevant portion of the State plan is Section 226-18, <u>Objectives and Policies for Facility Systems - Energy/Telecommunications</u>, which in relevant part, reads:

(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 state-wide energy and tele-communication systems capable of support the needs of the people,

(2) *increased energy self-sufficiency where the ratio of indigenous to imported energy use is increased, and*

(3) *Greater energy security in the face of threats to Hawaii's energy supplies and systems.*

The proposed 20 MW windfarm supports all three elements of this policy presented above: (1) the purpose of the windfarm is to provide reliable power of acceptable quality to MECO, (2) the windfarm would increase the ratio of indigenous resources used on Maui to generate electricity, and (3) the windfarm would reduce amount of fossil fuels needed by MECO to generate electricity. See Section 3.10 for more details.

4.2.4 Hawaii Energy Plans and Policies

State Energy Functional Plan

The State Energy Functional Plan describes objectives, policies and implementing actions in the following areas:

- Energy Conservation and Efficiency,
- Alternate and Renewable Energy,
- Energy Education,
- Legislation,
- Integrated Energy Management, and
- Energy Emergency Preparedness.

The goals and objectives of the State Energy Functional Plan and the Integrated Energy Policy that flows from the plan address generation, alternate energy sources, reduction of dependency on imported energy use and conservation

Hawaii Integrated Energy Policy

DBEDT has developed an integrated energy strategy for the State, entitled the Hawaii Energy Strategy (DBEDT, 1995). The primary goals of the HES are:

- *Increased diversification of fuels and sources of supply of these fuels;*
- *Increased energy efficiency and conservation;*
- *Development and implementation of regulated and non-regulated energy development strategies with the least possible overall costs to Hawaii's society;*
- *Establishment of a comprehensive energy policy analysis, planning, and evaluation system;*
- *Increased use of indigenous, renewable energy sources; and*
- *Enhanced contingency planning capability to effectively contend with energy supply disruptions.*

Similar to Hawaii State Energy Function Plan, the proposed windfarm is consistent with these goals of the Hawaii Energy Strategy.

4.2.5 Na Ala Hele Trails and Access Program

The Na Ala Hele Trails and Access Program was established in 1988 by Act 236 (Chapter 198D, HRS). Program responsibility, assigned to DLNR, includes planning, developing, acquiring, constructing and coordinating a statewide trail and access system. The program intent is to ensure adequate public access to coastal and mountain areas consistent with sound conservation principles. The program's vision statement is:

> *To develop, via the Na Ala Hele Program, a trail and access network and management system which:*
>
> - *provides a broad range of recreational, cultural, religious, and subsistence opportunities for all of Hawaii's people, and*
> - *helps to conserve Hawaii's cultural heritage and environment.*

The Lahaina Pali Trail has been designated a demonstration trail on the Na Ala Hele Trails and Access Program and is the first trail so designated on Maui. The trail is 7.2km (4.5mi) long, starting from near Ukumehame County of Maui Beach Park and ending near Pu'u Hele. It traverses the Kaheawa Pastures below the lower end of the proposed windfarm site. The trail joins the access road just before the road crosses the Malalowaiaole Gulch at about the 488m (1600ft) elevation level.

ZPAC initially consulted with the State's Na Ala Hele Trails and Access Program in conjunction with the wind measurement CDUA. Based on those discussions, ZPAC decided to relocate two wind turbine sites (originally planned to be located below the lower transmission lines) to locations above the lower transmission lines. These relocations will reduce the impact to the viewplanes along the trail. See also discussion of visual impacts in Section 3.16. Consequently, WSB-Hawaii believes that the proposed windfarm would not compromise the ability of the trail to meet the objectives of the Na Ala Hele Trails and Access program.

4.2.6 Coastal Zone Management Program

The mission of the Hawaii Coastal Zone Management (CZM) Program is to balance marine and coastal resources protection and sustainable economic development, anticipating emerging issues and facilitating their resolution by coordinating among interests, developing and articulating appropriate management policies, and involving the public in resource management issues.[10]

Enacted as Chapter 205A, HRS, the Hawaii CZM Program was promulgated in 1977 in response to the Federal Coast Management Act of 1972. The CZM area encompasses the entire state including all marine waters seaward to the extent of the state's police power and management authority, including the 12-mile U. S. territorial sea and all archipelagic waters. The program is built upon ten policy areas including objectives and policies.

Objectives. The CZM Management Program objectives and an assessment of the proposed windfarm project's potential impacts are as follows:

(1) **Recreational Resources** – to provide coastal recreational opportunities accessible to the public and protect coastal resources uniquely suited for recreational activities that cannot be provided elsewhere.

<u>WSB-Hawaii Assessment</u>. The proposed action would not impede access to beaches or recreational resources, such as the Old Lahaina Pali Trail (See Section 4.2.5).

[10] See Hawaii CZM Program website: http:/www.hawaii.gov/dbedt/czm/index.html.

(2) **Historic Resources** -- to 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.

WSB-Hawaii Assessment. No archaeological sites have been identified on the project site or along the proposed access route to the site (See Section 3.9 for discussion on cultural resource issues).

(3) **Scenic and Open Space Resources** - to protect, preserve, and where desirable, restore or improve the quality of coastal scenic and open space resources.

WSB-Hawaii Assessment. The proposed project will not affect the use or quality of the coastal scenic or open space resources. Where wind turbines would be seen from along the Old Lahaina Pali Trail or from a greater distance (e.g., from Kihei), the area is already affected by the presence of the utility's 69 KV transmission line. The presence of the wind turbines will not be visually intrusive or result in a loss of visual amenity (See Section 3.16 for discussion on visual impact issues).

(4) **Coastal Ecosystems** - to protect valuable coastal ecoystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.

WSB-Hawaii Assessment. The project would not impact marine ecosystems. There is some potential for negative impact on flora and fauna in the project area. Theses impacts are considered non-significant given the mitigation measures that have been proprosed (See Sections 3.7 and 3.8).

(5) **Economic Uses** - to provide public or private facilities and improvements important to the state's economy in suitable locations; and ensure that coastal dependent development such as harbors and ports, energy facilities, and visitor facilities, are located, designed, and constructed to minimize adverse impacts in the coastal zone area.

WSB-Hawaii Assessment. The project will provide electricity to the utility for the benefit of Maui. The project will provide net positive economic benefits due to the avoidance of fossil fuels (See Section 3.10).

(6) **Coastal Hazards** - to reduce hazard to life and property from tsunamic, storm waves, stream flooding, erosion, subsidence, and pollution.

WSB-Hawaii Assessment. The proposed project area is well above the tsunami and storm wave inundation zones. Proposed access to the site includes a crossing of the upper portion of Manawanui Gulch. The improvements of the existing access road in that area will be subject to a Stream Channel Alternation Permit (SCAP) to be authorized by the Water Commission. The project would not be a source of or generate any air or water pollution (See Sections 3.5 and 3.6 for discussion of topography, geology and soils and hydrology and water resources)

(7) **Managing Development** - to improve the development review process, communication, and public participation in the management of coastal resources and hazards.

WSB-Hawaii Assessment. This objective does not apply to the project.

(8) **Public Participation** - to stimulate public awareness, education, and participation in coastal management; and maintain a public advisory body to identify coastal management problems and provide policy advice and assistance to the CZM Program.

WSB-Hawaii Assessment. This objective does not apply to the project.

(9) **Beach Protection** - to protect beaches for public use and recreation; locate new structures inland from the shoreline setback to conserve open space and to minimize loss of improvements to erosion.

WSB-Hawaii Assessment. This objective does not apply to the project.

(10) Marine Resources - to implement the state's ocean resources management plan.

WSB-Hawaii Assessment. This objective does not apply to the project.

Policies. The CZM Management Program policies and an assessment of the proposed windfarm project's potential impacts are as follows:

(1) **Recreational resources** - to provide adequate coastal recreational opportunities, e.g., shoreline recreational resources, such as surfing sites, fish ponds and sand beaches

WSB-Hawaii Assessment. The proposed project will not impact this policy. The proposed project is set-back two miles from the shoreline and will not impact access to these shoreline recreational resources.

(2) **Historic resources** - to identify, analyze and preserve significant archaeological resources

WSB-Hawaii Assessment. The proposed project will not impact the CZM policies on historic resources. No archaeological sites have been identified on the project site or along the proposed access route to the site (See Section 3.9 for discussion on cultural resource issues).

(3) **Scenic and open space resources** - to identify valuable scenic resources in the CZM area, ensure that new developments are compatible with preserving these resources, and preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources.

WSB-Hawaii Assessment. The proposed project will not impact this policy. The proposed site would be located well above the shoreline at 2,000' to 3,200' elevation and set-back from the shoreline by approximately two miles.

(4) **Coastal ecosystems** - to preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance, minimize disruption or degradation to coastal water ecosystems and promote water quantity and quality planning.

WSB-Hawaii Assessment. The proposed project will not impact this policy.

(5) **Economic uses** - to concentrate coastal dependent development in appropriate areas, minimize adverse social, visual and environmental impacts, and direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments.

WSB-Hawaii Assessment. The proposed project will not impact this policy.

(6) **Coastal hazards** - to develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and nonpoint source pollution hazards, control development in areas subject to these coastal hazards, comply with the Federal Flood Insurance Program, prevent coastal flooding from inland projects, and develop a coastal point and nonpoint source pollution control program.

WSB-Hawaii Assessment. The proposed project will not impact this policy.

(7) **Managing development** - to use existing law effectively to manage present and future coastal zone management, facilitate permit applications in a timely manner and communicate potential impacts early in the development cycle to the public.

WSB-Hawaii Assessment. The proposed project will not impact this policy.

(8) **Public participation** - to maintain a public advisory board, disseminate information to the public and organize workshops, policy dialogues and site-specific mediations.

WSB-Hawaii Assessment. The proposed project will not impact this policy.

(9) **Beach protection** - to locate new structures inland from the shoreline setback, prohibit construction of private erosion-protection structures except when beneficial, and minimize construction of public erosion-protection structures seaward of the shoreline.

WSB-Hawaii Assessment. The proposed project will not impact this policy.

(10) **Marine resources** - to exercise an overall conservation ethic and practice stewardship in the protection, use and development of marine and coastal resources, assure that use and development is sound, coordinate management activities, partner with federal agencies, and promote research, including new, innovative technologies for exploring, using or protecting marine and coastal resources.

WSB-Hawaii Assessment. The proposed project will not impact this policy.

4.2.7 DLNR Conservation District Use Criteria

All uses of state-owned land, pursuant to Section 13-5-2, Hawaii Administrative Rules (HAR), require that a Conservation District Use Application (CDUA) be filed with DLNR and approved by the Board of Natural Resources (Board) prior to its initiation.[11] As part of the CDUA, the applicant must demonstrate that the proposed use is consistent with DLNR's Conservation District Use Criteria. A discussion of these criteria as they apply to the proposed project in as follows:

(1) The proposed land use is consistent with the purpose of the Conservation District;

Per DLNR Administrative Rules, Title 13, Chapter 5 (which are based on Hawaii Revised Statues, Chapter 183 authority), land use is regulated in the Conservation District "for the purpose of conserving, protecting, and preserving the important natural resources of the State through appropriate management and use to promote their long-term sustainability and the public health, safety and welfare."

The purpose of the proposed project is to develop a windfarm in an environmentally-sound manner on Maui and to sell renewable electricity to MECO. The needs of the proposed project are to provide 20 megawatts (MW) of wind generated electricity towards the growing electrical energy demand of Maui, to support the State's policy to reduce Hawaii's dependence on imported energy sources, and to help protect the State's environment. The windfarm is consistent with the purpose of the Conservation District and will support accomplishment of the objectives of the Conservation District as follows:

(a) construction of the windfarm will displace only 8.7 acres in a long, narrow 200 acre band of the Conservation District land. The windfarm includes the wind turbines, operations and maintenance building, site substation, meteorological towers and all

[11] Conservation District Use Application (Rev. 12/94), SOH, DLNR.

intrasite and access roads. Note: all intrasite electrical distribution lines will be buried. The land to be developed is a very small fraction of the total land in this portion of the Ukumehame District. Virtually none of the District's resources are used during the construction and operation of the windfarm. The windfarm is compatible with the existing and contemplated uses of the district;

(b) should the windfarm cease operation, the land can be easily restored to its existing condition. Therefore, there are not long-term negative impacts to the land;

(c) there are potential significant negative impacts to fauna (e.g., the endangered Nene) in the project area. These impacts need to be studied further; and

(d) there are positive impacts to the environment and the economy due to the offset of fossil fuel use.

2. The proposed land use is consistent with the objectives of the subzone of the land on which the use will occur;

Per DLNR Administrative Rules, Title 13, Chapter 5 (which are based on Hawaii Revised Statues, Chapter 183 authority), there are 12 permitted uses in the "protective" subzone. One of these, P-5 (Public Purpose Uses), includes:

> "Transportation systems, transmission facilities for public utilities, water systems, *energy generation facilities* utilizing the *renewable resources* of the area (e.g., hydroelectric or *wind farms*) and communication systems and other such land uses which are undertaken by non-governmental entities which *benefit the public and are consistent with the* purpose of the conservation district."

Referencing Section 3.3.2 in theFEA (and noted below), the proposed windfarm would be located primarily in the "General" Subzone. Uses within this zone are generally less restrictive that in the "Protective" Subzone.

Thus, the identified windfarm, if found to be consistent with DLNR policy is a potential land use in the Conservation District, subject to approval and issuance of a Conservation District Land Use Permit.

3. The proposed land use complies with provisions and guidelines contained in Chapter 205A, Hawaii Revised Statutes (HRS), entitled "Coastal Zone Management," where applicable;

The proposed project is in compliance with the Coastal Zone Management Program as discussed in Section 2.4.7.

4. The proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community or region;

WSB-Hawaii has identified and summarized the potential consequences (impacts) by category. The categories include land use, topography, geology and soils, hydrology, terrestrial flora, fauna, cultural resources, socioeconomics, infrastructure, public services and facilities, air quality and meteorology, noise, electro-magnetic fields, visual impact and community acceptance. The significance of the consequences was evaluated using guidelines established in Section 12, Chapter 200, Title 11, State of Hawaii (SOH) Department of Health, Administrative Rules as authorized by Chapter 343, HRS. WSB-Hawaii evaluated only one of the consequences identified in theFEA to be potentially significant. There are potential significant impacts to the Nene. For more details see Section 3.8 of this EA.

In addition, some of the impacts have been evaluated as positive or beneficial. These include impacts on socioeconomics, air quality and meteorology and community acceptance.

5. The proposed land use, including buildings, structures and facilities, shall be compatible with the locality and surrounding areas, appropriate to the physical conditions and capabilities of the specific parcel or parcels;

   The windfarm will include the wind turbines, their support towers and foundations; an operation and maintenance building; an intrasite electrical distribution network; a site interconnection substation; and an intrasite road network and access roads. WSB-Hawaii believes that ZPAC has designed the windfarm to be compatible with locality and surrounding areas, appropriate to the physical conditions and capabilities of the specific parcel or parcels. Most of the supporting discussion is included in Sections 3.16 (Visual Impact) and 3.17 (Community Acceptance).

6. The existing physical and environmental aspects of the land, such as natural beauty and open space characteristics, will be preserved or improved upon, whichever is applicable;

   The windfarm was designed from an aesthetic point of view to use wind turbines which are visually pleasing and to site them in a manner so that they blend in with the existing landscape. This approach serves to reduce the potential for visual clutter and to preserve the visual amenity of the area. Specifically, visual clutter is reduced by limiting the number of turbines to 27 and deploying them in a single, articulated row which follows the predominant ridgeline in the area. The O&M building would be a pre-fabricated structure painted with typical, earth-tone colors consistent with Hawaii rural (farm and ranch) structures. The intrasite electrical distribution network will be buried underground and will not be visible. The site interconnection substation will be built to be consistent with the existing utility transmission system. The number of roads and their size will be minimized to reduce visual clutter and reduce erosion potential. Finally, The remote location reduces the potential for visual impact. The turbines will be sited to minimize adverse impacts to viewplanes along the Old Lahaina Pali Trail. See Section 3.16 (Visual Impact) for more details.

7. Subdivision of the land will not be utilized to increase the intensity of land uses in the Conservation District; and

   ZPAC does not propose to subdivide the land. Instead, ZPAC seeks a term easement for access to develop and operate the windfarm.

8. The proposed land use will not be materially detrimental to the public health, safety and welfare.

   Since wind turbines are a non-polluting source of energy, they do not generally present air-born or water-born health hazards to the public. As with other sources of electrical energy, there can be some hazards associated by exposure to electro magnetic fields. As discussed in Section 3.15, the risks to windfarm personnel are negligible. Due the remote location of the windfarm, the risks to the public are even lower. Other concerns regarding public health, safety and welfare include cultural resources, visual impact and noise. As discussed above, no culturally-significant sites have been identified in the proposed project area, and there are no known cultural practices that would be impacted by the presence of the windfarm. Visual impact has also been discussed previously. The issue of noise impacts are discussed in detail in Section 3.14 of the EA. The Z-48 wind turbine is similar in noise output to other turbines of its size and rated capacity. When siting windfarms, there should be sufficient setback so that noise levels will not exceed local ordinances at the property line. The proposed windfarm should not be audible at distances greater than 1.6km (1m) . Thus, due to the remote location of the windfarm, it is not likely that the public will hear them.

4.2.8 Hawaii Administrative Rules – Significance Criteria

The Hawaii Administrative Rules, Title 11, Department of Health, Chapter 200, Section 12 specifies thirteen criteria when considering the significance of potential environmental effects. Agencies are to consider the sum of the effects on the quality of the environment and shall evaluate the overall and cumulative effects of an action. The following is an assessment of the potential effects of the action:

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

<u>WSB-Hawaii Assessment</u>. An irrevocable (irreversible) commitment to loss or destruction of any natural or cultural resource is one that cannot be changed once it occurs. Natural resources include topographic and geologic features, soils, air, water, flora and fauna. No topographic or geologic features will be disturbed (See Section 3.5). Some soil will be disturbed during the construction of the windfarm, but this use is revocable. The windfarm could be decommissioned, all equipment and structures could be removed and the soil could be restored to its original condition. The project will not generate any air or water emissions and will provide positive benefits through the reduction of fossil fuel use and the resulting emissions on Maui.

Regarding flora and fauna, potentially negative impacts have been identified, studied and discussed (See Section 3.7). WSB-Hawaii believes that negative impacts to native flora can be reduced to a negligible level through proposed mitigation measures during construction and operation. These mitigative measures include temporary removal and replacement of native flora during construction and a native plant propagation program during operation.

There are concerns regarding potential negative impacts on avifauna, including the endangered Nene (See Section 3.8). These impacts could result in irrevocable loss of *individual* avifauna. Discussion of potential impacts on the Nene and other avifauna have not yet resulted in agreement on substantial mitigative measures. Additional study of the environmental impacts and development of appropriate mitigation measures, including a Nene propagation program, is recommended.

Cultural resources include culturally-significant archaeological sites, native practices and uses in the area, and other human resources. Based on an archaeological survey, there are no culturally-significant archaeological sites in the project area (See Section 3.9). An archaeological survey was also conducted along the proposed spur access trail with negative findings. Consultation with the native Hawaiian community has indicated there no cultural uses in the project area or in nearby areas of the Ukumehame that would be negatively impacted by the project. There are other irrevocable human resources that would be lost, e.g., the labor involved in constructing the project.

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

<u>WSB-Hawaii Assessment</u>. The project will not curtail the range of beneficial uses of the environment. The proposed windfarm is consistent with the primary purpose and use of the Conservation District. It also supports overall State policy to increase use of indigenous energy resources. The proposed windfarm is a use permitted in the Conservation District. Specifically, the proposed windfarm site lies within the "General" subzone of the Conservation District. The proposed windfarm is a use consistent with the objectives of the more restrictive Conservation District Protective Subzone (See discussion in Section 3.3.2). Specifically, Section 13.5.22 of DLNR Conservation District Rules, identifies "energy generation facilities utilizing the renewable resources of the area (e.g., hydroelectric or wind farms" as a permissible "Public Purpose Use" in the "Protective" subzone. The proposed windfarm is consistent with and will not preclude other potential uses of the land, e.g., livestock grazing and bird hunting (See Section 3.4). Windfarms are generally deployed on lands already in use for some other purpose, e.g., livestock grazing or game hunting. As such, they are good examples of multiple purpose facilities.

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

<u>WSB-Hawaii Assessment</u>. Overall, the proposed windfarm is consistent with and supports long-term state policy to conserve the state's natural resources and to improve the quality of life. The project will help reduce our dependence on imported energy use and increase our use of indigenous natural resources, including energy, e.g., our tradewinds. The project helps improve the quality of life on Maui by offsetting a portion of the fossil fuel used to generated electricity. This reduced fuel use (estimated at about 102,000 barrels of oil a year) will also avoid the air pollutants that result from the fossil fuel use. The project further helps to improve the quality of life by bringing outside investment, tax and use revenues and new jobs to Maui. Finally, the use of the wind at the project site is consistent with native Hawaiian understanding and use of the wind. The only concern regarding this criteria is the potential negative impacts on avifauna as discussed above.

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

<u>WSB-Hawaii Assessment</u>. The proposed windfarm will have positive economic and social welfare impacts on the community. The project will bring outside investment which will create both short-term and long-term jobs, and tax and use revenues. Perhaps the most significant economic benefit will be the avoidance of imported energy fuel costs, as the dollars that would normally go out of state to pay for fossil fuels would recirculate on Maui and in the State. The project implementation will not negatively impact the social welfare (including cultural resources) of the community.

(5) Substantially affects public health;

<u>WSB-Hawaii Assessment</u>. The project will not result in any negative public health impact. The project health impacts will be positive through the reduction of pollution from the utility power plants at Kahului and Maalaea.

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

WSB-Hawaii Assessment. The project is anticipated to have negligible impacts on population and public facilities. Most of the jobs created by the project will be filled by local residents. The project will be self-contained and will require no extension of public facilities, e.g., water or other utilities.

(7) Involves a substantial degradation of environmental quality;

WSB-Hawaii Assessment. The project will not result in a substantial degradation of environmental quality. Quite to the contrary, the project is anticipated to improve environmental quality in the project area and within the county. This will be accomplished taking care taken during the construction and operation to minimize damage to the land, including flora and fauna, and the implementation of native plant and Nene propagation programs. It is anticipated that these propagation programs will provide a positive benefit over the project lifetime.

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

WSB-Hawaii Assessment. The proposed 20 MW windfarm is not anticipated to have any cumulative affects. The proposed windfarm is optimum given the size of the Zond Z-48 wind turbines and available land in the project area. Therefore, the proposed windfarm would not involve a commitment to larger actions, e.g., as addition of more wind turbines at a later time.

(9) Substantially affects air or water quality or ambient noise levels;

WSB-Hawaii Assessment. The project will not substantially affect air or water quality or ambient noise levels. In actuality, the project will provide an overall positive impact on air quality, since the project itself does not result in air emissions and because the wind-generated electricity will offset use of fossil fuels and their resulting emissions on Maui. All water used during construction and operation will be trucked in. As noted in Section 3.6, measures are recommended which should mitigate the potential impacts on the hydrologic and water resources in the area. Regarding noise levels, the wind turbines will slightly increase the ambient noise levels within the project area. It is believed that the noise will serve to alert avifauna in the area. As discussed in Section 3.14, the turbines would not be heard at the nearest residences (over two miles away) to the project.

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

WSB-Hawaii Assessment. The project will not detrimentally affect air or water quality or ambient noise levels. As discussed above, the impacts on air quality are considered positive, the impacts on water quality and ambient noise levels are negligible.

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

WSB-Hawaii Assessment. The proposed project site in the Kaheawa Pastures is not located in an environmentally sensitive area of the type as described above. Therefore, the project will not affect or is likely to suffer the type of damage of concern by this criteria. The site, which has been used previously by cattle ranchers for grazing, is a grassland and shrubland area dominated by non-native flora.

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

WSB-Hawaii Assessment. The project is not anticipated to substantially affect scenic vistas and viewplanes identified in county or state plans or studies. One comment was received from DLNR (Na Ala Hele Trails and Access Program) regarding potential impacts from viewpoints along the Old Lahaina Pali Trail. Several of the turbines or parts of the turbines would be visible from a one mile long section of the trail. The community has not expressed the concern visual impact would be significant. In part, the remote location of the proposed windfarm mitigates concern, as most people would not see the wind turbines. The West Maui Community Plan and the County of Maui Plan do not identify specific scenic vistas or viewplanes in the area.

(13) Requires substantial energy consumption.

WSB-Hawaii Assessment. The project would generate and consume electrical energy. The amount of electrical energy consumed is negligible to the amount that would be generated and delivered to the utility.

4.3 County

The plans and policies guiding development in Maui County that relate to the proposed windfarm project are the Maui County General Plan and the West Maui Community Plan.

4.3.1 Maui County General Plan

"Maui County's current General Plan was adopted by Ordinance No. 1052 and became effective June 24, 1980. The Maui County Charter in Section 8-8.3 Powers, Duties and Functions states that the planning director among other things shall recommend revisions of the general plan at least every ten years to guide development of the county.

Section 8-8.5 of the Maui County Charter requires that the general plan shall recognize and state the major problems and opportunities concerning the needs and the development of the county and the social, economic and environmental effects of such development and shall set forth the desired sequence, patterns and characteristics of future development. The purpose of the General Plan update, which is required every 10 years, is to address changes in socio-economic conditions, physical environment and current and emerging planning issues through amendments to the objectives and policies set for in the General Plan." (County of Maui, 1990).

Included in the General Plan are several objectives which are related to this proposal. The following are the most relevant:

Section I.C of Population, Land Use, the Environment and Cultural Resources - Environment:

Objective 1: *To preserve and protect the county's unique and fragile environmental resources*

Policy 1.c: *Support programs to reduce air, land and water pollution.*

The proposed windfarm supports to the objective of reducing air pollution. The wind-generated electricity would offset fossil fuels used by MECO and would reduce the air emissions from MECO's power plants. See section 3.13 for more details.

Section I.D Population, Land Use, the Environment and Cultural Resources - Cultural Resources:

Objective 1: *To preserve for present and future generations the opportunity to know and experience the arts, culture and history of Maui County.*

Policy 1.b: *Encourage the recordation and preservation of all cultural and historic resources, to include culturally significant natural resources.*

No archaeological sites are known to be present in the area proposed for the windfarm. Sites previously found were along the Old Lahaina Pali Trail which is out of the study area. See section 3.9 for more details.

Section II.A of Economic Activity - General:

Objective 1: *To provide an economic climate which will encourage the controlled expansion and diversification of the County's economic base.*

Policy 1.b: *Support programs, services and institutions which provide economic diversification.*

The proposed windfarm project would stimulate new economic activity on Maui, including construction and the creation of new, permanent jobs in a new industry for Maui. The economy would benefit further through the offset of fossil fuel use by MECO. The dollars not paid by the citizens of Maui to import oil would recirculate on Maui stimulating additional economic activity. See section 3.10 for more details.

Objective 1, Policy (a) of Transportation - Energy:

Objective 1: *to make Maui County more self-sufficient in its need for more non-renewable energy and more efficient in its use of energy.*

Policy c: *encourage programs to test the feasibility of alternative sources of energy production.*

The proposed windfarm would provide wind-generated electricity as an alternative on Maui. The windfarm would reduce the amount of fossil fuel used by MECO to generate electricity. See section 3.10 for more details.

4.3.2 West Maui Community Plan

The Maui County General Plan lays out broad objectives and policies for the long-term development of the County. A total of nine (9) community plans are developed and reflect current and anticipated regional conditions on Maui. Each plan and advances planning goals, objectives, policies and implementation considerations to guide decision-making in the region over a twenty (20) year planning horizon. Each plan is updated every ten (10) years. The proposed windfarm lies in the West Maui Community. "The West Maui Community Plan plans specific recommendations to address goals, objectives and policies in the General Plan, while recognizing the values and unique attributes of the region, in order to enhance the region's overall living environment." (County of Maui, 1996).

The West Maui Community Plan was first adopted in 1980 and was then named the Lahaina Community Plan. The Lahaina Community Plan was updated in 1992-1993. As part of this update, the plan was renamed the *West Maui* Community Plan to reinforce the regional nature of the plan.

There are no planned or proposed projects in the West Maui Community Plan that would be affected by the proposed windfarm. Following consultations with DLNR and other Parties, there are no other known proposed projects or uses of the land in the study area at the present time.

Included in Parts II and III the West Maui Community Plan are several opportunities, issues and objectives, which are related to this proposal. The following are the most relevant:

- **Part II, Description of the Region and its Problems and Opportunities**

Opportunity 2 (Stability of the Economic Base) in Section B (Identification of Major Problems and Opportunities):

...It is therefore important to maintain a stable economic base by encouraging the upgrading of existing visitor facilities; pursuing diversified economic opportunities; insuring responsible and sustainable growth to provide a range of ***job opportunities*** *so that the young people can remain in or return to the community; encouraging* ***alternate energy production*** *(i.e., solar,* ***wind*** *and biomass); identifying potential uses of federal, state and county lands to benefit the community; and in general, creating opportunities for more* ***self-sufficiency****.*

The proposed windfarm project is fully consistent and synergistic with the goals stated above.

Issue 3 in Section C (Interregional Issues):

The responsible use of county's natural resources is listed as one of the issues which suggest interregional, county-wide or island-wide analysis.

WSB-Hawaii believes that the proposed windfarm is a responsible use of the county's wind resource. The windfarm is an environmentally-responsible energy solution for the county. The solution provides an array of energy, environmental and economic benefits.

Part III, Policy Recommendations, Implementing Actions and Standards for the West Maui Region, Section A (Intended Effects of the West Maui Community Plan):

Objective 3, Energy Subsection of **Infrastructure**:

Promote the environmentally sensitive use of renewable energy resources, such as biomass, wind and solar.

WSB-Hawaii believes that the proposed windfarm is an environmentally-responsible energy solution for the county. This objective is consistent with those stated above.

4.4 Permits and Approvals

Federal, State and County permits and approvals are required for the proposed windfarm. The permits and approvals are summarized in Table 4.4-1.

Federal Approvals. There are no known Federal permits that directly relate to or influence the proposed action. There are three potential Federal approvals which could result in Federal involvement on or actions related to the project: one with Federal Aviation Administration (FAA), one with the Department of Interior (DOI), and one with Army Corps of Engineers.

ZPAC has filed a "Notice of Proposed Construction or Alteration" with the FAA. The FAA has subsequently determined that the proposed project would not be an obstruction to air navigation under Part 77 of Federal Aviation Regulations. Since the height of the turbines including the blades would exceed 60m (200ft), lighting is required to alert pilots. For this project, the FAA has approved lighting with a steady burning red obstruction light on the top of every other turbine nacelle.

The DOI, Fish and Wildlife Service, administers the Federal Endangered Species Act of 1973. DOI normally becomes involved in projects where Federal lands and or funds are to be used. This is not the case for this project. DOI could also become involved if it, or another federal agency, took an action that could materially affect the project. In the case of this project, there is a potential trigger associated with the FAA's review of the "Notice of Proposed Construction or Alteration" filed by ZPAC. If the FAA determined that their action could impact an endangered specie, they would initiate a Section 7 consultation pursuant to the Endangered Species Act. However, the FAA did not make this determination (See Section 3.8).

ZPAC has proposed to improve and utilize a spur road that extends from near Puu Anu to the upper area of the project site. This spur crosses the upper portion of the Manawanui Gulch. Subject to further review of the proposed use of the upper spur for site access, the Army Corps of Engineers could become involved, if they determine that this upper portion of Manawainui Gulch falls under their jurisdiction. See also Sections 3.6 and 4.1.

<u>State Approvals and Permits</u>. All uses of Conservation lands require a Conservation District Use Permit (CDUP). must submit a Conservation District Use Application (CDUA) to DLNR. Project approval would be granted via a Use of State Lands Approval (USLA) from the Land Management Division and a *Board Permit* from the Board of Land and Natural Resources (BLNR). Note: the *Board Permit* is the CDUP for this project.

Submittal of a CDUA triggers Chapter 343 HRS environmental reporting requirements which mandate either an environmental assessment (EA) or an environmental impact statement (EIS). This FEA was prepared in accordance with Chapter 343 requirements and in support of the CDUA. DLNR's approval of the USLA and granting of the CDUP is contingent upon their acceptance of this FEA.

As noted previously, ZPAC prepared an EA as part of ZPAC's application for approval of its wind monitoring program, a preliminary assessment was made by the State Historic Preservation Division (SHPD). At that time, no record was found of historic sites on the parcel (Evans, 1995). SHPD has subsequently completed a Historic Preservation Review of the project CDUA and DEA. The DEA included the archaeological survey conducted for ZPAC by the International Archaeological Research Institute, Inc. (IARII).

Per SHPD letter, dated August 25, 1998 (copy enclosed in Section 6), SHPD has found "the proposed windfarm to have 'no effect' on historic sites." SPHD also expressed concerns regarding possible historic sites *along the proposed upper spur road.* Note: *IARII* has conducted a follow-up survey along this proposed route. No sites were found (see Section 3.5 for details).

Prior to the start of site construction, ZPAC would need to apply to the SOH Department of Transportation for a permit to perform work on a State highway. This will be needed since access to the site is directly from the Honoapiilani Highway.

<u>County Permits</u>. Only construction permits would be required.

<u>Other Approvals or Permits</u>. Should the upper portion of the Manawainui Gulch be determined be a stream per DLNR Water Resources Division rules, ZPAC would need to prepare and receive approval for a Stream Channel Alteration Permit (SCAP).

Table 4.4-1*
Permits and Approvals

Accepting Authority: (Agency/Organization)	Approval/Permit/Action	Estimated Application Date	Processing Time	Public Hearing
USDOT FAA	Review and Approval of Notice of Construction or Alteration	December 14, 1998 (Actual)	Jan. 7, 1999 (Actual)	Not required
DLNR Land Management Division	Draft EA Final EA Draft EIS (if required) Final EIS (if required)	Apr. 30, 1998 (Actual) Jan. 27, 1999 Mar. 1, 1999 Sep. 1, 1999	Nov. 9, 1998 (Actual) 1 to 2 months 3 months	Jan. 13, 1999 (Actual)
DLNR Board of Land & Natural Resources	Conservation District Use Permit (*Board Permit*)	Apr. 30, 1998 (Actual)	15 to 18 months	Jan. 13, 1999 (Actual)
DLNR Land Management Division	Use of State Lands Approval (includes land use fee)	Apr. 30, 1998 (Actual)	15 to 18 months	If required by BLNR
DLNR Historic Preservation Division	Historic Sites Review	Apr. 30, 1998 (Actual)	Aug. 25, 1998 (Actual)	Not Required
DOT, Highways Division (*may not be needed*)	Permit to Perform Work on a State Highway	Apr. 1, 1999	3 months	Not Required
Maui County Planning Department	Site Construction Permit	May 1, 1999	3 months	If Required

*This Table is identical to Table 1.4-1

5. Topical Issues

5.1 Relationship Between the Proposed Windfarm Use and Maintenance of Long Term Productivity of the Study Area

WSB-Hawaii has identified potential short-term and long-term impacts associated with the proposed 20 MW windfarm project. This section includes a discussion of how these potential impacts, both negative and positive, affect the long term productivity of the study area.

Potential Negative Impacts

Most of the potential negative impacts would be short-term, construction-related and localized. Some are long-term, operation-related, both localized and regional. WSB-Hawaii does not believe there would be significant impact to the long-term productivity of the site's resources. WSB-Hawaii believes all negative impacts can be mitigated to a non-significant level or lower. Note: only the potential impacts on avifauna was evaluated as significant. ZPAC's goal is to reduce all negative impacts to negligible.

Short-Term. Impacts to the site's soil and vegetation would be short-term and associated with soil disturbances and potential erosion. For example, vegetation removed during excavation for the intrasite electrical distribution network would be replaced. Impacts to air quality would be short-term and associated with localized fugitive dust emissions from construction vehicles.

There could be short-term impacts on flora and fauna in the study area. A botanical survey did identify native plants in the area, but none that are endangered. Steps would be taken to avoid the native plants when the windfarm is constructed. A bird survey was performed to determine if any birds were being downed by on-site meteorological towers and to identify the birds in the area. No downed birds were found on-site and on endangered species were identified. However, Nene are known to be nearby and ZPAC plans additional surveys.

There are no known archaeological sites in the study area. This is based on a review of previous archaeological surveys conducted in support of the MECO EIS and a survey commissioned by ZPAC on the proposed windfarm site. Field inspections in March 1998 included the proposed windfarm site and in November 1998 the proposed upper access spur from Puu Anu to the site via the Manawainui Gulch. No additional surveys are needed unless the route of the upper access spur is altered from its present course.

Long-Term. There could be some minor permanent loss of vegetation due to the construction of the new access road, the intrasite road network, the foundations for the wind turbines, the site substation, and the site operation and maintenance facility. While the windfarm would be spread out over a narrow band of approximately 200 acres of the Kaheawa Pastures, the actual *footprint* (area covered by turbines, the site substation and interconnect hardware and operation and maintenance facility and intrasite road network) is estimated at 8.7 acres.

There could be long-term impacts on the birds and other wildlife that inhabit the study area or visit the area. WSB-Hawaii believes these impacts can be mitigated to an acceptable level. This is an area for further study (see *Unresolved Issues* below). There is the potential for some impact on the visual resources in the study area, but WSB-Hawaii believes this impact will not be significant. The primary concern has been for the potential impact on viewpoints along the Old Lahaina Pali Trail.

Potential Positive Impacts

WSB-Hawaii believes there are several potential positive energy, environmental and economic impacts. The wind-generated electricity would be a direct benefit to the people of Maui. As an alternative to the conventional oil-fired resources, the windfarm would help diversify the utility's resource base and support the State's goals of reducing dependence on imported energy use and increasing the use of indigenous sources (see Sections 1.3.2 and 4.2). The avoidance of fossil-fuel emissions would help protect the environment (see Sections 2.5 and 3.10). The project would create direct revenues for the State and jobs for the County, and provide multiplier effects that would help diversify the County's economy (See Section 3.10). Overall, the windfarm is a positive use of the Conservation District Use Lands that not only provides all of these benefits, but *does not interfere with the primarily conservation use of the land* and *does not preclude other uses*, such as livestock grazing and transmission line access.

5.2 Irreversible and Irretrievable Commitment of Resources

As noted in Sections 1.24 and 4.2.8, an irreversible commitment of a resource is one that cannot be changed once it occurs. An irretrievable commitment occurs when the resource cannot be recovered or reused. WSB-Hawaii believes the proposed 20 MW windfarm *would not result* in any irreversible commitment of resources. There would be some irretrievable *commitment of certain resources.*

The use of the land for the windfarm would not result in an irreversible commitment of resources. For example, the windfarm could be decommissioned, all equipment and structures could be removed and the land could be restored to its original condition.

The primary irretrievable resources that could be lost are associated with flora and fauna. With respect to flora, individual flora could be dislocated or damaged. With mitigation measures as proposed, the flora would be temporarily removed and replaced during construction. Individual avifauna could be harmed through collisions with the wind turbines or their towers. This is an area for further study (see below).

Other irretrievable resources that would be lost include the labor, materials and capital needed to plan, design, permit, construct and operate the windfarm. Also included, are the concrete, steel, fiberglass and other materials and labor used to: fabricate, construct and install the wind turbines, their towers and their foundations; the site substation and its foundation; the site electrical distribution network; the site operation maintenance facility and its foundation; the intrasite road network and the access road. This also includes the fuel and capital required to deliver all of the equipment and materials to the site and the additional fuel and other supplies consumed during the site construction and operational phases.

5.3 Probable Adverse Effects That Cannot Be Avoided

WSB-Hawaii believes there are potential adverse effects of the proposed windfarm project on specific avifauna, including the Nene, the Dark-rumped Petrel, the Hawaiian Hoary Bat, and the Pueo. While all of these species are residents of Maui, only the Pueo has been observed on the proposed project site. WSB-Hawaii believes that the potential adverse effects can be mitigated via the actions that have been discussed herein. While the specific mitigative measures are not all known at the present time, WSB-Hawaii believes that they can be developed after the additional surveys and studies as proposed by ZPAC.

5.4 Unresolved Issues

Overall, WSB-Hawaii has evaluated most of the potential impacts to be *non-significant* or less. The only exception is the potential for the impact on avifauna to be *significant.* With implementation of mitigative measures, WSB-Hawaii believes the avifauna impacts can be reduced to the *non-significant* or less and the *non-significant* negative impacts can be reduced to *negligible* or *none.* As discussed previously, this is consistent with ZPAC's goal to reduce the severity of the environmental impacts, (i.e., to reduce *non significant* to *negligible* or *none*, etc.) through implementation of a mitigation measures program. The following are the key potential impacts that require additional attention:

- Potential Impact on Avifauna Species and their Habitat (Preliminary rating: *significant*). A preliminary bird survey identified a number of natives species present on the site, but not listed as endangered. However, the endangered Hawaiian Nene have been observed nearby. Other species of concern include the Pueo (identified in the area) and other residents of Maui, including the Hawaiian Dark-rumped Petrel, Wedge-tailed Shearwater and the Hawaiian Hoary Bat. ZPAC is continuing to monitor for downed birds near the meteorological towers. Prior to construction, ZPAC proposes to plan, coordinate and conduct additional surveys to identify and characterize the habits of the species of concern in the project area. Subsequently, the mitigation measures program would be updated. The program would include additional monitoring during the initial operation of the windfarm and contributions to the Nene propagation program. Therefore, contingent upon further study and implementation of the mitigation measures, WSB-Hawaii believes that the severity of the impacts can be downgraded to *non-significant.* See Section 3.8 for the detailed discussion of this potential impact;

- Potential Impact on Terrestrial Flora (Preliminary rating: *non significant*). While no endangered plant species have been found to date, a number of native plants were discovered during the initial botanical surveys on the site and along the upper spur route. Additional surveys would be conducted to ensure that no native plants would be impacted during the improvements to the access road network and construction of the windfarm. Contingent upon implementation of the mitigation measures, WSB-Hawaii believes that the severity of the impacts can be downgraded to "negligible." See Section 3.7 for the detailed discussion of this potential impact;

- Potential Impact on Cultural Resources (Preliminary rating: *negligible*). There are no known archaeological sites in the study area. A recent archaeological survey did not uncover any sites on the proposed windfarm and along the proposed upper access spur route. An additional survey is planned if it should be necessary to alter the route of the upper access spur. See Section 3.9 for the detailed discussion of this potential impact; and

- Visual Resources (Preliminary rating: *non-significant*). The community has not expressed concern that the visual impact of the windfarm would be significant. Due to the remote location of the windfarm, most residents will not see the wind turbines a daily basis. The people most likely to see any of the wind turbines will be hikers while on a portion of the Old Lahaina Pali trail and passenger on north-bound incoming aircraft to Kahului Airport. See Section 3.16 for the detailed discussion of this potential impact.

CORRECTION

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

5.4 Unresolved Issues

Overall, WSB-Hawaii has evaluated most of the potential impacts to be *non-significant* or less. The only exception is the potential for the impact on avifauna to be *significant*. With implementation of mitigative measures, WSB-Hawaii believes the avifauna impacts can be reduced to the *non-significant* or less and the *non-significant* negative impacts can be reduced to *negligible* or *none*. As discussed previously, this is consistent with ZPAC's goal to reduce the severity of the environmental impacts, (i.e., to reduce *non significant* to *negligible* or *none*, etc.) through implementation of a mitigation measures program. The following are the key potential impacts that require additional attention:

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- Potential Impact on Terrestrial Flora (Preliminary rating: *non significant*). While no endangered plant species have been found to date, a number of native plants were discovered during the initial botanical surveys on the site and along the upper spur route. Additional surveys would be conducted to ensure that no native plants would be impacted during the improvements to the access road network and construction of the windfarm. Contingent upon implementation of the mitigation measures, WSB-Hawaii believes that the severity of the impacts can be downgraded to "negligible." See Section 3.7 for the detailed discussion of this potential impact;

- Potential Impact on Cultural Resources (Preliminary rating: *negligible*). There are no known archaeological sites in the study area. A recent archaeological survey did not uncover any sites on the proposed windfarm and along the proposed upper access spur route. An additional survey is planned if it should be necessary to alter the route of the upper access spur. See Section 3.9 for the detailed discussion of this potential impact; and

- Visual Resources (Preliminary rating: *non-significant*). The community has not expressed concern that the visual impact of the windfarm would be significant. Due to the remote location of the windfarm, most residents will not see the wind turbines a daily basis. The people most likely to see any of the wind turbines will be hikers while on a portion of the Old Lahaina Pali trail and passenger on north-bound incoming aircraft to Kahului Airport. See Section 3.16 for the detailed discussion of this potential impact.

6. Consulted Organizations, Individuals and Comments

6.1 Organizations Contacted

ZPAC has contacted the following organizations and individuals in the process of preparing this EA.

Federal

U.S. Department of Agriculture
Natural Resources Conservation Service
P. O. Box 50004
Honolulu HI 96850
Ken Kaneshiro

U.S. Army Corps of Engineers
Pacific Ocean Division, Building 230
Ft. Shafter, HI 96858
Bill Lennon, George Young

U.S. Department of Commerce
National Marine Fisheries Service
2570 Dole Street
Honolulu HI 96822
John Naughton

U.S. Department of the Interior
Fish and Wildlife Services
P. O. Box 50156
Honolulu HI 96850
Laurena Wada, Marlette Zablan

U.S. Department of the Interior
National Park Service
300 Ala Moana Boulevard
Box 50165
Honolulu HI 96850
Gary Barbano

U.S. Department of Transportation
Federal Aviation Administration
P. O. Box 50109
Honolulu HI 96825
Darice Young

State

Dept. of Accounting and General Services
1151 Punchbowl Street
Honolulu HI 96813
Alan Sanborn

Dept. of Business, Economic Dev. & Tourism
Office of Planning
P. O. Box 2359
Honolulu HI 96804-2359
Richard Egged, John Nagawa

State Energy Office
Dept. of Business, Economic Dev. & Tourism
P. O. Box 2359
Honolulu HI 96804-2359
Maurice Kaya, Steve Alber

Division of Consumer Advocacy
Dept. of Commerce and Consumer Advocacy
P. O. Box 541
Honolulu HI 96809
Chuck Totto

Dept. of Defense
Hawaii National Guard
3949 Diamond Head Road
Honolulu HI 968176-4495
Jane Yamamoto

Dept. of Health
Environmental Management Division
919 Ala Moana Boulevard
Honolulu HI 96813
Art Bauckham, Kathy Hendricks

State
(Continued)

Forestry and Wildlife Division
Dept. of Land and Natural Resources
1151 Punchbowl Street
Honolulu HI 96813
Michael Buck, Wayne Ching, Carol Terry

Forestry and Wildlife Div., Maui District Office
Dept. of Land and Natural Resources
1151 Punchbowl Street
Honolulu HI 96813
Wesley Wong, Meyer Ueoka, John Mederios, Fern Duval, John Cummings

Land Division
Dept. of Land and Natural Resources
1151 Punchbowl Street
Honolulu HI 96813
Dean Uchida, Lauren Tanaka

Land Division, Maui District Office
Dept. of Land and Natural Resources
54 South High Street
Wailuku HI 96793
Philip Ohta

Na Ala Hele Trail System
Forestry and Wildlife Division
Dept. of Land and Natural Resources
1151 Punchbowl Street
Honolulu HI 96813
Kirk Cottrell, Erin Low

Na Ala Hele Trail System
Forestry and Wildlife Div., Maui District Office
Dept. of Land and Natural Resources
1151 Punchbowl Street
Honolulu HI 96813
Mike Baker, Mark Peyton

State Historic Preservation Division
Dept. of Land and Natural Resources
33 S. King St, 6th Floor
Honolulu HI 96813
Sara Collins

State Park Division
Dept. of Land and Natural Resources
1151 Punchbowl Street
Honolulu HI 96813
Ralson Nagata, Dan Quinn

Office of Hawaiian Affairs
Land & Natural Resources Division
711 Kapiolani Boulevard, Suite 500
Honolulu HI 96813
Richard Stook, Lynn Lee

Dept. of Transportation
869 Punchbowl Street
Honolulu HI 96813
Elton Tashima

Dept. of Hawaiian Home Lands
Land Management Division
335 Merchant Street
Honolulu HI 96813
Joe Chu

Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu HI 96813
Gary Gill

State Legislature, State Capitol
Honolulu HI 96813
Reps. Joe Souki, Chris Halford, Terry Nui Yoshinaga; Sen. Brian Taniguchi

County of Maui

Office of Economic Development
County of Maui
200 South High Street
Wailuku HI 96793
Robbie Ann Guard

Office of the Managing Director
County of Maui
200 South High Street
Wailuku HI 96793
Kalvin Kobayashi

Department of Public Works & Waste Mgt.
County of Maui
200 South High Street
Wailuku HI 96793
Charles Jencks

Other

American Lung Association
245 North Kukui Street
Honolulu HI 96817
Allison Beale,Peter Flaschbart,Collen Welty

Hawaii Audubon Society
211 Ulana Street
Makawao HI 96768
Linda Paul,Renate Gassman-Duval

Conservation Council of Hawaii
44-211 Mikiola Drive
Kaneohe HI 96744
Bill Sager

Environmental Legislative Network
1030 Aoloa Place #102-B
Kailua HI 96734-5262
Susan Miller

Hawaii Blue Ocean Preservation Society
4234 Hana Highway
Haiku HI 96708
Carl Freedman

Hawaii Electric Company
P. O. Box 2750
Honolulu HI 96840
Tom Joaquin/Art Seki/Dan Ching

Kihei Community Association
P. O. Box 662
Kihei HI 96753
George Fontaine/Susan Bradford

Na Kupuna O Maui
Makawao, HI
Edwin Lindsey, Renee Silva

Life of the Land
1111 Bishop Street Suite 503
Honolulu HI 96813
Henry Curtis

Maalaea Community Association
250 Hauoli Street, #301
Wailuku Hi 96793
Jack Mueller

Maui Clean Air Coalition
P. O. Box 1870
Kihei HI 96753
Susan Douglas

Maui Electric Company, Ltd.
P. O. Box 398
Kahului, Maui HI 96732
Tom Jezierny, Bill Bonnet, Ed Reinhardt

Maui Tomorrow
P. O. Box 429
Makawao, Hawaii 96768
Scott Crawford, Dick Mayer, Mark Sheehan

National Wildlife Federation
94-610 Palai Street
Waipahu HI 96797-4535
Steve Montgomery

Safe Power Action Network
1314 South King Street #306
Honolulu HI 96814
Christen Mitchell

Sierra Club, Maui Chapter
SR 1 Box 47
Haiku HI 96708
Lucienne De Naie

Sierra Club, Oahu Chapter
P. O. Box 21577
Honolulu HI 96803
David Frankel

Hawaii State Coordinator
Union of Concerned Scientists
47-682-7 Hui Kelu Street
Kaneohe HI 96744
Michael Jones

Wailea Community Association
3750 Wailea Alanui STE I-33
Kihei HI 96753
Al Teter

6.2 Consultation Summary

ZPAC has contacted a number of organizations and individuals in the process of preparing both draft and final EAs. The consultations are summarized in Table 6.2-1.

6.3 Meetings

The following is a brief summary of two key meetings that ZPAC held to discuss issues relative to the preparation of this FEA.

ZPAC/DLNR Staff (December 18, 1998). The meeting included ZPAC (Keith Avery), WSB-Hawaii (Warren Bollmeier), Eric Nishibayashi Consulting (Eric Nishibayashi), DOFAW (Meyer Ueoka, Carol Terry, Art Medeiros, Fern Duval and John Cummings), and the Na Ala Hele Trails and Access Program (Mike Baker).

Prior to the meeting, a number of concerns had been raised regarding the potential for birds to collide with the wind turbines. To a lesser degree, there was also concern regarding the potential negative impact of the project on bird habitat. The primary concern is for the Nene, and to a lesser degree, other species of concern, including the Dark-rumped Petrel, Wedge-tailed Shearwater, Pueo and Golden Pacific Plover. While much is known about the Nene, it is not known whether they will see and avoid turbines. Therefore, it appears prudent to assume that the Nene may collide with the turbines and to focus on the development of definition of acceptable mitigation measures. It was agreed that further study is needed to determine extent to which the Nene and the other species of concern frequent and use the project area. While an number of potential mitigation measures, it was agreed that more study and consultation with key experts is needed in order to define viable mitigation measures.

There was also discussion regarding the potential impact of the windfarm on the Old Lahaina Pali Trail. Mike Baker reviewed the goals and objectives of the program, and reiterated his concerns that the presence of the wind turbines would create an attractive nuisance and negatively impact the viewplanes at various points along the trail. Mike indicated that about 50 people hike the trail per month. Keith pointed out that he was abandoning earlier plans to build a new access road west of the Manawainui Gulch, in part due to concerns about encouraging additional illegal trespass, but also that a reconnaissance had shown the road was not feasible to construct. After some discussion, it was agreed that the turbines may encourage some hikers to stray from the trail. Keith noted that illegal trespass and vandalism have not been a problem at Zond's windfarms on the mainland. In addition, the towers are designed and constructed to be climbable *only* by maintenance personnel who have special equipment. Keith agreed that six to as many as seven or eight turbines or parts of turbines may be visible from the trail for approximately one mile of the trail starting from where the trails leaves the access road (heading towards Lahaina).

DLNR Public Hearing (January 13, 1999). DLNR held a Public Hearing on ZPAC's CDUA for the proposed windfarm on January 13, 1999 at the Kihei Elementary School in Kihei on Maui. There were 30 attendees. ZPAC provided an overview of the project including a videotape presentation of the manufacturing and operation of the Zond wind turbines. There were 12 individuals that provided testimony on the application. These included Bill Bonnet from MECO and Mr. David Chenoweth. Both reiterated comments that they made to ZPAC on the draft EA. The remaining testifiers represented a spectrum of the community, including Na Kupuna O Maui, Maui Tomorrow, the Maui Emergency Preparedness Coalition and the Sierra Club. Overall, the testifiers supported the project application. No new issues were raised.

Table 6.2-1
Consultation Summary
20 MW Kaheawa Pastures Windfarm

Date	Organization	Person (s) Contacted	Type	Topics Discussed
6-10-97	Land Division - DLNR	Lauren Tanaka	M	Status of wind resource measurements and proposed 20 MW windfarm
6-10-97	Office of Environmental Quality Control	Gary Gill	M	ZPAC/Proposed 20 MW Windfarm Project
6-27-97	Land Division - DLNR	Lauren Tanaka	L	ZPAC/follow-up to 6-10-97 meeting
7-01-97	Natural Resources Cons. Service	Ken Kaneshiro	P	ZPAC/Proposed 20 MW Windfarm Project
7-01-97	U.S. Army Corps of Engineers	Bill Lennon	P	ZPAC/Proposed 20 MW Windfarm Project
7-01-97	U.S. Dept. of Commerce	John Naughton	P	ZPAC/Proposed 20 MW Windfarm Project
7-01-97	U.S. Dept. of Interior, National Park Svc.	Gary Barbano	P	ZPAC/Proposed 20 MW Windfarm Project
7-01-97	U.S. Dept. of Transportation - FAA	Darice Young	P	ZPAC/Proposed 20 MW Windfarm Project
7-01-97	Dept. of Accounting & General Services	Alan Sanborn	P	ZPAC/Proposed 20 MW Windfarm Project
7-01-97	Office of Planning - DBEDT	John Nagawa	P	ZPAC/Proposed 20 MW Windfarm Project
7-01-97	State Energy Office - DBEDT	Maurice Kaya	P	Status: Proposed 20 MW Windfarm Project
7-01-97	Office of Planning - DBEDT	John Nagawa	P	ZPAC/Proposed 20 MW Windfarm Project
7-08-97	State Historic Preservation Div - DLNR	Sara Collins	P	ZPAC/Proposed 20 MW Windfarm Project
7-08-97	Environmental Heath Division - DOH	Art Bauckham	P	ZPAC/Proposed 20 MW Windfarm Project
7-08-97	Dept. of Transportation	Elton Tashima	P	ZPAC/Proposed 20 MW Windfarm Project
7-08-97	Dept. of Hawaii Homelands	Joe Chu	P	ZPAC/Proposed 20 MW Windfarm Project
7-08-97	Dept. of Transportation	Elton Tashima	P	ZPAC/Proposed 20 MW Windfarm Project
7-09-97	Land Division - DLNR	Dean Uchida	L	Response to ZPAC 6-27-97 letter,
8-19-97	UH-Anthropology Dept.	Bion Griffin	P	Info on the Ukumehame ahupua'a
9-06-97	Private Citizen -- Resident of Maui	John Lake	P	Info on the Ukumehame ahupua'a
10-29-97	Maui Tomorrow	Scott Crawford	P	ZPAC/Proposed 20 MW Windfarm Project
11-07-97	Private Citizen -- Resident of Maui	Edwin Lindsey	P	ZPAC/Proposed 20 MW Windfarm Project
11-14-97	Visit -- to view site and discuss issues	Edwin Lindsey	F	Discuss impacts on the ahupua'a
1-07-98	Hawaii Blue Ocean Preservation Society	Carl Freedman	P	ZPAC/Proposed 20 MW Windfarm Project
1-08-98	Hawaii National Guard - DOD	Jane Yamamoto	P	ZPAC/Proposed 20 MW Windfarm Project
1-14-98	Forestry & Wildlife - DLNR Maui District Office (Na Ala Hele)	Mark Peyton	P	ZPAC/Proposed 20 MW Windfarm Project

Legend: D = Document, F = Field Visit, L = Letter, M = Meeting, P = Phone Call

Table 6.2-1
Consultation Summary
(Continued)

Date	Organization	Person (s) Contacted	Type	Topics Discussed
1-14-98	Forestry & Wildlife - DLNR Oahu Office (Na Ala Hele)	Kirk Cottrell, Erin Low	P	ZPAC/Proposed 20 MW Windfarm Project
1-14-98	Economic Development Office – COM	Robbie Ann Guard	P	ZPAC/Proposed 20 MW Windfarm Project
1-14-98	Maui Clean Air Coalition	Susan Douglas	P	ZPAC/Proposed 20 MW Windfarm Project
1-21-98	MECO	Bill Bonnet	M	Project Status
1-21-98	State Representative – Maui	Joe Souki	M	ZPAC/ Proposed 20 MW Windfarm Project
1-21-88	DLNR – Forestry & Wildlife Div	Mike Buck	M	Project Status
1-22-98	Wailea Community Association	Al Teter	L	ZPAC/Proposed 20 MW Windfarm Project
1-28-98	Kihei Community Association	Brian Miskae	L	ZPAC/Proposed 20 MW Windfarm Project
1-28-98	Maalaea Community Association	Jack Mueller	L	ZPAC/Proposed 20 MW Windfarm Project
1-31-98	Maui Community College	Don Ainsworth	L	ZPAC/Proposed 20 MW Windfarm Project
2-02-98	National Audubon Society	Linda Paul	M	ZPAC/Proposed 20 MW Windfarm Project
2-02-98	Nature Conservancy	Maile Bay	M	ZPAC/Proposed 20 MW Windfarm Project
2-02-98	UH Environmental Center	John Harrison	M	ZPAC/Proposed 20 MW Windfarm Project
2-08-98	Bishop Museum	Robert Pyle	P	ZPAC/Proposed 20 MW Windfarm Project
2-11-98	Audubon Society – Maui Rep	Renate Gassman-Duval	P	ZPAC/Proposed 20 MW Windfarm Project
2-12-98	Forestry	Fern Duval	P	ZPAC/Proposed 20 MW Windfarm Project
2-27-98	Office of Environmental Quality Control	Gary Gill	P	ZPAC/Proposed 20 MW Windfarm Project
3-01-98	National Renewable Energy Laboratory	Laura Vimmerstedt	P	ZPAC Proposal/Power Plant Emissions
3-05-98	County of Maui – Office of Planning	David Blane	M	ZPAC/Proposed 20 MW Windfarm Project
3-09-98	Outdoor Circle – Maui Chapter	David Sakoda	P	ZPAC/Proposed 20 MW Windfarm Project
3-11-98	SOH - House of Representatives	Rep. Paul Oshiro	P	ZPAC/Proposed 20 MW Windfarm Project
3-20-98	MECO	Ed Reinhardt	P	ZPAC Proposal/Project Status
3-20-98	Na Kapuna O Maui	Edwin Lindsey	F	ZPAC Proposal/Land Use Issues
9-03-98	Maui County Council	Econ. Dev. /Env. Com.	M	ZPAC/Proposed 20 MW Windfarm Project
9-29-98	Maui Tomorrow	Mark Sheehan	M	ZPAC/Proposed 20 MW Windfarm Project
10-25-98	Private Citizen	David Chenoweth	P	ZPAC Proposal/Comments on EA
10-26-98	SOH Senate	Brian Taniguchi	M	ZPAC/Proposed 20 MW Windfarm Project

Legend: D = Document, F = Field Visit, L = Letter, M = Meeting, P = Phone Call

Table 6.2-1
Consultation Summary
(Continued)

Date	Organization	Person (s) Contacted	Type	Topics Discussed
10-28-98	DLNR – Division of Forestry & Wildlife	Wes Wong	M	ZPAC/Proposed 20 MW Windfarm Project
10-28-98	SOH House of Representatives	Terry Nui Yoshinaga	M	ZPAC/Proposed 20 MW Windfarm Project
10-29-98	Na Kapuna O Maui	Edwin Lindsey	F	ZPAC Proposal/Site Access Issues
11-05-98	Wildlife Zoologist	Theresa Cabrera	P	ZPAC Proposal/Avifauna Issues
11-09-98	Avian/Bat Consultant	Reggie David	P	ZPAC Proposal/Avifauna Issues
11-09-98	DBEDT/Office of Planing	Charles Carole	P	ZPAC Proposal/CZM Issues
11-12-98	SOH House of Representatives	Paul Oshiro	M	ZPAC/Proposed 20 MW Windfarm Project
11-21-98	Na Kapuna O Maui	Edwin Lindsey	F	ZPAC Proposal/Site Access Issues
12-03-98	Maui County	Cult. Res. Commission	M	ZPAC/Proposed 20 MW Windfarm Project
12-18-98	DLNR/DOFAW (Maui)	DOFAW Staff	M	ZPAC Proposal/Comments on EA
12-21-98	National Renewable Energy Laboratory	Karin Sinclair	P	ZPAC Proposal/Avifauna Issues
12-30-98	USDOI/Fish & Wildlife Serrive	DOI Staff	M	ZPAC Proposal/Discuss End. Species Act
01-13-98	DLNR – Public Hearing	Community	M	ZPAC/Proposed 20 MW Windfarm Project

Legend: D = Document, F = Field Visit, L = Letter, M = Meeting, P = Phone Call

CORRECTION

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

Table 6.2-1
Consultation Summary
(Continued)

Date	Organization	Person (s) Contacted	Type	Topics Discussed
10-28-98	DLNR – Division of Forestry & Wildlife	Wes Wong	M	ZPAC/Proposed 20 MW Windfarm Project
10-28-98	SOH House of Representatives	Terry Nui Yoshinaga	M	ZPAC/Proposed 20 MW Windfarm Project
10-29-98	Na Kapuna O Maui	Edwin Lindsey	F	ZPAC Proposal/Site Access Issues
11-05-98	Wildlife Zoologist	Theresa Cabrera	P	ZPAC Proposal/Avifauna Issues
11-09-98	Avian/Bat Consultant	Reggie David	P	ZPAC Proposal/Avifauna Issues
11-09-98	DBEDT/Office of Planing	Charles Carole	P	ZPAC Proposal/CZM Issues
11-12-98	SOH House of Representatives	Paul Oshiro	M	ZPAC/Proposed 20 MW Windfarm Project
11-21-98	Na Kapuna O Maui	Edwin Lindsey	F	ZPAC Proposal/Site Access Issues
12-03-98	Maui County	Cult. Res. Commission	M	ZPAC/Proposed 20 MW Windfarm Project
12-18-98	DLNR/DOFAW (Maui)	DOFAW Staff	M	ZPAC Proposal/Comments on EA
12-21-98	National Renewable Energy Laboratory	Karin Sinclair	P	ZPAC Proposal/Avifauna Issues
12-30-98	USDOI/Fish & Wildlife Serrive	DOI Staff	M	ZPAC Proposal/Discuss End. Species Act
01-13-98	DLNR – Public Hearing	Community	M	ZPAC/Proposed 20 MW Windfarm Project

Legend: D = Document, F = Field Visit, L = Letter, M = Meeting, P = Phone Call

6.4 Comments on the Draft EA

A list of the Commentors on the Draft EA is included in Table 6.4-1. The actual letters received and ZPAC's responses to the Commentors follow the table. Note that the individual letters are in numerical order (annotated in the upper right corner of the first page of each letter, i.e., Exhibit 1, Exhibit 2, etc.). The response letters follow the Commentor letters in order and are similarly annotated (i.e., Exhibit 1A, Exhibit 2A, etc.). Note that these comments have been incorporated in this FEA as appropriate.

Table 6.4-1
List of Commentors on the Draft EA
Table

Exhibit	Organization	Date	Contact
1	DLNR-CRE	7-31-98	Patricia Edwards
2	DLNR-WRM	8-3-98	Timothy Johns/David Higa
3	DLNR-ENG	8-3-98	Andrew Monden
4	DLNR-DAR	8-10-98	W. Devick
5	DLNR-Land State Parks	8-12-98	Ralston Nagata
6	DLNR-DOFAW	8-12-98	Mike Buck/Wes Wong
7	DLNR - SHPD	8-25-98	Don Hibbard Sara Collins
8	DBEDT-Office Planning	9-29-98	Brad Mossman
9	Office of Hawaiian Affairs	10-5-98	Randall Ogata/Colin Kippen
10	DBEDT-ERT	10-7-98	Maurice Kaya
11	County of Maui - Planning	10-14-98 12-08-98	Lisa Nuyen
12	County of Maui - Public Works	10-21-98	Charles Jenks
13	DOI - Fish & Wildlife	10-22-98	Robert Smith
14	DOH	10-23-98	Lawrence Miike
15	David Chenoweth	11-6-98	David Chenoweth
16	US - Dept. of the Army	11-6-98	George Young
17	Safe Power Action Network	11-9-98	Christen Mitchell
18	OEQC	11-9-98	Gary Gill
19	MECO	11-9-98	Bill Bonnet
20	FAA	11-12-98	Darrice Young
21	FAA	1-04-99	Hawthorne CA Office

EXHIBIT 1

State of Hawaii
Department of Land and Natural Resources
Division of Conservation and Resources Enforcement

July 31, 1998

AUG 3 11 57 AM '98

MEMORANDUM

TO: Dean Uchida, Administrator
Land Division

FROM: Patricia Edwards, Acting Investigator
Division of Conservation and Resources Enforcement

SUBJECT: **Site Visit/Field Inspection Report 2902-MA**

1. CASE DATA

a. FILE NO: 2902-MA

b. INITIATOR: Zond Pacific, Inc.

c. LOCATION: TMK:(2) 4-8-01:08 Portion of Kaheawa Pastures, Ukumehame Ahupua'a

d. SUMMARY: DEVELOPMENT OF A WINDFARM TO SELL RENEWABLE ELECTRICITY TO MAUI ELECTRIC COMPANY

2. FINDINGS

a. Site visit/inspection conducted on 07/24/98 by DOCARE Officer S. Okamoto. There was no indication that any project work had been undertaken as of this date.

b. There was no indication of any discrepancy in the applicant's description of the site conditions/situation.

c. Nothing was noted that might be a bar to approval of the applicant's proposal.

3. COMMENTS

Officer Okamoto expressed a number of concerns with regards to public safety. Included are; (1) the isolated location, amount of vegetation and dry weather conditions could present difficulties in the event of a fire, (2) the 1.5 mile road to be built may encourage increased dirt bike use in area, (3) the nene goose situation needs to be monitored as one was sighted within .5 miles of the site, and (4) the site is near the Na Alahele trail and will more than likely encourage hikers to leave the trail and explore the sight. What measures will be taken to prevent unauthorized climbing on the tower?

Zond
ZOND PACIFIC INC.
A Subsidiary of ENRON Wind Corp.

EXHIBIT 1A

January 4, 1999

Patricia Edwards, Acting Investigator
Division of Conservation and Resources Enforcement
Department of Land and Natural Resources
P O Box 621
Honolulu HI 96809

Subject: CDUA File #MA-2902, Zond Pacific, Inc. 20 MW Windfarm on Kaheawa Pastures, Ukumehame ahupua'a, Maui TMK 4-8-01: 01.

Dear Ms. Edwards:

This letter is in response to your letter to Dean Uchida, Administrator, Land Division, DLNR, dated July 31, 1998, Site Visit/Field Inspection Report 2902-MA.

I would like to thank you for your site visit and comments about the proposed 20 MW Windfarm Project on Kaheawa Pastures in the Ukumehame Conservation District. The following is our response to your comments:

(1) **the isolated location, amount of vegetation and dry weather conditions could present difficulties in the event of a fire.**
Response: this is a valid concern. There have been a number of fires in the area over the past 20 years. A recent fire in the area burned most of the vegetation below an elevation of about 3000' in this portion of the Ukumehame District. The draft Environmental Assessment (EA) will be revised to include specific fire prevention measures and firefighting protocols.

(2) **the 1.5 mile road to be built may encourage increased dirt bike use in area,**
Response: we are no longer considering this proposed new road, in part, due to your concern. Other reviewers expressed similar concerns. The proposed access will be via the current jeep road and an existing spur.

(3) **the nene goose situation needs to be monitored as one was sighted within .5 miles of the site, and**
Response: Other organizations, including DOFAW, have raised concerns regarding the Nene. We discussed these concerns in a meeting with DOFAW personnel on Maui on December 18, 1998. We are planning additional surveys to confirm the presence and habits of the Nene on the site and to devise mitigation measures.

(4) **the site is near the Na Alahele trail and will more likely encourage hikers to leave the trail and explore the site. What measures will be taken to prevent unauthorized climbing on the tower?**
Response: Other organizations, including DOFAW, have raised similar concerns

485 Waiale Rd.
Wailuku, Hawaii 96793
PH: 808/244-9389 • FAX: 808/244-9535

13000 Jameson Rd.
Tehachapi, California 93561
PH: 805/822-6835 • FAX: 805/822-5015

309 Avalon Dr.
Ashland, Oregon 97520
PH: 541/482-0854 • FAX: 541/488-2504

regarding the potential for hikers to leave the trail and explore the site. Given that there will not be a new road west of the Manawainui Gulch, a major new path to the windfarm would be eliminated. Hikers would have to be divert an hour or more to reach the lower end of the site (from the Lahaina side of the Manawainui Gulch) and two or more hours from the Maalaea site. We believe it is unlikely that many hikers will actually reach the site. Moreover, the towers are designed to be unclimbable by non-maintenance personnel. Specifically, the lowest rungs for maintenance personnel (who need to climb the towers periodically) are approximately 15 ft off the ground. Special climbing equipment is required. Thus, we believe the risk of someone climbing any of the 27 towers is very low.

Also please note that the original TMK reference (TMK: 4-08-01: par. 5) for the subject CDUA was inadvertently reported incorrectly. The correct designation is as stated above: TMK 4-8-01: par. 1.

If you have any questions regarding this response, please call me at 800-605-1050. Mahalo!

Sincerely,

Keith Avery
Vice-President

EXHIBIT 2

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

August 3, 1998

TO: Mr. Dean Uchida, Administrator
Land Division

FROM: Timothy E. Johns, Deputy Director
Commission on Water Resource Management

SUBJECT: Draft Environmental Assessment, Kaheawa Pastures 20 MW Windfarm, Maui.

FILE NO.: MA-2902

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

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

[ ] We recommend coordination with the county government to incorporate this project into the county's 20-year Water Use and Development Plan, which is subject to regular updates.

[ ] We recommend coordination with the Land Division of the State Department of Land and Natural Resources to incorporate this project into the 20-year State Water Projects Plan, which is subject to regular updates.

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

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

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

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

[ ] If the proposed project diverts additional water from streams or if new or modified stream diversions are planned, the project may need to obtain a stream diversion works permit and petition to amend the interim instream flow standard for the affected stream(s).

[X] If the proposed project performs any work within the bed and banks of a stream channel, the project may need to obtain a stream channel alteration permit and a petition to amend the interim instream flow standard for the affected stream(s).

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

[X] OTHER:

The document indicates there are two intermittent streams - Malalowaiaole and Manawainui at the proposed windfarm site which may require SCAPs for culvert crossings from the unpaved access road.

If there are any questions, please contact David Higa at 587-0249.

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EXHIBIT 2A

January 4, 1999

Timothy E. Johns, Deputy Director
Commission on Water Resource Management
Department of Land and Natural Resources
P O Box 621
Honolulu HI 96809

Subject: Draft Environmental Assessment, Kaheawa Pastures 20 MW Windfarm, Maui, File No. MA-2902.

Dear Mr. Johns:

This letter is in response to your letter to Dean Uchida, Administrator, Land Division, DLNR, dated August 3, 1998, same subject.

I would like to thank you for your comments regarding the proposed 20 MW Windfarm Project on Kaheawa Pastures in the Ukumehame Conservation District. Also please note that the original TMK reference (TMK: 4-08-01: par. 8) for the subject CDUA was inadvertently reported incorrectly. The correct designation is as stated above: TMK 4-8-01: par. 1.The following is our response to your comments:

(1) **we are concerned about the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.** Response: There are no streams, springs or ponds on the proposed site. During construction and operation of the windfarm, all water used on site would be trucked in. ZPAC's operational procedures include protocols for handling and disposal of transmission oils, cleaning fluids and other hazardous materials. Use of these materials is minimized and all disposal will be at approved off-site locations. The Hydrology Section of the EA will be revised to include these procedures. Also note that the State Department of Health (DOH) has reviewed the EA (see attached letter from Lawrence Miike) and did not have any comments to offer at this time. ZPAC will send a copy of this letter to Mr. Miike.

(2) **If the proposed project performs any work within the bed and banks of a stream channel, the project may need to obtain a stream channel alteration permit and a petition to amend the interim instream flow standard for the affected stream (s), and**
Response: There are two intermittent streams (the Malalowalaole and Manawainui

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13000 Jameson Rd.
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309 Avalon Dr.
Ashland, Oregon 97520
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Gulches) in proximity of the site. The existing jeep road crosses the Malalowaiaole Gulch at an elevation of approximately 1600' just after the jeep road joins the Old Lahaina Pali trail. The current access road avoids crossing the Manawainui Gulch. ZPAC is considering improvement and use of an alternate spur to shorten the distance to the site. This spur runs westward from near Puu Anu through the upper portion of the Manawainui Gulch. Reference my previous letter, dated November 25, 1998. I have requested an evaluation as to whether this portion of the Manawanui is considered a stream. Should it be determined that it is a stream channel and should ZPAC wish to use this route to the site, we will apply for a SCAP.

(3) **Other: The document indicates there are two intermittent streams – Malalowaiaole and Manawainui at the proposed windfarm site which may require SCAPs for culvert crossings from the unpaved access road.**
Response: Neither of these gulches is on the proposed site. Both are to the Maalaea-side of the project site. As noted above, the existing site access road crosses the Malalowaiaole Gulch. *After further review of transportation requirements* during the construction period, ZPAC is now proposing to widen portions of the road at and on both sides of the gulch. We need to know if this road improvement would require a SCAP. As noted above, a request has already been made for evaluation of the Manawainui Gulch crossing.

If you have any questions regarding this response, please call me at 800-605-1050. Mahalo!

Sincerely,

Keith Avery
Vice-President

cc: DOH (L. Miike)

EXHIBIT 3

ENGINEERING BRANCH

COMMENTS

We have no objections to the Chairperson signing the application.

The proposed project will not impact our current projects.

For your information; the proposed project site, according to FEMA Community Panel Map No. 150003 0235 B, is located in Zone C. This is an area minimal flooding.

Zond
ZOND PACIFIC, INC.
A Subsidiary of ENRON Wind Corp.

EXHIBIT 3A

January 4, 1999

Andrew Monden, Chief Engineer
Engineering Branch, Land Division
Department of Land and Natural Resources
P O Box 621
Honolulu HI 96809

Subject: Draft Environmental Assessment, Kaheawa Pastures 20 MW Windfarm, Maui, File No. MA-2902; TMK 4-8-01: par. 1.

Dear Mr. Monden:

This letter is in response to your letter to Dean Uchida, Administrator, Land Division, DLNR, dated August 3, 1998, same subject.

I would like to thank you for your comments regarding the proposed 20 MW Windfarm Project on Kaheawa Pastures in the Ukumehame Conservation District. The following is our response to your comments:

(1) we have no objections to the Chairperson signing the application.
Response: Thank your for this comment.

(2) the proposed project will not impact our current projects, and
Response: Thank your for this comment.

(3) For you information; the proposed project site, according to FEMA Community Panel Map No. 15003 0235 B, is located in Zone C. This an area (of) minimal flooding.
Response: Thank your for this comment.

Also please note that the original TMK reference (TMK: 4-08-01: par. 8) for the subject CDUA was inadvertently reported incorrectly. The correct designation is as stated above: TMK 4-8-01: par. 1.

If you have any questions regarding this response, please call me at 800-605-1050. Mahalo!

Sincerely,

Keith Avery
Vice-President

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309 Avalon Dr.
Ashland, Oregon 97520
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EXHIBIT 4

DIVISION OF AQUATIC		
DIRECTOR	/	Suspense Date:
COM FISHERIES		Draft Reply ☐
AQ RES/ENV		Reply Direct ☐
AQ RES/I&N		Comments ☐
STAFF SVCS		Information ☐
FISH DEV		Comp Act & File ☐
STATISTICS		Return to:
AFRC		Copies to:
EDUCATION		Remarks:
SECRETARY		
OFFICE SVCS		
FEO A/O		98-690

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION
Planning Branch
Honolulu, Hawaii

In reply, please refer to:
File No.: MA-2902
Suspense Date: Three weeks

8/11

MEMORANDUM

TO: Aquatic Resources; Conservation & Resources Enforcement; Forestry & Wildlife; Historic Preservation; Maui District Land Office; Engineering Branch; State Parks; Commission of Water Resource Management

FROM: DEAN UCHIDA, Administrator
Land Division

SUBJECT: **Request for Authorization from the Department to Process a Conservation District Use Application Located on State-owned Lands**

All Conservation District Use Applications (CDUA) must be signed by the landowner prior to the submission of the application to the Department. Applications involving the use of State lands require the signature of the Chairperson on behalf of the Board of Land and Natural Resources.

Please review the attached application and comment with respect to your division's present and future programs. Your comments will then be forwarded to the Chairperson for consideration on whether to sign as landowner on this CDUA. (Note: the Chairperson's signature on the application does not constitute the Department's endorsement of the proposed use).

General information regarding the attached application is provided below:

APPLICANT: Zond Pacific, Inc.

AGENT: Keith Avery, Vice-President

LANDOWNER: STATE OF HAWAII

PROPOSED USE: Construction and Operation of a 20 Megawatt Windfarm

RECEIVED
JUL 21 1998
Div. of Aquatic Resources

No Objections
D Eckert for W Devick

LAND MANAGEMENT DIV. ID:808-587-0455 NOV 16'98 8:25 No.002 P.04

EXHIBIT 4A

Zond
ZOND PACIFIC INC.
A Subsidiary of ENRON Wind Corp.

January 4, 1999

William Devick, Acting Administrator
Aquatic Resources Division
Department of Land and Natural Resources
P O Box 621
Honolulu HI 96809

Subject: Request for Authorization from the Department to Process a Conservation District Use Applications Located on State-owned Lands.

Dear Mr. Devick:

This letter is in response to your letter to Dean Uchida, Administrator, Land Division, DLNR, dated August 10, 1998, same subject. Thank you for taking the time to review and comment on the subject request. I would also like to note that the original TMK reference (TMK: 4-08-01: par. 8) for the subject CDUA was inadvertently reported incorrectly. The correct designation is TMK 4-8-01: par. 1.

If you have any further questions or comments regarding this environmental assessment, please call me at 800-605-1050. Mahalo!

Sincerely,

Keith Avery
Vice-President

485 Waiale Rd.
Wailuku, Hawaii 96793
PH: 808/244-9389 • FAX: 808/244-9539

13000 Jameson Rd.
Tehachapi, California 93561
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309 Avalon Dr.
Ashland, Oregon 97520
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EXHIBIT 5

DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF STATE PARKS

MEMORANDUM

DATE: August 12, 1998

TO: Dean Uchida, Administrator
Land Division

FROM: Ralston Nagata, Administrator

SUBJECT: **Review and Comment on CDUA File No. MA-2902, Request for Authorization to Process a CDUA for the Construction and Operation of 20 MW Windfarm, Ukumehame, West Maui**

The proposed action calls for the construction and operation a windfarm located on the ridge above McGregor Point between the elevations of 1900 and 3200 feet. The Lahaina-Pali Trail, a Na Ala Hele Demonstration Trail, is located below the proposed windfarm, and crosses the windfarm access road at about 1300 feet elevation.

The Division of State Parks has no objections to the processing of a CDUA for the construction and operation of a 20 MW windfarm. We note the applicant's Draft EIS statement indicates that two wind turbines were relocated to minimize adverse impacts to viewplanes along the trail, after consultation with the Na Ala Hele program representative - a commendable action to minimize adverse impacts to recreational opportunities.

We also note that Ukumehame is identified in the DEIS as a State Park (pages 1-9 and 4-4). Ukumehame is actually a County of Maui Beach Park and should be identified as such.

AUG 12 9 00 AM '98

Zond
ZOND PACIFIC INC.
A Subsidiary of ENRON Wind Corp.

EXHIBIT 5A

January 4, 1999

Ralston Nagata, Administrator
Division of State Parks
Department of Land and Natural Resources
P O Box 621
Honolulu HI 96809

Subject: Review and Comment on CDUA File No. MA-2902, Request for Authorization to Process a CDUA for the Construction and Operation of 20 MW Windfarm, Ukumehame, West Maui.

Dear Mr. Nagata:

This letter is in response to your letter to Dean Uchida, Administrator, Land Division, DLNR, dated August 12, 1998, same subject. Thank you for taking the time to review and comment on the subject CDUA and the draft environmental assessment (EA). We have noted your the comment on the designation of the Ukumehame Park as a County of Maui Beach Park and will revise the EA accordingly.

I would also like to note that the original TMK reference (TMK: 4-08-01: par. 8) for the subject CDUA was inadvertently reported incorrectly. The correct designation is TMK 4-8-01: par. 1.

If you have any further questions or comments regarding this environmental assessment, please call me at 800-605-1050. Mahalo!

Sincerely,

Keith Avery
Vice-President

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EXHIBIT 6

Division of Forestry & Wildlife

1151 Punchbowl Street, Rm. 325 • Honolulu, HI 96813 • (808) 587-0166 • Fax (808) 587-0160

August 12, 1998

MEMORANDUM

TO: Lauren Tanaka, Planner
Land Division

THRU: Dean Uchida, Administrator
Land Division

FROM: Michael G. Buck, Administrator
Division of Forestry and Wildlife

SUBJECT: **CDUA File #MA-2902, Zond Pacific, Inc. 20 MW Windfarm on Kaheawa Pastures, Ukumehame ahupua'a, Maui TMK 4-8-01:08, approximately 200 acres.**

We have reviewed this proposal with respect to its impacts on the natural resources and endangered species in particular. The attached represents DOFAW's comments to this CDUA, file # MA-2902 by applicant Zond Pacific, Inc..

Attachment

C: Maui DOFAW Branch

AUG 14 11 12 AM '98

EXHIBIT 6

DEPARTMENT OF LAND & NATURAL RESOURCES
Division of Forestry and Wildlife
Maui District

MEMORANDUM August 11, 1998

TO: Nelson Ayers, Resource Management Forester

FROM: Wes Wong, District Manager

SUBJECT: Draft Environmental Assessment -- Kaheawa Pastures 20 MW wind farm, Ukumehame, Maui, TMK: 4-8-01: par. 8.

We have reviewed the subject document and have the following comments.

Na Ala Hele Trails and Access

Comments

1. The report seems to relate overall close consultation on the placement and mitigation of impacts on behalf of the Trails & Access Program. The report also suggests the project has a seeming fit with the Program's Vision statement and responsibilities. It describes a future scenario where impacts would be felt chiefly by maintenance and DLNR personnel. Finally, it suggests that consultation with State agencies has and will go far toward developing mitigative measures across a wide spectrum of impacts. We disagree.

2. A representative of Zond Pacific contacted Na Ala Hele several years ago to discuss setting up test equipment for wind force and duration sampling. However, there has been no other consultation or direct communication about the subject project with NAH District Staff. Claims of recent telephone consultation between Staff and the applicant representative are apparently false. No field inspections or other specific consultation related to placement of the proposed turbine structures has yet been made.

3. Important to the Lahaina Pali Trail's historical and interpretive context is its relative remoteness from developed areas. With the exception of damage to the trail resulting from constructing an access road during installation of the MECO 69KV Power Line project, and negative impacts to the views caused by the power poles and lines themselves, the area around the Trail remains relatively free of infrastructure intrusive to view planes. Construction of the proposed turbines would amount to a direct assault on these view planes from points along the trail.

4. Numerous incidents of trespass and unauthorized access by four wheel-drive passenger cars, motorcycles, mountain bikes, and hikers are noted by our Department regularly. We believe the project will create an attractive nuisance in the sense that trespassers may be emboldened to approach the turbines and vandalize them. With our Department's diminished capacity to

enforce no-trespass laws in the area, the project would likely become a magnet for periodic acts of vandalism.

5. As mentioned above, the Draft EA seems to suggest an overall acceptance on Na Ala Hele's part based on close consultation and a seeming fit with the Program's vision and responsibilities. In fact, the opposite is true. Our definition of "sound conservation principles" includes preservation of view planes and cultural heritage that is inconsistent with any large-scale, audibly moving turbine structures.

<u>Wildlife:</u>

Comments

1. Section 3.8.1 page 3-20. Footnote 3 denotes consultation by ZPAC with myself about birds, bird's habitats, and habits in reference to this project – This is false.

2. Section 3.8.2 page 3-23. A quote attributed to myself. "The breeding season is in the fall from October through December" is exactly backwards: Breeding season is December through October for a ten month period. I am unaware I provided any specific data, knowingly, for this project, to ZPAC or its consultants.

3. Section 3.8.2 page 3-24. Any increases of rats, mongooses and feral cats their predators, in the area so near to Hawaiian Goose release is of considerable concern to the State. This EA suggests the windfarms could generate population increases of such mammals. This needs mitigation.

4. Section 3.8.2 page 3-25 and 3-27 <u>Discussion</u> and <u>Shearwater and Petrels</u>: It should be imperative that the turbines by ZPAC have red flashing-lights affixed to them and operable all night long to deter collisions by nocturnally active petrels, shearwaters, and Hawaiian Geese.

   ZPAC personnel or consultants need to survey at bi-weekly intervals for 12 weeks, then monthly for an additional 12 weeks, beginning with initiation of turbine activity and report results to the Division of Forestry and Wildlife. All injured wildlife or carcasses of wildlife need to be salvaged and given to DOFAW due to the fact that Hawaiian Bat, Hawaiian Goose, and/or Dark-Rumped Petrels could be involved. As an additional control, entry permission for State Wildlife Staff to do spot visits to the turbines need to be developed.

Comments

1. The Maui Division of Forestry & Wildlife has long considered establishing a public game bird hunting program over the State lands in the Ukumehame area. The project area has huntable populations of both Ring-necked Pheasants and Black Francolin along with Gray Francolin and doves (2 species). As the total project area is said to utilize only some 8.7

acres, of the 200 acre parcel, the balance of the project parcel should be allowed for game bird hunting. Although other acreage remains for public hunting, the project area is one of the better parcels with an average of 8% downward slope, without numerous gullies and ravines. As no mention of public game bird hunting was noted in the EA, we trust this to be an oversight, which will be addressed and deemed "compatible" in the area.

2. The creation of an additional access road to the project area will foreseeably create a tremendous "unauthorized entry" problem. The existing access road, although posted, generates numerous complaints of unauthorized entry of hikers, mountain bikers, and dirt bikes. Where the existing access road and Na Ala Hele trail intersect, numerous hikers deviate from the hiking trail and proceed along the access road. No mention is made as to proposed deterrents along Honoapiilani Hwy and at the Na Ala Hele trail intersection to curb unauthorized entry and passage along the proposed route.

3. Although the issue of "grass fires" is mentioned in the EA, a real threat exists of a wildfire being started as a direct result of the project; be it initiated by downed lines, vehicle catalytic converters or any other means. The recent Papawai Point Wildfire is an example of what can be expected should a wildfire start in the vicinity. The fact that mauka of the project site is the Nene release area further adds credence to this concern. In the event that a project related wildfire is started, the applicant should assume all costs for suppression and losses, and bear full responsibility thereof.

4. Although the need for "additional study" of bird strikes was mentioned and that nocturnal studies for Dark-rumped Petrels and Wedge tailed Shearwaters be conducted, more thorough dusk to dark studies for the presence of bats should be conducted along with nocturnal monitoring of the movements of the Nene. Any loss of an endangered species as result of a structure collision "after the fact" should not be tolerated.

5. Mention was made of maintenance equipment and supplies being stored either in the O&M structure or "designated graded parking areas" only, however no mention was noted of contaminant (i.e., petroleum products, acids, solvents, etc.) containment in the event of accidental release. Appropriate means for containment must be included in any plans and subject to review and approval by the authority having jurisdiction.

Comments

1. In 1995 nene propagation and releases occurred in the upper portion of Hana'ula. To date a total of 62 nene were released in this area. During the Down Wildlife Survey, which was conducted in 1997 there were only 23 nene. Concerns of wind generators could hamper and create downed nene and affect their flyways which occur from Hana'ula to Haleakala, Lahaina, and Wailuku.

2. Nene are not agile fliers like sea birds and tend to fly in pairs or family flocks and prefer grassy habitats. Nene are also ground nesting birds. This proposed area for wind generators will hinder possible breeding, flocking, and nesting sites for the nene.

3. Concerns for nearby nesting around wind generators may cause grounding, injury, or death to nene fledglings as well as adults.

4. In section 3.8 it is not noted that Hawaiian Hoary bat is listed as an endangered species. In section 3.8.2 it states that wind turbines should be clearly visible to birds and bats. It should be noted that bats travel on sonar rather than vision.

5. It is known that Dark-rumped petrels and Wedge-tailed shearwaters are residents of Maui, and potential strikes may occur especially when attracted to tower lights.

6. The Pacific golden plover is listed as a migratory species which inhabits mostly open areas with either low vegetation or large grassy fields very similar to the proposed wind generator site.

7. Forest Bird Recovery Plans recommends translocation of forest birds that once inhabited the West Maui Forest Reserve. This project could make a negative impact on this translocation of the reintroduction of forest birds to the West Maui Forest Reserve.

8. Inclement weather conditions already plays an important role in the movement of wildlife and should these wind generators they be erected may cause more grounded wildlife.

9. According to the survey that was conducted for Down Wildlife, some important factors were not considered; first, night monitoring and surveys conducted during the early mornings as well as sunset. This is an important factor to consider when addressing endangered species, such as Nene, Dark-rump petrel, and the Hawaiian bat. Second, it appears that what was done was a sweep through the wind monitoring towers instead of conducting a survey and monitoring wildlife.

Should this project be approved we recommend the following conditions should apply:

1. A fire plan be developed.

2. That all trash accumulated from the construction from the area be properly removed.

3. As stated in the Environmental Assessment, the life of this project (30 years) that conditions to restore the area will be strictly enforced.

4. That the access road leading form Honapiilani Highway at Mc Gregor to the project site be improved and maintained.

5. That Division of Forestry and Wildlife staff be permitted on the project site at anytime upon request.

6. That monitoring of wildlife be conducted during the construction.

Zond
ZOND PACIFIC INC
A Subsidiary of ENRON Wind Corp.

EXHIBIT 6A

January 4, 1999

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

Subject: CDUA File #MA-2902, Zond Pacific, Inc. 20 MW Windfarm on Kaheawa Pastures, Ukumehame ahupua'a, Maui TMK 4-8-01: Par. 1, approximately 200 acres

Dear Mr. Buck:

This letter is in response to your letter to Lauren Tanaka, Planner, Land Division, DLNR, dated August 12, 1998, same subject. This letter included detailed comments from your staff on the draft Environmental Assessment (EA) prepared by WSB-Hawaii for Zond Pacific's proposed (subject) 20 MW windfarm on Maui. I have included attached a response to each of the detailed comments. This *response incorporates the results* of meeting with DLNR staff on Maui on December 18, 1998.

The meeting participants included myself, Zond Pacific's consultants Warren Bollmeier (WSB-Hawaii) and Eric Nishibayashi (Eric Nishibayashi Consulting) and DLNR staff (Dr. Carol Terry, Meyer Ueoka, Dr. Fern Duval, John Medeiros, John Cummings and Mike Baker).

The meeting was very helpful in terms of gaining a better understanding of DNLR's comments on the EA and DLNR's plans for the Ukumehame District. We believe the interchange also helped DLNR gain a better understanding of Zond Pacific's plans. The discussion centered on the concerns regarding the safety and habitat of the avifauna (especially the Nene) that are either residents in or that may frequent the proposed project area. **Zond Pacific recognizes the possibility that Nene may collide with the wind turbines. However, it is not known whether the project would have a *significant* impact on the local Nene population.**

Because there may be a significant impact to the newly introduced Nene and your concern that the project is significant by size alone, we will be upgrading the final EA to an EIS. We will be following OEQC rules for the expansion of our application.

In addition, we collectively do not know what mitigative measures would prevent Nene collisions with the wind turbines and or their towers. Therefore, we agree with DLNR staff that an additional survey needs to be conducted to confirm the presence of the Nene on the project site and to study their habits. Zond Pacific's goal is to use the results of the survey to devise an improved mitigative measures strategy to minimize the incremental risks of the project to the Nene. Zond Pacific will follow-up up with DLNR staff (John Medeiros and Dr. Fern Duval) to plan and coordinate this study.

CORRECTION

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

Zond
ZOND PACIFIC INC
A Subsidiary of ENRON Wind Corp.

EXHIBIT 6A

January 4, 1999

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

Subject: CDUA File #MA-2902, Zond Pacific, Inc. 20 MW Windfarm on Kaheawa Pastures, Ukumehame ahupua'a, Maui TMK 4-8-01: Par. 1, approximately 200 acres

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The meeting participants included myself, Zond Pacific's consultants Warren Bollmeier (WSB-Hawaii) and Eric Nishibayashi (Eric Nishibayashi Consulting) and DLNR staff (Dr. Carol Terry, Meyer Ueoka, Dr. Fern Duval, John Medeiros, John Cummings and Mike Baker).

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Because there may be a significant impact to the newly introduced Nene and your concern that the project is significant by size alone, we will be upgrading the final EA to an EIS. We will be following OEQC rules for the expansion of our application.

In addition, we collectively do not know what mitigative measures would prevent Nene collisions with the wind turbines and or their towers. Therefore, we agree with DLNR staff that an additional survey needs to be conducted to confirm the presence of the Nene on the project site and to study their habits. Zond Pacific's goal is to use the results of the survey to devise an improved mitigative measures strategy to minimize the incremental risks of the project to the Nene. Zond Pacific will follow-up up with DLNR staff (John Medeiros and Dr. Fern Duval) to plan and coordinate this study.

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PH: 541/482-0854 • FAX: 541/488-2504

Michael G. Buck,
January 4, 1999
Page 2

It was also agreed that surveys should also be conducted to identify the presence and habits of other important species, including the Dark-rumped Petrel, Wedge-tailed and Newell's Shearwater, and the Pueo. Zond Pacific will follow-up with DLNR staff to coordinate these surveys. Note: since we did not discuss the Hawaiian Hoary Bat, we will follow-up with DLNR staff to discuss the need for a bat survey, although none have been identified previously.

We also discussed the potential impacts of the project on the Na Ala Hele Trail and Access Program, and specifically the potential impact to the Old Lahaina Pali Trail. The potential impacts include the possibility that the project will become an attractive nuisance and that the presence of the wind turbines will negatively impact the viewplanes along the trail. From the discussion, Zond Pacific agrees that the windfarm may encourage hikers to stray from the trail for a closer look at the wind turbines. Note that we have withdrawn its proposal for a new access road to the site. Thus, hikers would have to hike cross-country and uphill to reach the windfarm site. While this is a possibility, Zond Pacific notes that uninvited visitors have not been a problem on any of its existing windfarms in California and other locations. Zond-Pacific will follow-up with DLNR staff to discuss potential mitigative measures.

Regarding potential visual impact, Zond Pacific believes that six to as many as seven or eight or parts of wind turbines will be visible along up to a half mile or so of the trail. The view of the wind turbines will be behind the existing new utility transmission lines. Evaluation of the potential visual impact is necessarily subjective and dependent on the viewer and his viewpoint. Zond Pacific continues to believe that the presence of the wind turbines will not be found to be visually intrusive to hikers. Zond Pacific will follow-up with DLNR staff to discuss potential mitigative measures to reduce the potential visual impacts.

Also please note that the original TMK reference (TMK: 4-08-01: par. 8) for the subject CDUA was inadvertently reported incorrectly. The correct designation is as stated above: TMK 4-8-01: par. 1.

If you have any questions on our response to your comments, please call me at 800-605-1050. Mahalo!

Sincerely,

Keith Avery
Vice-President

Attachment

Zond

ZOND PACIFIC INC.

A Subsidiary of ENRON Wind Corp.

Attachment
Zond Pacific Responses to DLNR Comments re:
Zond Pacific's Draft Environmental Assessment
Kaheawa Pastures 20 MW Windfarm

The following comments with Zond Pacific's responses were received from:

Na Ala Hele Trails and Access

Comments:

1. The report seems to relate overall close coordination on the placement and mitigation of impacts on behalf of the Trails & Access Program. The report also suggests the project has a seeming fit with the Program's Vision statement and responsibilities. It describes a future scenario where impacts would be felt chiefly by maintenance and DLNR personnel. Finally, it suggests that consultation with State agencies has and will go far toward developing mitigative measures across a wide spectrum of impacts. We disagree.

   ZPAC Response. ZPAC did discuss the proposed wind project with DLNR (Mike Baker) during the application period for the Wind Monitoring equipment. ZPAC agrees that coordination could have been better during the preparation of windfarm EA and apologizes for this oversight. ZPAC has met on December 18, 1998 with Mike Baker to discuss the issues of concern to the Trails & Access Program. There is need for additional discussion. ZPAC will take the action to follow-up.

2. A representative of Zond Pacific contacted Na Ala Hele several years ago to discuss setting up test equipment for wind force and duration sampling. However, there has been no other consultation or direct communication about the subject project with NAH District Staff. Claims of recent telephone consultation between Staff and applicant representative are apparently false. No field inspections or other specific consultation related to placement of the proposed turbine structures has yet been made.

   ZPAC Response. As noted above, ZPAC agrees that coordination could have been better during the preparation of windfarm EA and apologizes for this oversight. ZPAC's consultant WSB-Hawaii did contact the following DLNR (Mark Peyton, Kirk Cottrell and Erin Low personnel on January 14, 1998 regarding the proposed project). We apologize for not following-up prior to the release of the draft EA with Mr. Baker. As noted above, additional discussion and follow-up will occur.

3. Important to the Lahaina Pali Trial's historic and interpretative context is its relative remoteness from developed areas. With the exception of damage to the trail resulting from constructing an access road during installation of the MECO 69KV Power Line project, and negative impacts to views caused by the power poles and lines themselves, the areas around the Trail remains relatively free of infrastructure intrusive to view planes. Construction of the proposed turbines would amount to a direct assault on those view planes from points along the trail.

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Ashland, Oregon 97520
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ZPAC Response. Zond Pacific believes that six to as many as seven or eight wind turbines (or parts of wind turbines), will be visible along up to a half mile or so of the trail. The view of the wind turbines will include the existing utility transmission lines. Evaluation of the potential visual impact is necessarily subjective and dependent on the viewer and his viewpoint. Zond Pacific continues to believe that the presence of the wind turbines will not be found to be visually intrusive to hikers. Zond Pacific will follow-up with DLNR staff to discuss potential mitigative measures to reduce the potential visual impacts.

4. Numerous incidents of trespass and unauthorized access by four wheel-drive passenger cars, motorcycles, mountain bikes, and hikers are noted by our Department regularly. We believe the project will create an attractive nuisance in the sense that trespassers may be emboldened to approach the turbines and vandalize them. With our Department's diminished capacity to enforce no-trespass laws in the area, the project would likely become a magnet for periodic acts of vandalism.

   ZPAC Response. ZPAC agrees that some hikers may choose to divert from the trail up the existing access road or go cross-country to seek a better view of the wind turbines. Realistically, there is no way to prevent this type of occurrence. However, ZPAC notes that there is relatively little evidence from other windfarms to suggest that vandalism will be a significant problem. Wind turbine towers are designed and installed to be unclimbable except by maintenance personnel. The fact that ZPAC personnel will be on-site (though not daily) will be a deterrent. Zond-Pacific will follow-up with DLNR staff to discuss any additional potential mitigative measures.

5. As mentioned above, the Draft EA seems to suggest an overall acceptance on Na Ala Hele's part based on close consultation and a seeming fit with the Program's vision and responsibilities. In fact, the opposite is true. Our definition of "sound conservation principles" includes preservation of view planes and cultural heritage that is inconsistent with any large-scale, audibly moving turbine structures.

   ZPAC Response. Following discussions on Dec. 18, we understand this concern. As noted before, evaluation of visual impact is necessarily subjective. Consequently, we would agree that reasonable people can disagree as to what is a visual intrusion. ZPAC does not believe that hikers will find the wind turbines to be visually intrusive. In fact, the opposite may be proven to be true. Note: the Pacific Crest Hiking Trail comes within 100' of 700 kW wind turbines in Tehachapi, CA. The local Chapter of the Sierra Club, which supports the windfarms in Tehachapi, provides periodic guided hikes along this section of the trail. ZPAC will continue to follow-up with DLNR personnel to discuss potential mitigative measures.

<u>Wildlife</u>

Comments:

1. Section 3.8.1 page 3-20. Footnote 3 denotes consultation by ZPAC with myself about birds, bird's habitats, and habits in reference to this project -- This is false.

ZPAC Response. *The person providing this comment, as well as the following four comments, is not named, but is assumed to be Dr. Fern Duval. ZPAC's consultant WSB-Hawaii (Warren Bollmeier) did contact Dr. Duval on February 12, 1998 and again on February 26, 1998.*

2. Section 3.8.2 page 3-23. A quote attributed to myself. "The breeding season is in the fall from October through December" is exactly backwards: Breeding season is December through October for a ten month period. I am unaware I provided any specific data, knowingly, for this project, to ZPAC or its consultants.

ZPAC Response. *ZPAC apologizes. This was a typo and will be corrected in the final EA. As mentioned above, Warren Bollmeier did contact Dr. Fern Duval.*

Section 3.8.2 page 3-24. Any increases of rats, mongooses and feral cats their predators, in the area so near to Hawaiian Goose release is of considerable concern to the State. This EA suggests the windfarms could generate population increases of such mammals. This needs mitigation.

ZPAC Response. *ZPAC agrees with the concern regarding the Nene. However, ZPAC does not believe the windfarm design as proposed will encourage significant increases in rodent populations. Where there have been increases of rodent populations on mainland windfarms, several factors were present including: (1) a higher density of turbines leading to a greater disturbance of the land. ZPAC will minimize actual permanent disturbance of the land as discussed in the EA); (2) areas of disturbed land that were either not necessary (e.g., unnecessary on-site roads) or were not revegetated where possible (e.g., areas disturbed around tower foundations), and (3) lack of attention to good housekeeping habits (e.g., rubbish, including construction materials and broken wind turbine parts, was not removed on a regular basis).*

Mitigation measures will be implemented during construction and operation of the proposed windfarm project to: (1) prevent transport of rodents to the site,(2) minimize disturbance of the land, (3) construct and maintain rodent-proof site structures, (4) remove rubbish expeditiously during construction and routinely during operation, and (5) trap rodents should that prove to be necessary.

3. Section 3.8.2 page 3-25 and 3-27. Discussion and Shearwater and Petrels: It should be imperative that the turbines by ZPAC have red flashing-lights affixed to them and operable all night long to deter collisions by nocturnally active petrels, shearwaters, and Hawaiian Geese.

ZPAC Response. *ZPAC's concern is to maintain a balance between making the wind turbines sufficiently visible to the birds, while not impacting human perceptions. For example, bright lights may attract birds to the towers. Bright flashing lights will certainly bring unnecessary human attention to the towers. ZPAC believes there is viable solution that must take into account: (1) any FAA requirements (yet to be determined), (2) relevant* *research data pertaining to alerting vs. attracting birds with lights, and (3) visual impact to humans. ZPAC will revise the EA after reaching consensus with FAA, DLNR and other parties as to the best approach.*

ZPAC personnel or consultants need to survey at bi-weekly intervals for 12 weeks, then monthly for an additional 12 weeks, beginning with initiation of turbine activity and report results to the Division of Forestry and Wildlife. All injured wildlife or carcasses of wildlife need to be salvaged and given to DOFAW due to the fact that Hawaiian Bat, Hawaiian Goose, and/or Dark-Rumped Petrels could be involved. As an additional control, entry permission for State Wildlife Staff to do spot visits to the turbines need (sic) to be developed.

***ZPAC Response.** ZPAC's agrees. Wildlife monitoring should be conducted during the construction and initial operation phases. ZPAC will discuss the elements for a monitoring program and also a wildlife grounding protocol. The monitoring program and wildlife grounding protocol will be included in the final EA.*

Comments

1. The Maui Division of Forestry & Wildlife has long considered establishing a public game bird hunting program over the State lands in the Ukumehame area. The project area has huntable populations of both Ring-necked Pheasants and Black Francolin along with Gray Francolin and doves (2 species). As the total project area is said to utilize only some 8.7 acres, of the 200 acre parcel, the balance of the project parcel should be allowed for game bird hunting. Although of the acreage remains for public hunting, the project area is one of the better parcels with an average of 8% downward slope, without numerous gullies and ravines. As no mention of public game bird hunting was noted in the EA, we trust this to be an oversight, which will be addressed and deemed "compatible" in the area.

   ***ZPAC Response.** ZPAC was unaware that DLNR had potential plans to allow bird hunting in the project area. Not including this potential use in the EA was an oversight. This potential use will be discussed in the final EA. ZPAC believes that the windfarm will be a compatible with bird hunting.*

2. The creation of an additional access road to the project area will foreseeably create a tremendous "unauthorized entry" problem. The existing access road, although posted, generates numerous complaints of unauthorized entry of hikers, mountain bikers, and dirt bikes. Where the existing access road and Na Ala Hele trail intersect, numerous hikers deviate from the hiking trail and proceed along the access road. No mention is made as to proposed deterrents along Honoapiilani Hwy and at the Na Ala Hele trail intersection to curb unauthorized entry and passage along the proposed route.

   ***ZPAC Response.** After further review, ZPAC has decided to withdraw its proposal for construction of a new site access road and will utilize the existing road for site access. However, since there is concern regarding traverse of the upper, more sensitive areas of the Kaheawa Pastures, ZPAC is investigating the possibility of utilizing an existing secondary* *spur that traverses an upper section of the Manawainui Gulch at approximately 2,800 ft. elevation. This would avoid use of approximately two miles of the upper roads. ZPAC commissioned an inspection of the proposed route by its avian, plant and archaeological consultants. ZPAC will revise the draft EA to incorporate these changes and to include new mitigation measures as appropriate to protect the flora and fauna and any cultural resources found along this route.*

3. Although the issue of "grass fires" is mentioned in the EA,, a real threat exists of a wildfire being started as a direct result of the project; be it initiated by downed lines, vehicle catalytic converters or any other means. The recent Papawai Point Wildfire is an example of what can be expected should a wildfire start in the vicinity. The fact that mauka of the project site is the Nene release area further adds credence to this concern. In the event threat a project related wildfire is started, the applicant should assume all costs for suppression and losses, and bear full responsibility thereof.

   ZPAC Response. *ZPAC has taken steps in the design of the proposed project to minimize the risk of a windfarm-generated fire. These include: (1) undergrounding of the intra-site electrical collection network, (2) design of the site substation to industry standards, which include a fire-clear zone within the fenced-in substation area, and (3) automatic shutdown features in the wind turbines in the case of overheating of the key components. ZPAC agrees with comment regarding operational fire-prevention measures, e.g., ensuring that all vehicles have spark arrestors, cellular phones, and fire extinguishers. The EA will be revised to include site operation fire-prevention measures. ZPAC carries fire insurance on all of its projects.*

4. Although the need for "additional study" of bird strikes was mentioned and that nocturnal studies for Dark-rumped Petrels and Wedge tailed Shearwaters be conducted, more thorough dusk to dark studies for the presence of bats should be conducted along with nocturnal monitoring of the Nene. Any loss of an endangered species as result of a structure collision "after the fact" should not be tolerated.

   ZPAC Response. *ZPAC concurs that an additional bird survey should be conducted (prior to project approval) to: (1) identify the presence and study the movements of species that are known to be on Maui, but were not identified to be on site during the previous survey, and (2) revise the planned mitigation measures as appropriate.. ZPAC will coordinate with DLNR in the design, implementation and review of the results of an additional survey (s).*

5. Mention was made of maintenance equipment and supplies being stored either in the O&M structure or "designated graded parking area" only, however no mention was noted of contaminant (i.e., petroleum products, acids, solvents, etc.) containment in the event of accidental release. Appropriate means for containment must be included in any plans and subject to review and approval by the authority have jurisdiction.

   ZPAC Response. *ZPAC concurs with this comment. This was an area that was overlooked in the EA. The EA will be revised to include the following operational and protocol procedures: (1) listing of maintenance equipment and supplies that will be on-site, (2) procedures for storing and containing potential contaminants, and (3) procedures for disposing of spent materials, e.g., gearbox oil, hydraulic fluid, etc.*

Comments

1. In 1995 nene propagation and releases occurred in the upper portion of Hana'ula. To date a total of 62 nene were released in this area. During the Down Wildlife Survey, which was conducted in 1997 there were only 23 nene. Concerns of wind generators could hamper and create downed nene and affect their flyways which occur from Hana'ula to Haleakala, Lahaina, and Wailuku.

   ZPAC Response. *ZPAC plans to conduct an additional bird survey. Hopefully, this survey will provide the answers to some currently unanswered questions about the Nene. Are they frequenting the project area? Are there any discernible flight patterns that could be disrupted by the wind turbines. Will the turbines disrupt their habitat? ZPAC will coordinate with DLNR in the design, implementation and review of the results of this survey.*

2. Nene are not agile fliers like seabirds and tend to fly in pairs or family flocks and prefer grassy habitats. Nene are also ground nesting birds. This proposed area for wind generators will hinder possible breeding, flocking, and nesting sites for the nene.

   ZPAC Response. *The previous bird study did not result in any sightings of Nene in the project area. As noted above, the additional survey should shed some light on the Nene's frequency and use of this area. ZPAC will coordinate with DLNR in the design, implementation and review of the results of this survey.*

3. Concerns for nearby nesting around wind generators may cause grounding, injury, or death to nene fledglings as well as adults.

   ZPAC Response. *The same comments apply as for 2. above.*

4. In section 3.8 it is noted that (sic) Hawaiian Hoary bat is listed as an endangered species. In section 3.8.2 it states that wind turbines should be clearly visible to birds and bats. It should be noted that bats travel on sonar rather than vision.

   ZPAC Response. *The comment is well-taken and the EA will be revised accordingly. ZPAC's understanding is that bats are attracted to lights, as are insects. ZPAC will consult with a bat expert to add a more detail to the discussion of bats in the EA.*

5. It is known that Dark-rumped petrels and Wedge-tailed shearwaters are residents of Maui, and potential strikes may occur especially when attracted to tower lights.

   ZPAC Response. *This issue needs further discussion, as we have received conflicting inputs. Will lights alert or attract the birds? If lights are needed, is a red-flashing light preferred? ZPAC will consult with additional bird experts knowledgeable in the use of lighting to alert birds and bats.*

6. The Pacific golden plover is listed as a migratory species which inhabits mostly open areas with either low vegetation or large grassy fields very similar to the proposed wind generator site.

ZPAC Response. There have been recent sightings of the Pacific golden plover in the area since the recent fire.

7. Forest Bird Recovery Plans recommends translocation of forest birds that once inhabited the West Maui Forest Reserve. This project could make a negative impact on this translocation of the reintroduction of forest birds to the West Maui Forest Reserve.

   ZPAC Response. This issue was not discussed during the December 18, 1998 meeting. ZPAC would like to discuss these potential plans and will follow-up with DLNR staff.

8. Inclement weather conditions already plays (sic) an important role in the movement of wildlife and should these wind generators they (sic) be erected (sic) may cause more grounded wildlife.

   ZPAC Response. This issue was not discussed during the December 18, 1998 meeting. ZPAC would like to discuss these potential plans and will follow-up with DLNR staff.

9. According to the survey that was conducted for Down (sic) Wildlife, some important factors were not considered; first, night monitoring and surveys conducted during the early mornings as well as sunset. This is an important factor to consider when addressing endangered species, such as Nene, Dark-rumped petrel, and the Hawaiian bat. Second, it appears that what was done was sweep through the wind monitoring towers instead of conducting a survey and monitoring wildlife.

   ZPAC Response. As noted previously, ZPAC plans to conduct an additional bird survey. ZPAC will coordinate with DLNR in the design, implementation and review of the results of this survey.

Should this project be approved we recommend the following conditions should apply:

1. A fire plan be developed.

   ZPAC Response. ZPAC agrees. A fire plan will be included in the final EA.

2. That all trash accumulated from the construction from the area be properly removed.

   ZPAC Response. ZPAC agrees. This recommendation (already consistent with ZPAC's operational procedures) will be included in the EA as a mitigative measure to discourage rodent population growth.

3. As stated in the Environmental Assessment the life of this project (30 years) that conditions to restore the area will be strictly enforced.

   ZPAC Response. ZPAC agrees. It is anticipated that this requirement would be included in the Conservation District Use Permit, Right of Entry, or the Term Easement Agreement.

4. That the access road leading form (sic) Honapiilani Highway at McGregor to the project site be improved and maintained.

   ZPAC Response. ZPAC agrees. It is anticipated that this requirement would be included in the Conservation District Use Permit.

5. That Division of Forestry and Wildlife staff be permitted on the project site at anytime upon request.

   ZPAC Response. ZPAC agrees and encourages the Division of Forestry and Wildlife to project site. It is anticipated that this requirement would be included in the Conservation District Use Permit.

6. That monitoring of wildlife be conducted during the construction.

   ZPAC Response. ZPAC agrees. A plan for this monitoring program will be included in the final EA and would be included as a requirement in the Conservation District Use Permit.

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

MICHAEL C
BOARD OF LAN... CES

EXHIBIT 7

DEPUTY
GILBERT COLOMA-AGARAN

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

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

August 25, 1998

LOG NO: 22084
DOC NO: 9808BD04

MEMORANDUM

TO: Dean Uchida, Administrator
Land Division

FROM: Don Hibbard, Administrator
State Historic Preservation Division

SUBJECT: **Chapter 6E-8 Historic Preservation Review of a CDUA and Draft EA for the Construction of a 20 Megawatt Windfarm**
Ukumehame Ahupua'a, Lahaina District, Island of Maui TMK 4-8-01: Par. 8

This letter is a Historic Preservation review of a Conservation District Use Area (CDUA) permit application and draft Environmental Assessment (EA) for the construction of a 20 megawatt windfarm located in Ukumehame Ahupua'a. This is also a review of a document entitled *An Archaeological Reconnaissance Survey for 27 Wind Turbines in the Ukumehame Uplands, Island of Maui* submitted by IARII as part of the draft EA. Our review is based on reports, maps, and aerial photographs maintained at the State Historic Preservation Division; no field check was conducted of the subject property.

The archaeological reconnaissance of the proposed windfarm appears adequate to have located all likely above-ground historic sites on the subject property. No such sites were encountered, nor were any expected due to the location of the windfarm between 2000 and 3000 fasl on the dry leeward slopes of west Maui. We therefore find the report to be acceptable (with one comment to be addressed in Attachment 1) and find the proposed windfarm to have "no effect" on historic sites.

However, we are concerned that the proposed access road alternate routes to the windfarm have not yet been determined or presented in the draft EA, nor subject to archaeological survey. We therefore recommend that construction plans for these routes be submitted to SHPD for our approval, prior to beginning construction.

In the event that historic remains (i.e. subsurface firepits, artifacts, or human skeletal remains) are inadvertently uncovered during construction, all work should cease in the vicinity and the contractor or archaeologist should immediately contact the State Historic Preservation Division office.

If you have any questions please contact Dr. Sara Collins at ~~587-0013~~. 692-8023

BD:jen

Attachment

cc. Lisa Nuyen, Maui County Planning Department (fax: 243-7634)
Ralph Nagamine, Maui County Department of Public Works (fax: 243-7972)
Myra Tomonari-Tuggle, IARII (fax: 943-0716)

EXHIBIT 7A

Zond
ZOND PACIFIC INC.
A Subsidiary of ENRON Wind Corp.

January 4, 1999

Don Hibbard, Administrator
State Historic Preservation Division
33 South King Street, 5th Floor
Honolulu HI 96813

Subject: Chapter 6E-8 Historic Preservation Review of a CDUA and Draft EA for the Construction and Operation of a 20 MW Windfarm, Ukumehame Ahupua'a, Lahaina District, Island of Maui. TMK 4-8-01: Par. 1.

Dear Dr. Hibbard:

This letter is in response to your letter to Dean Uchida, Administrator, Land Division, DLNR, dated August 25, 1998, same subject. Thank you for taking the time to review and comment on the subject CDUA and the draft environmental assessment (EA). We have noted your comment regarding the archaeological reconnaissance survey conducted for Zond Pacific by International Archaeological Research Institute (IARII). The EA will be revised accordingly. I would also like to note that the original TMK reference (TMK: 4-08-01: par. 8) for the subject CDUA was inadvertently reported incorrectly. The correct designation is as stated above: TMK 4-8-01: par. 1.

Regarding the proposed access road alternate routes to the windfarm, we have determined that the proposed new road west of the Manawainui Gulch is not feasible and are withdrawing that proposal. We are now planning to use the current jeep road and an existing spur. Improvements would be required for both the main jeep road and the spur, which connects the windfarm site to the main jeep road at the old cattle corral at Puu Anu. IARII has conducted an archaeological survey of this road and found no historic sites (see the attached report). Per your request, we will keep you informed of the plans for the road improvements.

Per your recommendation, we will revise the EA to include the procedures to be followed during construction. Specifically, if historic remains are inadvertently uncovered during construction, all work will cease in the vicinity and Zond Pacific will contact both its consultant (IARII) and the State Historic Preservation Division office.

If you have any further questions or comments regarding this environmental assessment, please call me at 800-805-1050. Mahalo!

Sincerely,

Keith Avery
Vice-President

Attachment

EXHIBIT 8

DIRECTOR
BRADLEY J. MOSSMAN
DEPUTY DIRECTOR
RICK EGGED
DIRECTOR, OFFICE OF PLANNING

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

OFFICE OF PLANNING
235 South Beretania Street, 6th Flr., Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Tel.: (808) 587-2846
Fax: (808) 587-2824

Ref. No. P-7715

September 29, 1998

MEMORANDUM

TO: Michael D. Wilson, Chairperson
Department of Land and Natural Resources

ATTN: Lauren Tanaka
Planning Branch, Land Division

FROM: Bradley J. Mossman
Director, Office of Planning

SUBJECT: Conservation District Use Permit Application #MA-2902, 20 MW Windfarm at Kaheawa Pastures, Ukumehame, Maui; TMK: 4-8-01: por. 8

We do not have any concerns relative to the project's compliance with the Coastal Zone Management (CZM) objectives and policies. However, as a matter of legal conformity with the Office of Environmental Quality Control's administrative rules, an assessment of the project's compliance with CZM should be included in the environmental assessment document.

If there are any questions, please contact Charles Carole of our CZM Program at 587-2804.

Zond

ZOND PACIFIC INC

A Subsidiary of ENRON Wind Corp.

EXHIBIT 8A

January 4, 1999

Bradley J. Mossman, Director
Office of Planning
Department of Business, Economic Development and Tourism
P O Box 2359
Honolulu HI 96804

Subject: Conservation District Use Permit Application #MA-2902, 20 MW Windfarm on Kaheawa Pastures, Ukumehame, Maui; TMK 4-8-01: par.1.

Dear Mr. Mossman:

This letter is in response to your letter to Mr. Mike Wilson, Chairperson, DLNR, dated September 29, 1998, same subject. Thank you for taking the time to review and comment on the subject application and the draft environmental assessment (EA) for the project. Per your recommendations, we will add a section to the EA to assess the project's compliance with Coastal Zone Management (CZM) objectives and policies.

Also, I would like to note that the original TMK reference (TMK: 4-08-01: par. 8) for the subject CDUA was inadvertently reported incorrectly. The correct designation is as stated above: TMK 4-8-01: par. 1.

If you have any further questions or comments regarding this environmental assessment, please call me at 800-605-1050. Mahalo!

Sincerely,

Keith Avery
Vice-President

485 Waiale Rd.
Wailuku, Hawaii 96793
PH: 808/244-9389 • FAX: 808/244-9538

13000 Jameson Rd.
Tehachapi, California 93561
PH: 805/822-6835 • FAX: 805/822-5015

309 Avalon Dr.
Ashland, Oregon 97520
PH: 541/482-0854 • FAX: 541/488-2504

PHONE (808) 594-1888

FAX (808) 594-1865

EXHIBIT 9

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

October 5, 1998

Post-it® Fax Note 7671	Date 10-15-98 # of pages ▸ 4
To Warren	From Lauren
Co./Dept.	Co. DLNR
Phone #	Phone # 587-0385
Fax # 241-7753	Fax # 587-0455

Mr. Keith Avery
Vice President
Zond Pacific, Inc.
485 Waiale Road
Wailuku, Hawai'i 966793

Re: Conservation District Use Permit Application #MA-2902 for the Construction and Operation of a Twenty Megawatt Windfarm at Kaheawa Pastures, Ukumehame, Maui, Hawai'i; TMK: 4-8-01: por. 08.

Dear Mr. Avery:

Thank you for the opportunity to comment on the Conservation District Use Application (CDUA) and Environmental Assessment (EA) for the proposed windfarm at Kaheawa Pastures, Ukumehame, Maui. Zond Pacific, Inc proposes to construct a 20 MW windfarm at Kaheawa Pastures in the Ahupua'a of Ukumehame, Maui. Zond Pacific, Inc. expects to supply wind-generated electricity to Maui Electric. The Office of Hawaiian Affairs has the following concerns with the preparation and/or conclusions in the draft EA, at this time.

First, we are concerned with the finding of non-significant impacts to flora. The EA explains that the project area is mostly grass lands with some scrub vegetation although, indigenous plants exist in the lower elevations of the project. The EA concludes that the impacts to flora will be negligible in the area of the windfarm. However, the project also includes the possibility of a new access road to the windfarm. Almost no information is included in the EA on the impacts to indigenous plants if a new access road is built Impacts from construction of a new road is not addressed. In addition, in the EA is silent on the potential for introducing new alien species to the windfarm and surrounding areas by vehicles traveling the access road. Hawai'i fragile ecosystems and its unique soil and climate conditions make any potential introduction of alien species a major concern which must be addressed in the EA.

Second, the EA superficially discusses the effects of the windfarm on the Pueo and the endangered Hawaiian Hoary bat. Both species are known to frequent the area. Any encounter with the blades of a windmachine would be fatal. Despite the finality of any encounter, the proposed mitigative measure consists of a wait and see attitude. This is not acceptable. We suggest that further studies be done and more effective mitigation be devised. Only after studies on elevations of flight, flight patterns, nesting and habitation areas are completed can a valid assessment be accomplished.

Mr. Keith Avery, Vice President
Zond Pacific, Inc.
October 5, 1998
Page two

Finally, the EA concludes that surface archaeological resources are not likely to be found in the area. However, the possibility exists that subsurface resources may be found during construction. The EA should contain some statement or plan on how such resources will be treated.

If you have any questions please contact Lynn Lee, EIS Planner at 594-1936.

Sincerely

Randall Ogata
Administrator

Lynn Lee
for Colin Kippen
Acting Land Division Officer

cc: Board of Trustees
Lauren Tanaka- DLNR

LAND MANAGEMENT DIV. ID:808-587-0455 OCT 15'98 14:57 No.007 P.02

Zond
ZOND PACIFIC INC.
A Subsidiary of ENRON Wind Corp.

EXHIBIT 9A

January 4, 1999

Randall Ogata, Administrator
Colin Kippen, Acting Land Division Officer
Office of Hawaiian Affairs
711 Kapiolani Boulevard, Suite 500
Honolulu HI 96813

Subject: Conservation District Use Permit Application #MA-2902 for the Construction and Operation of a Twenty Megawatt Windfarm at Kaheawa Pastures, Ukumehame, Maui; TMK 4-8-01: par.1.

Dear Messrs. Nagata and Kippen:

This letter is in response to your letter to me, dated October 5, 1998, same subject. Thank you for taking the time to review and comment on the subject application and the draft environmental assessment (EA) for the project. I would like to respond to your comments regarding potential project impacts on flora, the Pueo and Hawaiian Hoary Bat, and archaeological sites. Also, please note that the original TMK reference (TMK: 4-08-01: par. 8) for the subject CDUA was inadvertently reported incorrectly. The correct designation is as stated above: TMK 4-8-01: par. 1.

Flora. Your comments were directed primarily to the proposed new access road to the windfarm and the potential for introducing new alien species to the windfarm. *After further review, Zond Pacific, Inc. (ZPAC) has decided to withdraw its proposal for construction of a new site access road and will utilize the existing road for site access. However, since there is concern regarding traverse of the upper, more sensitive areas of the Kaheawa Pastures, ZPAC is investigating the possibility of utilizing an existing secondary spur that traverses the Manawainui Gulch at approximately 2,800 ft. elevation. This would avoid use of approximately two miles of the upper roads. Since this existing spur road would need to be improved to allow transport of equipment to the site, ZPAC commissioned an inspection of the proposed route by its plant consultant (Art Medeiros). This first inspection did identify native species along the route. ZPAC's new construction plans will include removing and replacing individual plants under appropriate supervision (e.g., Mr. Medeiros). Messrs. Rene Silva and Edwin Lindsey from Na Kupuna O Maui have also inspected the proposed site and access route. Mr. Silva has proposed that he work with ZPAC to plan and implement a native flora propagation program on the site in conjunction with the windfarm construction and operation. ZPAC has agreed that this is an excellent idea, especially in light of the recent fire that has virtually burned all vegetation to the ground in the project area.. These changes will be incorporated in the revised EA. We will keep you appraised of our plans.*

Your points regarding the introduction of alien species are well-taken and were overlooked in the preparation of the draft EA. *Protocol for inspecting and cleaning all vehicles traveling to the site will be included in the revised EA.*

485 Waiale Rd.
Wailuku, Hawaii 96793
PH: 808/244-9389 • FAX: 808/244-9539

13000 Jameson Rd.
Tehachapi, California 93561
PH: 805/822-6835 • FAX: 805/822-5015

309 Avalon Dr.
Ashland, Oregon 97520
PH: 541/482-0854 • FAX: 541/488-2504

Randall Ogata, Administrator
Colin Kippen, Acting Land Division Officer
Office of Hawaiian Affairs

January 4, 1999
Page 2

Pueo and Hawaiian Hoary Bat. Your concerns are primarily the risk to the Pueo and the Hawaiian Hoary Bat, which to date only the Pueo are known to frequent the area. You are also concerned that the proposed mitigative measures are not sufficient. *We share your concerns regarding the safety of the Pueo, as we and our consultant Eric Nishibayashi have observed them in the project area. We recently met with DLNR staff (Carol Terry, Fern Duval, John Medeiros, John Cummings and Mike Baker). As a result of the meeting, ZPAC will be conducting additional surveys to identify in more detail the avian species that habitate or frequent the area. Please let us know if you have more specific recommendations regarding the survey methodology and or would like to participate in the planning and implementation of the surveys.*

In the surveys conducted to date, bats have not been observed. Please note that Eric or his assistant were observing in late PM periods, though not generally past dusk. Preliminary discussions of the project with two bat experts, Theresa Cabrera and Reggie Hand, have suggested that the project area is not prime habitat for bats. Since you have stated that the Hawaiian Hoary Bat is known to frequent the area, we will contact you to discuss this matter further.

Archaeological Sites. Our comment regarding the possibility that subsurface archaeological resources may be found during construction is well-taken. *The EA will be revised to include instructions, should historic remains are inadvertently uncovered during construction, for all work to cease in the vicinity; and that ZPAC will contact both its archaeological consultant (International Archaeological Research Institute, Inc.) and the State Historic Preservation Division (SHPD) office. Further construction will continue after approval from SHPD.*

If you have any further questions or comments regarding this environmental assessment, please call me at 800-605-1050. Mahalo!

Sincerely,

Keith Avery
Vice-President

4182

EXHIBIT 10

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

BRADLEY J. MOSSMAN
DEPUTY DIRECTOR
RICK EGGED
DIRECTOR, OFFICE OF PLANNING

ENERGY, RESOURCES, AND TECHNOLOGY DIVISION
235 South Beretania St., 5th Flr., Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Tel.: (808) 587-3807
Fax: (808) 586-2536

SCA Misc: WBsm 10.7.98

RECEIVED
98 OCT 9 A8:35
DEPT. OF LAND & NATURAL RESOURCES STATE OF HAWAII

October 7, 1998

Mr. Michael D. Wilson
Director
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Wilson:

Thank you for your letter of September 17, 1998, asking for our review and comment on the Conservation Use Permit Application #MA-2902 for the Construction and Operation of a Twenty Megawatt Windfarm at Kaheawa Pastures, Ukumehame, Maui, Hawaii; TMK: 4-8-01: por. 08.

We strongly support and urge approval of the proposed windfarm as it comports with State Energy Policy Objectives as listed in Hawaii Revised Statutes Section 226-18(a). It meets the objectives of planning for:

1. Dependable, efficient, and economical state-wide energy systems capable of supporting the needs of the people;
2. Increased energy self-sufficiency where the ratio of indigenous to imported energy use is increased; and
3. Greater energy security in the face of threats to Hawaii's energy supplies and systems.

The impacts on the land are relatively minor compared to the effects of a similar amount of fossil-fueled generation capacity. The proposed windfarm will make a major positive contribution to reducing Hawaii's dependence on foreign oil, reducing air pollution and greenhouse gas emissions, and enhancing the quality of Maui's environment.

The Department of Business, Economic Development, and Tourism urges approval of the Conservation Use Permit Application. Thank you for the opportunity to provide these comments.

Sincerely,

for [signature]
Maurice H. Kaya, P.E.
Energy, Resources, and Technology
Program Administrator

EXHIBIT 10A

Zond
ZOND PACIFIC INC.
A Subsidiary of ENRON Wind Corp.

January 4, 1999

Maurice Kaya, Program Administrator
Energy, Resources and Technology
Department of Business, Economic Development and Tourism
P O Box 2359
Honolulu HI 96804

Subject: Conservation District Use Permit Application #MA-2902, 20 MW Windfarm on Kaheawa Pastures, Ukumehame, Maui; TMK 4-8-01: par.1.

Dear Mr. Kaya:

This letter is in response to your letter to Mr. Mike Wilson, Director, DLNR, dated October 7, 1998, same subject. Thank you for taking the time to review and comment on the subject application and the draft environmental assessment (EA) for the project. We appreciate your support of the project.

Also, I would like to note that the original TMK reference (TMK: 4-08-01: par. 8) for the subject CDUA was inadvertently reported incorrectly. The correct designation is as stated above: TMK 4-8-01: par. 1.

If you have any further questions or comments regarding the CDUA, environmental assessment or the project plans, please call me at 800-605-1050. Mahalo!

Sincerely,

Keith Avery
Vice-President

LINDA LINGLE
Mayor

LISA M. NUYEN
Director

DONALD A. SCHNEIDER, II
Deputy Director

CLAYTON I. YOSHIDA
Planning Division

AARON H. SHINMOTO
Zoning Administration and
Enforcement Division

EXHIBIT 11

COUNTY OF MAUI
DEPARTMENT OF PLANNING

October 14, 1998

Ms. Laura Tanaka
Department of Land and Natural Resources
P. O. Box 621
Honolulu, Hawaii 96809

Dear Ms. Tanaka:

RE: Conservation District Use Permit Application No. MA-2902, for the Construction and Operation of a Twenty Megawatt Windfarm at Kaheawa Pastures, Ukumehame, Maui Hawaii; TMK: 4-8-01:Por. 08

Thank you for the opportunity to comment on this application. In general, the Maui Planning Department (Department) supports the development of this kind of alternative energy facility as it will reduce our island's dependency on fossil fuels. It is also consistent with the policies of our General and Community Plans.

Our primary concern with this facility is visual. The island's beauty is an extremely valuable amenity to both our residents and the visitor industry. The project site is clearly visible from the Kihei/Wailea area and Upcountry, stretching from Ulupalakua through Pukalani. This encompasses approximately one-third of the island's population, and one of our scenic vistas. Our concern stems from this Department's experience with the visibility of certain small structures in Kula, or on the ridge of Haleakala, from Wailuku. This is over 20 miles away.

The text says that the computer simulations are darker than what would be expected after construction; and nowhere does it say what color the turbines would be. We can only assume they will be the near-white color shown in the photos. This leaves us with inconclusive analysis, and the impression that the project may be more visible than anticipated.

250 SOUTH HIGH STREET, WAILUKU, MAUI, HAWAII 96793
PLANNING DIVISION (808) 243-7753; ZONING DIVISION (808) 243-7253; FACSIMILE (808) 243-7634

Ms. Laura Tanaka
October 14, 1998
Page 2

This Department also disagrees with the statement that most observers would view the windfarm as "visually aesthetic" (Pg. 3-84). Regardless of the tours, or the educational efforts, it is clear that the appearance of what is now an unobstructed ridgeline will change. Some members of the public will find this unacceptable.

Since the visual impacts remain an "unresolved issue" (Pg. 1-8), we believe the permit should be conditioned for after-the-fact evaluation and mitigation of visual impacts. Other steps such as a change in color could be implemented.

We also suggest that the permit be conditioned to deal with the possibility of project bankruptcy. Should the project fail, the County does not want the removal of the turbines to be at the taxpayers' expense.

If you have any questions, please contact Mr. William Spence, Staff Planner, of this office at 243-7735.

Sincerely,

for LISA M. NUYEN
Director of Planning

LMN:WRS:cmb
c: Clayton Yoshida, AICP, Planning Program Administrator
Will Spence, Staff Planner
Project File
General File
S:\ALL\WILL\CORESPON\WINDFARM.WPD

LAND MANAGEMENT DIV. ID:808-587-0455 NOV 16'98 8:26 No.002 P.02

LINDA LINGLE
Mayor

LISA M. NUYEN
Director

DONALD A. SCHNEIDER, II
Deputy Director

CLAYTON I. YOSHIDA
Planning Division

AARON H. SHINMOTO
Zoning Administration and
Enforcement Division

COUNTY OF MAUI
DEPARTMENT OF PLANNING

EXHIBIT 11

October 14, 1998

Ms. Laura Tanaka
Department of Land and Natural Resources
P. O. Box 621
Honolulu, Hawaii 96809

Dear Ms. Tanaka:

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Our primary concern with this facility is visual. The island's beauty is an extremely valuable amenity to both our residents and the visitor industry. The project site is clearly visible from the Kihei/Wailea area and Upcountry, stretching from Ulupalakua through Pukalani. This encompasses approximately one-third of the island's population, and one of our scenic vistas. Our concern stems from this Department's experience with the visibility of certain small structures in Kula, or on the ridge of Haleakala, from Wailuku. This is over 20 miles away.

The text says that the computer simulations are darker than what would be expected after construction; and nowhere does it say what color the turbines would be. We can only assume they will be the near-white color shown in the photos. This leaves us with inconclusive analysis, and the impression that the project may be more visible than anticipated.

Ms. Laura Tanaka
October 14, 1998
Page 2

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If you have any questions, please contact Mr. William Spence, Staff Planner, of this office at 243-7735.

Sincerely,

for LISA M. NUYEN
Director of Planning

LMN:WRS:cmb
c: Clayton Yoshida, AICP, Planning Program Administrator
Will Spence, Staff Planner
Project File
General File
S:\ALL\WILL\CORESPON\WINDFARM.WPD

ZOND PACIFIC INC.
A Subsidiary of ENRON Wind Corp.

EXHIBIT 11A

January 4, 1999

Ms. Lisa M. Nuyen
Director of Planning
County of Maui
200 South High Street
Wailuku, Maui HI 96793

Subject: Conservation District Use Permit Application No. MA-2902, for the Construction and Operation of a Twenty Megawatt Windfarm at Kaheawa Pastures, Ukumehame, Maui, Hawaii; TMK: 4-8-01, par.1.

Dear Ms. Nuyen:

This letter is in response to your letter to Ms. Lauren Tanaka, Land Division, DLNR, dated October 14, 1998, same subject. Thank you for taking the time to review and comment on the subject Conservation District Use Permit Application and draft environmental assessment (EA). I would like to respond to your comments regarding potential visual impact and removal of the turbines at the conclusion of the project. I would also like to note that the original TMK reference (TMK: 4-08-01: par. 8) for the subject CDUA was inadvertently reported incorrectly. The correct designation is as stated above: TMK 4-8-01: par. 1.

Visual Impact. We understand your general concern with visual impact to be related to how visible the project might be from the Kihei/Wailea area and Upcountry, stretching from Ulupalakua through Pukalani.
Response: *We understand and appreciate you concern regarding potential impact. One of the reasons that ZPAC selected the site at Kaheawa Pastures was its remote location and the fact that the turbines would not be visible from the Honapiilani Highway.*

Referring to the visual impact section of the environmental assessment, you have noted that the color of the turbines was not stated.
Response: *the turbines (including the nacelles and blades) will be painted in an off-white color. The towers will be constructed of galvanized steel, which is dull-gray color. We apologize for this oversight and will correct the text.*

You have commented that the "Department also disagrees with the statement that most observers would view the windfarm as 'visual aesthetic' (Pg. 3-84). Regardless of the tours, or the educational efforts, it is clear that the appearance of what is now an unobstructed ridgeline will change."
Response: *We would like to note: (1) reasonable people can disagree as to what is visually aesthetic. For example, from our experience we have found that many observers note that wind turbines add a positive feeling relating to the awareness that a natural*

renewable energy resource is being utilized instead of fossil energy; (2) views of the Kealaloia ridge currently are not actually free from views of manmade objects. Roads, utility poles and lines can be seen from the main highway, as you drive from Wailuku or Maalaea. However, the turbines would not be visible from the Honoapiilani Highway; (3) the turbines will be visible from the Kihei/Waimea and Upcountry areas at distances of six miles and more; and (4) the only views of the turbines that will place them against the sky will be from various locations on the Kaheawa Pastures, possibly from the Old Lahaina Pali Trail or from aircraft landing or taking off from the Kahului airport, and possibly from Upcountry viewpoints at 2,000 to 3000' above sea level and over ten miles away.

You stated "Since the visual impacts remain an 'unresolved Issue' (Pg. 1-8), we believe the permit should be conditioned for after-the-fact evaluation and mitigation of visual impacts. Other steps such as change in color could be implemented."
Response: *During the preparation of the draft EA, the issue of visual impact was considered unresolved pending comments from government agencies and the community. We have received comments from several others regarding visual impact. Consequently, we believe it is now appropriate need to assess whether the potential visual impact meets the criteria for significant impact as defined in section 11-200-12 of Hawaii Administrative Rules. Specifically, one of the thirteen significance criteria an agency uses t determine if a proposed action may have significant impact (and thus require the preparation of a full environmental impact statement) is whether the action 'substantially affects scenic vistas and viewplanes identified in county or state plans or studies'..."*

In response, we believe the assessment of visual impact must be made in the context of the project's overall benefits, i. e., the windfarm provides an alternative source of electrical energy for Maui, one which reduces pollution and brings outside investment, revenues and jobs to Maui. Wind turbines are necessarily visible, as are other power facilities. The goal of the windfarm visual design in the Kaheawa Pastures is to reduce the visual impact to humans to a minimum. As noted in the *draft environmental assessment, a number of steps were taken in the preliminary project design phase to minimize the visual impact (e.g., there is only one row of turbines, the turbines would be identical in design, shape, height and color, the site's electrical network will be buried underground, etc.).*

We would like to note that there is one particularly important trade-off in the visual design process. The trade-off is between making the turbines sufficiently visible to alert birds and aircraft pilots versus avoiding visual impacts that offend common human sensibilities. Thus, ZPAC's goal is protect the birds and the pilots while at the same time not installing turbines that will be viewed as visually intrusive. Regarding color, off-white has been determined by industry to be the best color for wind turbines in most landscape locations.

We believe we have designed the proposed windfarm using the best industry practices. Given our response to your concerns, we would now like to ask you if you believe the project will result in significant visual impacts.

Ms. Lisa M. Nuyen, Dir. of Planning
County of Maui

January 4, 1999
Page 3

<u>Removal of the Turbines Upon Project Completion</u>. You stated "We also suggest that the permit be conditioned to deal with the possibility of bankruptcy. Should the project fail, the County does not want the removal of the turbines to be at taxpayers' expense." ***Response:*** *your point is well-taken and we concur. We anticipate that the CDUP will include a clause requiring turbine removal at completion of the project.*

If you have any further questions or comments regarding this application or the EA, please call me at 800-605-1050. Mahalo!

Sincerely,

Keith Avery
Vice-President

LINDA CROCKETT LINGLE
Mayor

CHARLES JENCKS
Director

DAVID C. GOODE
Deputy Director

AARON SHINMOTO, P.E.
Chief Staff Engineer

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT
LAND USE AND CODES ADMINISTRATION
250 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration

EASS
Wastewater

LLOYD P.C.W. LEE, P.E.
Engineering Division

Solid Waste Division

BRIAN HASHIRO, P.E.
Highways Divisions

EXHIBIT 12

OCT 26 3 04 PM '98

October 21, 1998

Ms. Lauren Tanaka
State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
1151 Punchbowl Street
Honolulu, Hawaii 96813

SUBJECT: CONSERVATION DISTRICT USE APPLICATION #MA-2902
TWENTY MEGAWATT WINDFARM (PROPOSED BY ZOND PACIFIC, INC.) AT KAHEAWA PASTURES, UKUMEHAME, MAUI, HAWAII
TMK (2) 4-8-001: 008

Dear Ms. Tanaka:

The proposed windfarm project is located in the State Land Use Commission's Conservation District, therefore, my department does not have regulatory jurisdiction that will affect the project. However, we recommend that the project developers be required to comply with the county's construction (building, electrical and plumbing) codes and the county's grading ordinance.

Please call Ralph Nagamine at (808) 243-7379 if you have any questions regarding this letter.

Very truly yours,

CHARLES JENCKS
Director of Public Works
and Waste Management

RMN S:\LUCA\CZM\ZOND.WPD

c: Planning Department

Zond
ZOND PACIFIC INC.
A Subsidiary of ENRON Wind Corp.

EXHIBIT 12A

January 4, 1999

Charles Jencks, Director
Department of Public Works and Waste Management
County of Maui
220 South High Street
Wailuku, Maui, HI 96793

Subject: Conservation District Use Application # MA-2902 Twenty Megawatt Windfarm (Proposed by Zond Pacific, Inc.) at Kaheawa Pastures, Ukumehame, Maui, Hawaii; File; TMK: 4-8-01, par.1.

Dear Mr. Jencks:

This letter is in response to your letter to Ms. Lauren Tanaka, Land Division, DLNR, dated October 21, 1998, same subject. Thank you for taking the time to review and comment on the subject Conservation District Use Application (CDUA) and the draft environmental assessment (EA). I would also like to note that the original TMK reference (TMK: 4-08-01: par. 5) for the subject CDUA was inadvertently reported incorrectly. The correct designation is as stated above: TMK 4-8-01: par. 1.

We concur with your comment that the project developers be required to comply with the county's construction (building, electrical and plumbing) codes and the county's grading ordinance. When the project has been approved by DLNR, we will contact you regarding the permits appropriate for the project.

If you have any further questions regarding this response, please call me at 800-605-1050. Mahalo!

Sincerely,

Keith Avery
Vice-President

485 Waiale Rd.
Wailuku, Hawaii 96793
PH: 808/244-9389 • FAX: 808/244-6539

13000 Jameson Rd.
Tehachapi, California 93561
PH: 805/822-6835 • FAX: 805/822-5015

309 Avalon Dr.
Ashland, Oregon 97520
PH: 541/482-0654 • FAX: 541/488-2504

EXHIBIT 13

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Ecoregion
300 Ala Moana Boulevard, Room 3122

Post-it® Fax Note 7671	Date 10/26/98 # of pages ▸ 2
To Warren	From Lauren
Co./Dept.	Co.
Phone #	Phone # 587-0385
Fax # 247-7753	Fax #

In Reply Refer To: DH

OCT 22 1998

98 OCT 26 P3:15

RECEIVED
DEPT. OF LAND & NATURAL RESOURCES STATE OF HAWAII

Michael D. Wilson
Department of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

Re: Conservation District Use Permit Application #MA-2902, Construction and Operation of a Twenty Megawatt Windfarm, Ukumehame, Maui, Hawaii

Dear Mr. Wilson;

The U.S. Fish and Wildlife Service (Service) has reviewed the Draft Environmental Assessment (DEA) and permit application for the construction and operation of a 20 megawatt windfarm to be located at Kaheawa Pastures, Ukumehame, Maui. The applicant is Zond-Pacific, Incorporated (ZOND) and the project sponsor is the Hawaii Department of Land and Natural Resources (DLNR). The proposed windfarm would consist of a single articulated row of 27 wind turbines, each supported on a 50 meter high lattice tower. The fiberglass rotor blades have a diameter of 48 meters. Power generated by the turbines will be routed via underground cables through a substation and provided to the Maui Electric Company Limited (MECO). In preparation for this project a feasibility study was conducted in which six wind measurement towers were installed in 1995. The Service offers the following comments for your consideration.

The 3-month study conducted at this project site to address the potential collision of birds with wind towers found no evidence that there was bird mortality associated with the wind measuring towers. However, continued monitoring should be conducted after construction of the windfarm towers to ensure that these structures are not sources of mortality to endangered birds such as nene (*Branta sandvicensis*) or dark-rumped petrels (*Pterodroma phaeopygia sandwichensis*) or to the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*). Biweekly surveys should be conducted with the onset of turbine operation and should be continued through the peak periods of seasonal bird and bat activity. In addition, noted mitigation measures, such as enhancing the visibility of the towers, rotors, and guy wires to reduce bird collisions need to be implemented. In addition to the monitoring to be conducted by the contractor, State and/or Federal biologists should be granted access to conduct periodic checks for bird mortality. No threatened or endangered plants were located at the proposed project site.

The DEA states that windfarms have been noted to encourage mice and rat populations on the mainland. Since these alien rodents are typically detrimental to Hawaiian ecosystems and since their elevated abundance could lead to an increased chance of raptors, such as the pueo (*Asio flammaeus sandwichensis*), which is a native species of concern, or the introduced barn owl (*Tyto alba*), colliding with the windfarm structures. The Service recommends that monitoring be conducted to determine if mice, rats, or other alien mammals (e.g., mongooses, cats, dogs) increase due to project impacts or activities. The Service further recommends that if these species increase, then appropriate mitigation measures be conducted by the applicant to reduce the number of these species to an acceptable (i.e., background) level.

In addition, our communications with the Federal Aviation Administration (FAA) indicate that their agency has not been contacted regarding this project. Such a project requires that a *Notice of Construction* and Alteration, provided by the FAA, be completed by the applicant and returned to the FAA. If, after reviewing this potential project, the FAA determines that this project may pose a serious threat to any federally listed threatened or endangered species, then FAA should initiate consultation with the Service in order to comply with section 7 of the Endangered Species Act.

The Service appreciates the opportunity to comment on this DEA and permit application. If you have questions regarding these comments, please contact Fish and Wildlife Biologists Dave Hopper or Lorena Wada by phone at (808) 541-3441.

Sincerely,

Donald Palawski

Robert P. Smith
Pacific Islands Manager

cc: FAA, Darice Young
DOFAW, Maui
Zond-Pacific

Zond
ZOND PACIFIC INC
A Subsidiary of ENRON Wind Corp.

EXHIBIT 13A

January 4, 1999

Robert Smith
Pacific Islands Manager
USDOI, Fish & Wildlife Service
P. O. Box 50088
Honolulu HI 96850

Subject: Conservation District Use Permit Application No. MA-2902, Construction and Operation of a Twenty Megawatt Windfarm, Ukumehame, Maui, Hawaii.

Dear Mr. Smith:

This letter is in response to your letter to Mr. Mike Wilson, Director, DLNR, dated October 22, 1998, same subject. Thank you for taking the time to review and comment on the subject Conservation District Use Permit Application and draft environmental assessment (EA). I would also like to note that the original TMK reference (TMK: 4-08-01: par. 8) for the subject application was inadvertently reported incorrectly. The correct designation is TMK 4-8-01: par. 1. The following is our response to your comments:

(1) potential collision for birds with wind towers – you have suggested that continued monitoring be conducted after the construction of the windfarm towers to ensure that these structures are not sources of mortality to endangered birds such as nene (*Branta sandvicensis*) or dark-rumped petrels (*Pterodramoa phaeopygisa sandvicensis*) or to the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*). You have provided suggestions for the monitoring program and enhancing the visibility of the towers, rotors, and guys wires, and for gaining site access.

Response: your concerns are similar to those received from DLNR/DOFAW. We met with DOFAW staff on Maui on December 18, 1998 to discuss their concerns. The meeting was very helpful in terms of gaining a better understanding of DNLR's comments on the EA and DLNR's plans for the Ukumehame District. We believe the interchange also helped DLNR gain a better understanding of Zond Pacific's plans. The discussion centered on the concerns regarding the safety and habitat of the avifauna (especially the Nene) that are either residents in or that may frequent the proposed project area. Zond Pacific recognizes the possibility that Nene individuals may collide with one or more of the wind turbines. Given that, we consider the potential impact to Nene individuals to be *significant*. However, at this time, there are insufficient data either to assess whether the project would put the local Nene population at risk.

485 Waiale Rd.
Wailuku, Hawaii 96793
PH: 808/244-9389 • FAX: 808/244-9539

13000 Jameson Rd.
Tehachapi, California 93561
PH: 805/822-6835 • FAX: 805/822-5015

300 Avalon Dr.
Ashland, Oregon 97520
PH: 541/482-0854 • FAX: 541/488-2504

In addition, we collectively do not know what mitigative measures would prevent Nene collisions with the wind turbines and or their towers. Therefore, we agree with DLNR staff that a new survey needs to be conducted to confirm the presence of the Nene on the project site and to study their habits. Zond Pacific's goal is to use the results of the survey to devise an improved mitigative measures strategy to minimize the incremental risks of the project to the Nene. It was also agreed that surveys should also be conducted to identify the presence and habits of other important species, including the Dark-rumped Petrel, Wedge-tailed and Newell's Shearwater, and the Pueo. In our discussions with local bat experts, it would appear that the project area is not considered prime bat habitat. However, we did not discuss the potential impact on the Hawaiian Hoary Bat during the DLNR meeting. Therefore, we will follow-up with DOFAW and you regarding specific concerns. We are happy to allow you access to the site, contingent upon approval from DLNR, to participate in subsequent surveys or for other purposes.

(2) the potential for the project to encourage increases in mice and rat populations on the project site – if these populations increase, there is increased risk of native pueo (*Asio flammaeus sandwichensis*) and the barn owl (*Tyro alba*) collisions with the windfarm structures. You recommend monitoring the mice, rat and other alien mammal populations, and, if warranted, taking appropriate action to reduce the populations to an acceptable (e. g., background) level, and

Response: This concern has also been raised by DOFAW. After further review, ZPAC does not believe the windfarm design as proposed will encourage significant increases in rodent populations. Where there have been increases of rodent populations on mainland windfarms, several factors were present there, which will not be present at the proposed site. These include: (1) a higher density of turbines leading to a greater disturbance of the land. ZPAC will minimize actual permanent disturbance of the land as discussed in the EA; (2) areas of disturbed land that were either not necessary (e.g., unnecessary on-site roads) or were not revegetated where possible (e.g., areas disturbed around tower foundations), and (3) lack of attention to good housekeeping habits (e.g., rubbish, including construction materials and broken wind turbine parts, was not removed on a regular basis).

Mitigation measures will be implemented during construction and operation of the proposed windfarm project to: (1) prevent transport of rodents to the site, (2) minimize disturbance of the land, (3) construct and maintain rodent-proof site structures, (4) remove rubbish expeditiously during construction and routinely during operation, and (5) trap rodents should that prove to be necessary.

CORRECTION

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

In addition, we collectively do not know what mitigative measures would prevent Nene collisions with the wind turbines and or their towers. Therefore, we agree with DLNR staff that a new survey needs to be conducted to confirm the presence of the Nene on the project site and to study their habits. Zond Pacific's goal is to use the results of the survey to devise an improved mitigative measures strategy to minimize the incremental risks of the project to the Nene. It was also agreed that surveys should also be conducted to identify the presence and habits of other important species, including the Dark-rumped Petrel, Wedge-tailed and Newell's Shearwater, and the Pueo. In our discussions with local bat experts, it would appear that the project area is not considered prime bat habitat. However, we did not discuss the potential impact on the Hawaiian Hoary Bat during the DLNR meeting. Therefore, we will follow-up with DOFAW and you regarding specific concerns. We are happy to allow you access to the site, contingent upon approval from DLNR, to participate in subsequent surveys or for other purposes.

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Response: This concern has also been raised by DOFAW. After further review, ZPAC does not believe the windfarm design as proposed will encourage significant increases in rodent populations. Where there have been increases of rodent populations on mainland windfarms, several factors were present there, which will not be present at the proposed site. These include: (1) a higher density of turbines leading to a greater disturbance of the land. ZPAC will minimize actual permanent disturbance of the land as discussed in the EA; (2) areas of disturbed land that were either not necessary (e.g., unnecessary on-site roads) or were not revegetated where possible (e.g., areas disturbed around tower foundations), and (3) lack of attention to good housekeeping habits (e.g., rubbish, including construction materials and broken wind turbine parts, was not removed on a regular basis).

Mitigation measures will be implemented during construction and operation of the proposed windfarm project to: (1) prevent transport of rodents to the site, (2) minimize disturbance of the land, (3) construct and maintain rodent-proof site structures, (4) remove rubbish expeditiously during construction and routinely during operation, and (5) trap rodents should that prove to be necessary.

(3) **Required Consultation with the FAA - you had noted that as of October 22, 1998, the FAA had not been contacted regarding this project.**

Response: That is correct. Subsequently, I forwarded the Notice of Construction or Alteration for the project to the FAA on December 14, 1998. As of this writing, we have not heard from them. We will contact you to discuss this issue further.

If you have any questions regarding this response, please call me at 800-805-1050. Mahalo!

Sincerely,

Keith Avery
Vice-President

LD 4379

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

EXHIBIT 14

OCT 27 9 23 AM '98

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

In reply, please refer to:

October 23, 1998

98-205/epo

TO: The Honorable Michael D. Wilson, Chairperson
Department of Land and Natural Resources

FROM: Lawrence Miike
Director of Health

SUBJECT: CONSERVATION DISTRICT USE APPLICATION

Applicant:	Zond Pacific, Inc.
File No.:	MA-2901
Request:	Construction and Operation of a 20 Megawatt Windfarm
Location:	Kaheawa Pastures, Ukumehame, Maui
TMK:	4-8-1: por. of 8

Thank you for allowing us to review and comment on the subject request. We do not have any comments to offer at this time.

RECEIVED
98 OCT 26 P 3:15
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

LAND MANAGEMENT DIV. ID:808-587-0455 NOV 16'98 8:25 No.002 P.05

ZOND PACIFIC INC.
A Subsidiary of ENRON Wind Corp.

EXHIBIT 14A

January 4, 1999

Lawrence Miike
Director of Health
Department of Health
P O Box 3378
Honolulu HI 96809

Subject: Conservation District Use Application No. MA-2902, for the Construction and Operation of a Twenty Megawatt Windfarm at Kaheawa Pastures, Ukumehame, Maui, Hawaii; TMK: 4-8-01, par.1.

Dear Mr. Miike:

This letter is in response to your letter to Mr. Mike Wilson, Chairperson, DLNR, dated October 23, 1998, same subject.

Thank you for taking the time to review and comment on the subject Conservation District Use Application and the draft environmental assessment (EA). I would also like to note that the original TMK reference (TMK: 4-08-01: par. 8) for the subject CDUA was inadvertently reported incorrectly. The correct designation is as stated above: TMK 4-8-01: par. 1.

If you have any questions regarding this application, please call me at 800-605-1050. Mahalo!

Sincerely,

Keith Avery
Vice-President

485 Waiale Rd.
Wailuku, Hawaii 96793
PH: 808/244-9389 • FAX: 808/244-8539

13000 Jameson Rd.
Tehachapi, California 93561
PH: 805/822-6835 • FAX: 805/822-5015

809 Avalon Dr.
Ashland, Oregon 97520
PH: 541/482-0654 • FAX: 541/488-2504

Nov. 6th, 1998

EXHIBIT 15

Kieth Avery
Zond Pacific, Inc.
485 Waiale Dr.
Wailuku, Hi, 96793

RE: KAHEAWA PASTURES WINDFARM, TMK: 4-08-01:08 Request by Zond Pacific for a Conservation Dist. Use Permit — of 6-11-98

Dear Kieth: BY COPY OF THIS LETTER, I ASK OUR DLNR. TO PLEASE REJECT THIS APPLICATION UNLESS THEY:

1 — OBTAIN AN ENFORCEABLE CONTRACT FOR EQUIPMENT REMOVAL, DISPOSAL, & LAND RESTORATION IN THE EVENT THE WINDFARM CEASES OPERATION.

2 — CAN BE SURE THAT ALL WINDFARM EQUIPMENT CANNOT BE SEEN FROM UKUMEHAME VALLEY — to the West.

I compliment you and Zond Pacific for a comprehensive Draft Environmental assessment. However, I believe that a statement in your APPLICATION FOR CONSVATION DISTRICT USE [Page 9 of 11 — XVI - 1.(b)] to be grossly incorrect. I do not believe that "the land can be easily restored to its existing Condition". The prospect of an abandoned operation &/or a bankrupt operator, bothers me greatly. Surely, the cost to the taxpayer to remove & dispose of the equipment & supporting infrastructure would be high. Removing & disposing of the MASSIVE TOWER BASES, alone, would be a huge effort at great cost.

I support the KYOTO PROTOCOL even though our U.S. Senate does not. I however have a strong feeling that the proposed system may not be economic for the following reasons:

1 — low avoided costs related to cap. equip. needed for low or no wind periods

2 — Cost & inefficiency of energy storage

3 — I believe that price of Oil & Gas will generally remain low for at least the first half of the next century, regardless of increasing demand & political disruptions for the following reasons:

(a) the world area for petroleum exploration & developemt has recently doubled.

(b) There have been many amazing recent advances in petroleum exploration, drilling, & production technologies.

thank for your help in getting material for me to review

Dave Chenoweth

DAVE CHENOWETH
340 FRONT ST.
LAHAINA, HI., 96761
808·661·8327
572·8328

COPY: Lauren Tanaka
DLNR. Land Division
P.O. Box 621, Honolulu, 96809

Mike Wilson
DLNR.
P.O. Box 621, Honolulu, Hi, 96809

Buck &

O.E.Q.C. 235 S. Beretania St
#702, Honolulu, 96813

CORRECTION

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

would be a [illegible] effort at great cost.

I support the KYOTO PROTOCOL even though our U.S. Senate does not. I however have a strong feeling that the proposed system may not be economic for the following reasons:

1 — low avoided costs related to cap. equip. needed for low or no wind periods

2 — Cost & inefficiency of energy storage

3 — I believe that price of Oil & Gas will generally remain low for at least the first half of the next century, regardless of increasing demand & political disruptions for the following reasons:

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Mike Wilson
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Buck &

O.E.Q.C. 235 S. Beretania St
#702, Honolulu, 96813

EXHIBIT 15A

Zond
ZOND PACIFIC INC
A Subsidiary of ENRON Wind Corp.

January 4, 1999

David Chenoweth
340 Front Street
Lahaina HI 96701

Subject: Re: Kaheawa Pastures Windfarm, TMK: 4-8-01, par.1, Request by Zond Pacific for a Conservation District Use Permit — of 6-11-98

Dear Mr. Chenoweth:

This letter is in response to your letter to me, dated November 6, 1998, same subject. Thank you for taking the time to review and comment on the subject Conservation District Use Permit request by Zond Pacific. I would also like to note that the original TMK reference (TMK: 4-08-01: par. 8) for the subject CDUA was inadvertently reported incorrectly. The correct designation is as stated above: TMK 4-8-01: par. 1.

I would like to respond to your comments as follows:

(1) **the need for an enforceable contract for equipment removal, disposal and land restoration in the event the windfarm ceases operation,**
Response: your point is well-taken and we concur. All of our windfarm land-use contracts or permits contain a clause requiring turbine removal at completion of the project. We anticipate that such a clause would be included in the Conservation District Use Permit with DLNR for this project.

(2) **your request that the wind turbines not be seen from the Ukumehame Valley – to the West,**
Response: the turbines will not be visible from the Ukumehame Valley.

(3) **you disagreed with Zond Pacific's statement "the land can easily be restored to its existing condition,"**
Response: As noted above, Zond Pacific would be required to remove all equipment at the end of the project. The wind turbines and their towers are designed for ease of installation and removal. Since the tower foundations are buried below the surface, returning the turbine sites to the original condition is a straightforward process. You are correct that a substantial amount of dollars would be required to remove the equipment. Should this occur due to any default on Zond Pacific's part, the removal costs will be covered by insurance.

(4) **you have raised questions regarding the economic viability of the project**
Response: We appreciate your concern regarding the challenge of making the proposed windfarm economically viable. Zond Pacific has been the business is to construct and operate windfarms for profit since 1984. Zond Pacific's parent company (Enron Wind Corporation) has been in this business, successfully since 1980. The principal factors determining project economic viability are: (a) an adequate wind resource at the site – the proposed site has an excellent wind resource, and (b) a financible Power Purchase Contract. In the case of the latter, projects can be economically viable today in Hawaii at the utility's power purchase price (i.e., its avoided cost) and given currently-available state and federal financial incentives. In the case of the proposed project, the economic viability looks good.

If you have any questions regarding this response, please call me at 800-605-1050.
Mahalo!

Sincerely,

Keith Avery
Vice-President

UD

4485

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

REPLY TO ATTENTION OF

EXHIBIT 16

RECEIVED
98 NOV 6 A8:10
DEPT. OF LAND & NATURAL RESOURCES STATE OF HAWAII

November 6, 1998

Operations Branch

Michael D. Wilson, Director
Department of Land and Natural Resources
State of Hawaii
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Wilson:

We have reviewed the Conservation District Use Permit Application #MA-2902 for the Construction and Operation of a Twenty Megawatt Windfarm at Kaheawa Pastures, Ukumehame, Hawaii; TMK: 4-8-01: por. 08. The application did not provide enough information to determine if the two gulches in the area are within the Corps' jurisdiction, or if the access road for the windfarm will cross the gulches, so we are not able to determine if a Department of the Army (DA) permit will be required for this project.

Sincerely,

George P. Young, P.E.
Chief, Operations Branch

EXHIBIT 16A

Zond
ZOND PACIFIC INC.
A Subsidiary of ENRON Wind Corp.

January 4, 1999

George P. Young, P. E.
Chief, Operations Branch
Department of the Army
U. S. Army Engineer District, Honolulu
Fort Shafter HI 96853-5440

Subject: Conservation District Use Permit Application No. MA-2802, for the Construction and Operation of a Twenty Megawatt Windfarm at Kaheawa Pastures, Ukumehame, Maui, Hawaii; TMK: 4-8-01, par.1.

Dear Mr. Young:

This letter is in response to your letter to Mr. Mike Wilson, Director, DLNR, dated November 9, 1998, same subject. Thank you for taking the time to review and comment on the subject Conservation District Use Permit Application and the draft environmental assessment (EA). I would also like to note that the original TMK reference (TMK: 4-08-01: par. 8) for the subject CDUA was inadvertently reported incorrectly. The correct designation is as stated above: TMK 4-8-01: par. 1.

You have raised two questions regarding the application related to the two gulches (the Malalowaiaole and Manawainui) in the area:

(1) will the access road for the windfarm will cross the gulches?
Response. The existing access to the windfarm is via a primary jeep road which crosses the Malalowaiaole Gulch at an elevation of about 1,600' and just after the road joins the Old Lahaina Pali Trail. The access road continues to climb to the old cattle corral near Puu Anu at an elevation of about 2,800'. We are investigating the possibility of utilizing an existing secondary spur that traverses west from the corral through an upper section of the Manawainui Gulch to the proposed windfarm site.

(2) do either of the gulches fall within the Corps' jurisdiction?
Response. We don't know. These two gulches are intermittent streams which empty into the ocean. We have contacted the DLNR Water Resource Management (WRM) regarding whether the improvement of the roads through either gulch would require a Stream Channel Alteration Permit (SCAP). As of this writing, we have not heard back from DLNR/WRM in this matter. We will follow-up with you.

If you have any questions regarding this response, please call me at 800-605-1050. Mahalo!

Sincerely,

Keith Avery
Vice-President

Safe Power Action Network
1314 South King Street # 306; Honolulu, HI 96814
phone: (808) 593-0300 fax: (808) 593-0525
christen@outdoorcircle.org

EXHIBIT 17

November 9, 1998

Lauren Tanaka
Department of Land & Natural Resources
1151 Punchbowl Street
Honolulu, HI 96813

Re: Zond Pacific 20 MW Windfarm Project Draft Environmental Assessment

Dear Ms. Tanaka:

On behalf of the Safe Power Action Network (SPAN), I would like to comment on the Zond Pacific 20 MW Windfarm Project Draft Environmental Assessment. SPAN is a statewide coalition of environmental organizations, community groups, legislators, and citizens, formed in response to Hawaiian Electric Company, Inc. (HECO)'s announced plans to build a third 138,000 volt electric transmission line from the Kamoku Substation (near Iolani School) into the Pukele Substation (in Palolo Valley), the proposed "Kamoku-Pukele line." SPAN's mission is to promote awareness and to act to protect the health, safety, and quality of life of the people of Hawai'i on issues involving energy and infrastructure planning and development through education and advocacy.

The Draft Environmental Assessment for Zond Pacific's planned windfarm on Maui is a well-written document that clearly explores the potential environmental impacts from the proposed project. That said, SPAN remains concerned about the visual and noise impacts of the project. At the same time, SPAN commends Zond Pacific for their computer simulations of the visual impact of the project. The towers appear clearly in the simulations, and their visual impact does not appear to be falsely minimized. SPAN defers, however, to the opinions of the residents of the area as to whether the impacts of the project have been appropriately mitigated.

SPAN would also note that the exploration of wind as an energy resource is sorely needed in this State. Zond Pacific's aid in reducing Hawaii's reliance on oil is welcomed. Their estimate that the windfarm will allow Maui Electric Company to avoid $46 million in oil purchases, combined with the avoided air pollution emissions from that oil, demonstrates how valuable alternative energy sources truly are.

Thank you for the opportunity to comment.

Sincerely,

Christen Mitchell

Christen Mitchell
SPAN Coordinator

cc: Keith Avery, Zond Pacific, Inc.
Warren Bollmeier, WSB-Hawaii

EXHIBIT 17A

Zond
ZOND PACIFIC INC
A Subsidiary of ENRON Wind Corp.

January 4, 1999

Christen Mitchell, Coordinator
Safe Power Action Network
1314 South King Street #308
Honolulu HI 96814

Subject: Zond Pacific 20 MW Windfarm Project Draft Environmental Assessment

Dear Ms. Mitchell:

This letter is in response to your letter to Lauren Tanaka, Land Division, DLNR, dated November 9, 1998, same subject. Thank you for taking the time to review and comment on the subject draft environmental assessment (EA).

I would also like to note that the original TMK reference (TMK: 4-08-01: par. 8) for the project was inadvertently reported incorrectly. The correct designation is TMK 4-8-01: par. 1.

The following is our response to your comments:

(1) you have expressed concerns about the project's potential visual impact and whether the impacts have been appropriately mitigated.
Response: we appreciate your frank comments of the potential impacts, including your assessment of computer-simulated photographs and the need for comments from residents of the area. We have proposed the remote location of the windfarm, in part, to minimize visual impacts. However, wind turbines are necessarily visible. We want their presence to alert birds and aircraft pilots on the one hand. On the other, we do not want to offend common human sensibilities. We believe we have visually designed the project to the best industry practice. We also realize that reasonable people can disagree on what is visually aesthetic or intrusive. As of this writing, the vast majority of the people we have contacted do not believe the potential visual impact to be significant. Please note also that the nearest residents live over two miles from the windfarm and will not be able to see the windfarm from their homes or from along the Honoapiilani Highway.

(2) you have expressed concerns about the project's potential noise impact and whether the impacts have been appropriately mitigated.
Response: As noted above, the nearest residents are over three miles from the windfarm. The turbines will not be audible at those distances.

If you have any questions regarding this response, please call me at 800-805-1050.
Mahalo!

Sincerely,

Keith Avery
Vice-President

465 Waiale Rd.
Wailuku, Hawaii 96793
PH: 808/244-9389 • FAX: 808/244-9539

13000 Jameson Rd.
Tehachapi, California 93561
PH: 805/822-6835 • FAX: 805/822-5015

309 Avalon Dr.
Ashland, Oregon 97520
PH: 541/482-0654 • FAX: 541/488-2504

BENJAMIN J. CAYETANO
GOVERNOR

EXHIBIT 18

GARY GILL
DIRECTOR

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

November 9, 1998

Mr. Keith Avery
Zond Pacific, Inc.
485 Wai'ale Drive
Wailuku, Hawai'i 96793

Dear Mr. Avery:

Having reviewed the draft environmental assessment (DEA) for the "Kaheawa Pastures Windfarm", Wailuku, Maui, Hawai'i, TMK 4-8-01:8, we submit the following comments for your response.

1. ADMINISTRATIVE REQUIREMENT TO INCLUDE EARLY CONSULTATION WRITTEN COMMENTS

Section 11-200-10, Hawai'i Administrative Rules states in pertinent part that an environmental assessment shall contain "(12) Written comments and responses to the comments under the early consultation provisions of ... section 11-200-9(b)(1) ... ."

The DEA does not include these documents. In the final environmental assessment, revise Section 6 to include copies of written comments (letters, documents, memoranda, etc. listed in Table 7.1) and responses to these comments.

2. VISUAL IMPACTS

In section 11-200-12, Hawai'i Administrative Rules, one of the thirteen significance criteria an agency uses to determine if a proposed action may have significant impact (and thus require the preparation of a full environmental impact statement) is whether the action "[s]ubstantially affects scenic vistas and viewplanes identified in county or state plans or studies ... ."

The proposed windfarm is on state-owned conservation land at elevations ranging from 2,000 to 3,200 feet above seal level. Your consultant clearly notes that the turbine towers depicted in the photographs (see, Figures 3.16.3-1 through 3.16.3-4) appear to have less impact than they probably would in a real photograph and in real life. Given the picture in Figure 3.16.1-1, we would expect the towers to stand out quite prominently in real life. Please provide more accurate renderings in the final environmental assessment.

Please consult with the Maui County Planning Department as to whether the Lahaina or Wailuku Community Plan identifies scenic vistas or viewplanes for the area in need of preservation. Please also consult with the Federal Aviation Administration to ascertain if their requirements would allow the painting of the towers and blades in earth-tone colors to minimize visual impacts.

3. **EFFECT OF TOWER LIGHTING ON AVIFAUNA**

If the FAA requires that the towers be lit at night, please discuss the impact of such lighting on avifauna in terms of bird and bat strikes.

4. **DISCUSSION OF EACH OF THE THIRTEEN SIGNIFICANCE CRITERIA**

Please discuss each of the thirteen significance criteria set forth in Section 11-200-12, Hawai'i Administrative Rules. A sample discussion is enclosed for your information.

A copy of all comment letters, and your responses must be submitted to the Department of Land and Natural Resources for their inclusion in the final environmental assessment and notice of determination for this project.

If there are any questions, please call Leslie Segundo, Environmental Health Specialist at 586-4185.

Sincerely,

GARY GILL
Director

c: Mr. Warren S. Bollmeier, WSB-Hawaii
Ms. Lauren Tanaka, DLNR

Enclosure

SECTION 9
DETERMINATION

This Environmental Assessment, prepared in accordance with Chapter 343, Hawaii Revised Statutes as amended, has concluded that the potential for impacts associated with the proposed action will be minimal.

The potential effects of the proposed project are evaluated based on the significance criteria in section 11-200-12 (Hawaii Administrative Rules, revised in 1996). The following is a summary of the potential effects of the action.

(1) Development of the project will involve the irrevocable loss of certain environmental and fiscal resources. However, the development of additional lots with improved infrastructure will benefit the Hawaiian beneficiaries of the State of Hawaii by providing homestead lots to those on the waiting list. The county of Hawaii will benefit in terms of additional consumer spending on construction materials, home furnishings, and appliances and associated tax revenues.

(2) The project will not curtail the range of beneficial uses of the environment. Due to rocky substrates most of the project area is not suitable for agricultural uses. All properties proposed for this project are currently undeveloped vacant lands. The surrounding areas are sparsely developed for single family residential use.

(3) The project would be in conformance to the Chapter 344, HRS, State Environmental Policy, to enhance the quality of life. It is the long term goal of the project to foster a Hawaiian lifestyle with subsistence homesteads traditional to Hawaiians of the recent past. The neighborhood that would result from this project would reflect the culture and values of the past Hawaiian communities.

(4) The proposed low density of homestead development is not anticipated to have significant effects on the economic or social welfare of the community or the state.

(5) The proposed low density project is not anticipated to have substantial effects on public health. The Department of Hawaiian Home Lands will improve existing facilities and provide infrastructure necessary to support the proposed development. The development of basic support infrastructure such as drainage, sewer, water and communication and electrical utilities, will be done in accordance with county standards and integrated with existing systems.

(6) The proposed low density of the homestead development is not anticipated to result in substantial secondary impacts. Hilo is the only major metropolitan area in Hawaii County and a major population center of the island. The present level of public facilities and services provides adequate services to handle the current demand. The proposed project is not expected to place enough of a demand to result in the need to increase the level of current facilities and services.

(7) The proposed project is not anticipated to involve a substantial degradation of environmental quality. Most of the immediate and surrounding areas of the project sites have previously been disturbed for agricultural and/or residential uses. All proposed sites are currently undeveloped vacant land and covered by overgrown vegetation mostly comprised of introduced species.

(8) The proposed low density of development is not anticipated to result in cumulative effects; therefore, it would not involve a commitment to larger actions.

(9) The proposed project is not anticipated to have substantial effects on a rare, threatened, or endangered species, or its habitat. Most of the sites have historically been modified for agricultural and urban-residential uses. The botanical survey conducted in September, 1996, did not find any plants listed or proposed for listing as Threatened or Endangered. No Threatened or Endangered fauna was seen or heard

during the recent site visit on September 20, 1996.

(10) No significant impacts on the area's long-term air or water quality or ambient noise levels are anticipated to result from the project. There will be some short-term impacts on the air quality and noise levels as a result of project construction. Adequate mitigation measures will be taken as described in Section 2.10 of this Environmental Assessment.

(11) The project is not anticipated to affect environmentally sensitive areas. However, the Hilo area has been subject to several natural hazards including flood, tsunami inundation, volcanic activity, and earthquakes. The potential threats of these natural hazards for the each project site are discussed in Section 2.8 of this Environmental Assessment.

(12) The proposed low density development will not significantly affect the area's visual resource. The most prominent feature of the landscape is the 14,000-foot peak of Mauna Kea. The magnificent views toward the mountain are seen from various locations within the general project area.

(13) The proposed scattered lot homestead development is not anticipated to result in substantial energy consumption.

In accordance with the provisions set forth in Chapter 343, Hawaii Revised Statutes, this Environmental Assessment has determined that the project will not have significant adverse impacts on the environment. The Department of Hawaiian Home Lands is considering the issuance of a Finding of No Significant Impact (FONSI). Anticipated impacts will be temporary and will not adversely impact the environmental quality of the area. Therefore, it is recommended that an Environmental Impact Statement (EIS) not be required.

EXHIBIT 18A

Zond
ZOND PACIFIC INC.
A Subsidiary of ENRON Wind Corp.

January 4, 1999

Gary Gill
Director, OEQC
235 South Beretania Street, Suite 702
Honolulu HI 96813

Subject: Draft Environmental Assessment for the Kaheawa Pastures Windfarm, Ukumehame, Maui, Hawaii; TMK: 4-8-01, par.1.

Dear Mr. Gill:

This letter is in response to your letter to me, dated November 9, 1998, same subject. Thank you for taking the time to review and comment on the subject draft environmental assessment (DEA). I would like to note that the original TMK reference (TMK: 4-08-01: par. 8) for the project was inadvertently reported incorrectly. The correct designation is as stated above: TMK 4-8-01: par. 1. Also, the Kaheawa Pastures are located in the Ukumehame Conservation District and the proposed windfarm would be located in the Lahaina District, Maui.

The following is our response to your comments:

(1) **Administrative Requirement to Include Early Consultation Written Comments per Section 11-200-10, Hawaii Administrative Rules.**
Response: Per your request, the DEA will be revised to include written comments and responses to the comments under the early consultation provisions of Section 11-200-10.

(2) **Re Visual Impacts: you have commented on the computer-simulated photographs of the turbines and the need to consult with the Maui County Planning Department.**
Response: As of this writing, the majority of the people we have contacted have not expressed the opinion that the potential visual impact would be significant. Specifically, we have not received any comments, based on the photographs and analysis provided in the EA, suggesting that the turbines would be visually intrusive except from Na Ala Hele trails group with concern of visual impact to trail hikers. In part, we believe the remote location of the proposed windfarm mitigates concern. Most people, that would see the turbines, would be viewing them at a distance, as from Kihei, Upcountry or from an airplane. We believe the computer-simulated photographs *overstate* the impression the actual turbines will give in real life *under most conditions*. We say *under most conditions* as there may be times (i.e., time of the day, atmospheric conditions, viewpoints, etc.) when the turbines will be as dark as in the photographs. Please note that the color of the wind turbines (nacelle and blades) is off-white, the color of the galvanized-steel, truss towers is a dull-gray. Please call if you would like to discuss this issue further.

Since the windfarm falls in the West Maui (Lahaina district) jurisdiction, we have reviewed the West Maui Community Plan along with the County of Maui

Plan, and have discussed potential visual impacts with the County of Maui Planning Department. The West Maui plan discusses protection of view corridors and scenic vistas and designing landscape buffers along major roadways in such a manner as to provide periodic views of the mountains and ocean. However, the plan doesn't identify specific scenic vistas or viewplanes. The County Plan is silent on the issue of visual impacts. The County of Maui has commented on potential visual impacts per their review of the EA. Our response to their comments are attached for your information. We will update the EA with this discussion.

We have submitted a Notice of Construction or Alteration to the Federal Aviation Administration (FAA). As of this writing, we have not heard back from the FAA regarding the proposed project. Based on our experience with the FAA on other projects, their normal concern has to do with lighting to alert aircraft pilots to the presence of the wind turbines that extend above 200' above ground level. That will be the case for the proposed project. As noted in the EA, off-white colors have been found to be the best for turbines in most locations. We are also proposing the use of truss-type, galvanized steel towers (which have a dull gray color). We believe the openness of this type of tower will reduce the visual impact to humans. These visual design features, we believe, provide find the best balance between making the turbines visible to birds and pilots on the one hand, while not offending common human sensibilities on the other hand.

(3) the effect of tower lighting on avifauna, and
Response: Other organizations, including DOFAW, have raised concerns regarding lighting. As with the trade-off on turbine and tower colors, there is a similar trade-off in lighting. Specifically, what type of lighting will alert avifauna and pilots on the one hand, but not attract avifauna on the other hand. The preliminary answer, after discussion with DOFAW, would appear to be red lights. We will be discussing these lighting issues further with the FAA and DOFAW, and will update the EA accordingly.

(4) discussion of the each of the thirteen significance criteria.
Response: Per your request, we will include a section in the revised EA to discuss the thirteen significance criteria.

Finally, we are in the process of responding to each of the draft EA reviewers and will include copies of all letters and responses in the final EA. If you have any questions regarding this response, please call me at 800-605-1050. Mahalo!

Sincerely,

Keith Avery
Vice-President

Maui Electric Company, Ltd. • 210 West Kamehameha Avenue • PO Box 398 • Kahului, Maui, HI 96732-0398 • (808) 871-8461

EXHIBIT 19

William A. Bonnet, P.E.
President

November 9, 1998

VIA FACSIMILE (541-488-2504) AND U.S. MAIL

Mr. Keith Avery
Zond Pacific, Incorporated
485 Waiale Drive
Wailuku, Hawaii 96793

Dear Mr. Avery:

Maui Electric Company, Ltd. ("MECO") has reviewed the draft Environmental Assessment ("EA") entitled "Kaheawa Pastures 20 MW Wind Farm Maui, Hawaii" dated June 11, 1998. The Hawaiian Electric Utilities[1] strongly encourage and support the goal of actually implementing reliable, sustainable, cost-effective renewable energy resources. In accordance with the "The Environmental Notice" published on October 8, 1998 by the Office of Environmental Quality Control, we hereby submit public comments on the draft EA to clarify certain statements pertaining to MECO.

[1] Maui Electric Company, Limited ("MECO"), Hawaiian Electric Company, Inc. ("HECO"), and Hawaii Electric Light Company, Inc. ("HELCO")

On page 2-14, the draft EA states:

ZPAC has been negotiating a power purchase agreement with MECO and MECO's parent company, the Hawaiian Electric Company (HECO). There has been substantial agreement on the terms and conditions of the agreement including price. It is anticipated that the negotiations will be satisfactorily concluded soon.

The proposed term for the agreement is 25 years. MECO would purchase all the electricity the windfarm could produce subject to specified times when the utility would not be obligated, e.g., should operational circumstances require the windfarm to be shutdown or curtailed temporarily.

In general, MECO is willing to pay a non-utility generators (NUG) the utility's avoided cost for electricity delivered by the NUG to the utility's transmission system. Specifically, if the NUG can provide firm power, the NUG would receive both a capacity and an energy payment. For non-firm or as-available generators, the utility would make only the energy payment. At the present time, the proposed energy payments starts at approximately 5 cents per kWh and escalates at 1.5% per year for 20 years, regardless of the utility's cost.

The details of a proposed power purchase agreement stated in the draft EA are for a windfarm project at Kahua Ranch on the Island of Hawaii that Zond Pacific and Hawaiian Electric Company, with its subsidiary Hawaii Electric Light Company (HELCO), have been negotiating. Negotiations between Zond Pacific and MECO to purchase the energy from the Kaheawa Pasture windfarm have yet to occur.

MECO has not received a non-utility generator proposal from Zond Pacific, which is required to begin the formal negotiation process. Zond Pacific and the Hawaiian Electric Utilities agree that a power purchase agreement for the Big

On page 3-34, the draft EA states:

> *In addition, it is estimated that the project will save ratepayers $13M over the 25 year lifetime, based on 3.5% per year MECO rate increase*

It is not clear how the windfarm project will save $13M in rate increases. If Zond Pacific sells the electricity generated by the Kaheawa Pasture windfarm to MECO at a price that is equal to the cost that MECO would have incurred to generate the electricity without the windfarm project (i.e. MECO's avoided cost), then the windfarm project would not change the total cost of electricity to MECO's customers.

The Hawaiian Electric Utilities strongly support the goals of increased energy self-sufficiency and greater energy security, but believe that these goals should be obtained without sacrificing the goal of providing dependable, efficient, economical statewide energy systems capable of supporting the needs of our customers.

Sincerely,

William A. Bonnet

c: Ms. Lauren Tanaka, Department of Land and Natural Resources
(Via Facsimile: 808-587-0455 and U.S. Mail)
Mr. Warren Bollmeier, WSB-Hawaii
(Via Facsimile: 808-247-7753 and U.S. Mail)
Mr. Gary Gill, Office of Environmental Quality Control
(Via Facsimile: 808-586-4186 and U.S. Mail)

EXHIBIT 19A

Zond
ZOND PACIFIC INC
A Subsidiary of ENRON Wind Corp.

January 4, 1999

Bill Bonnet, President
MECO
P. O. Box 398
Kahului, Maui, HI 96732-0398

Subject: Draft Environmental Assessment, Twenty Megawatt Windfarm at Kaheawa Pastures, Ukumehame, Maui, Hawaii; TMK: 4-8-01, par.1.

Dear Mr. Bonnet:

This letter is in response to your letter to me, dated November 9, 1998, same subject. Thank you for taking the time to review and comment on the subject draft environmental assessment (EA). I would also like to note that the original TMK reference (TMK: 4-08-01: par. 8) for the subject CDUA was inadvertently reported incorrectly. The correct designation is as stated above: TMK 4-8-01: par. 1.

The following is our response to your comments regarding:

(1) **the proposed power purchase contract with MECO, and**
Response: at the time that the EA was written, formal renegotiations had not been initiated. Subsequently, Zond Pacific has requested that MECO prepare a power purchase agreement for the proposed project on Maui. The revised EA will be updated accordingly.

(2) **the projected savings to ratepayers of $13M over the 25 year lifetime, based on a 3.5% per year MECO rate increase**
Response: the projected savings were based on the differential anticipated between MECO's 20-year estimate of annual rate increases of 3.5% (due to increases in the MECO's avoided cost) versus power purchase payments to Zond Pacific that would be fixed at the original avoided cost escalating at only 1.5%. Thus, the lifetime savings would differ depending on the actual growth in the utility's rates due to avoided cost increases versus Zond Pacific's power purchase price with fixed annual escalator. If you have revised your cost projections, we would be happy to redo our analysis and update the EA.

If you have any questions regarding this response, please call me at 800-605-1050. Mahalo!

Sincerely,

Keith Avery
Vice-President

485 Waiale Rd.
Wailuku, Hawaii 96793
PH: 808/244-9369 • FAX: 808/244-9539

13000 Jameson Rd.
Tehachapi, California 93561
PH: 805/822-6835 • FAX: 805/822-5015

309 Avalon Dr.
Ashland, Oregon 97520
PH: 541/482-0854 • FAX: 541/488-2504

EXHIBIT 20

4531

U.S. Department of Transportation
Federal Aviation Administration

Western-Pacific Region
Real Estate and Utilities Team, AHNL-54B

Box 50109
Honolulu, HI 96850-4983

Post-it® Fax Note 7671	Date 11/19/98	# of pages ▶ 1
To Warren	From Lauren	
Co./Dept.	Co.	
Phone #	Phone # 587-0385	
Fax # 247-7753	Fax #	

November 12, 1998

Mr. Michael D. Wilson
State of Hawaii
Department of Land and N
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Wilson:

Your letter of October 28, 1998, forwarded for our review and comment the draft Environmental Assessment of June 11, 1998, for "Kaheawa Pastures 20 Megawatt Windfarm, Maui, Hawaii" for Zond Pacific, Wailuku, Hawaii.

Due to the type of operations and structures of this proposed facility, we have contacted and requested that representatives of Zond Pacific file a "Notice of Construction and Alteration" (FAA Form 7460-1) with our agency so that an Airspace Evaluation be conducted as soon as possible.

We appreciate this opportunity to comment on this proposed project. Please contact me at 541-1236, if there are any further questions or ways we may be of assistance.

Sincerely,

Darice B. N. Young

Darice B. N. Young
Realty Contracting Officer, AHNL-54B

RECEIVED
98 NOV 18 A9:33
DEPT. OF LAND & NATURAL RESOURCES STATE OF HAWAII

LAND MANAGEMENT DIV. ID:808-587-0455 NOV 19,98 9:52 No.014 P.01

Zond
ZOND PACIFIC, INC
A Subsidiary of ENRON Wind Corp.

EXHIBIT 20A

January 4, 1999

Darice B. N. Young
Realty Contacting Officer
USDOT/FAA
P O Box 50109
Honolulu HI 96850-4983

Subject: Draft Environmental Assessment, Twenty Megawatt Windfarm at Kaheawa Pastures, Ukumehame, Maui, Hawaii; TMK: 4-8-01, par.1.

Dear Ms.Young:

This letter is in response to your letter to Mr. Mike Wilson, DLNR, dated November 12, 1998, same subject. Thank you for taking the time to review and comment on the subject environmental assessment (EA). I would also like to note that the original TMK reference (TMK: 4-08-01: par. 8) for the subject CDUA was inadvertently reported incorrectly. The correct designation is as stated above: TMK 4-8-01: par. 1.

Please note that I did forward a "Notice of Construction and Alteration" (FAA Form 7460-1) to the FAA office in Los Angeles. If you have any questions regarding this response, please call me at 800-605-1050. Mahalo!

Sincerely,

Keith Avery
Vice-President

485 Waiale Rd.
Wailuku, Hawaii 96793
PH: 808/244-9389 • FAX: 808/244-9639

13000 Jameson Rd.
Tehachapi, California 93561
PH: 805/822-6835 • FAX: 805/822-6015

309 Avalon Dr.
Ashland, Oregon 97520
PH: 541/482-0654 • FAX: 541/488-2504

Please Type or Print on This Form

Prop.

Form Approved OMB No.

EXHIBIT 21

US Department of Transportation Federal Aviation Administration

DEC 30 1998

Notice of Proposed Construction or Alteration

Failure To Provide All Requested Information May Delay Processing Of Your Notice

Aeronautical Study Number: 98-AWP-3353-OE

1. Nature of Proposal

A. Type: [X] New Construction [ ] Alteration *

B. Class: [X] Permanent [ ] Temporary (Duration ____ months)

C. Work Schedule Dates: Beginning June 1999 End June 2000

* If Alteration, provide previous FAA Aeronautical Study Number, if available:

3A. Name, address, and telephone number of individual, company corporation, etc. proposing the construction or alteration. (Number, Street, City, State, and Zip Code)

Zond Pacific, Inc.
485 Waiale Rd
Wailuku, Maui, HI 96793

Area Code (808) Telephone Number 244-9389

3B. Name, address and telephone number of proponent's representative, if different than 3A. above.

Keith Avery
Zond Pacific, Inc.
309 Avalon Dr.
Ashland, OR 97520

(800) 605 1050
Area Code Telephone Number

2. Complete Description of Structure

Please describe the proposed construction or alteration.

A. For proposals involving transmitting stations, include effective radiated power (ERP) and assigned frequency. If not known, give frequency band and maximum ERP.

B. For proposals involving overhead wire, transmission lines, etc., include the size and the configuration of the wires and their supporting structures.

C. For buildings, include site orientation, dimensions, and construction materials.

D. Optional— Describe the type of obstruction marking and lighting system desired. The FAA will consider this in their study.

4. Location Of Structure

A. Coordinates (to hundredths of seconds, if known)

Latitude: 156 ° 33 ' 0. "

Longitude: 20 ° 48 ' 47. "

B. Nearest City or Town and State: Maalaea

(1) Distance to 4B: 5 miles

(2) Direction to 4B: Southwest

C. Nearest public or military airport, heliport, flightpark, or seaplane base: Kahului

(1) Distance from structure to nearest point of nearest runway: 8 miles

(2) Direction from structure to airport: Northeast

4D. Source for Item 4A data: [X] USGS 7.5' Quad Chart [ ] Survey [ ] Other Specify

Indicate the reference datum: [X] NAD 27 [ ] NAD 83 [ ] Other Specify

4E. Description of site location with respect to highways, street, airports, prominent terrain, features, existing structures, etc. Please attach a U.S. Geological Survey Map (or equivalent) showing the construction site. If available, attach a copy of a documented site survey with the surveyor's certification.

5. Height and Elevation (to nearest foot)

A. Elevation of ground above mean sea level.	2000'-3200'	3200
B. Height of structure including all appurtenances and lighting above ground or water.	75 meters	246
C. Overall height above mean sea level	2240-3440'	3446

Notice is required by Part 77 of the Federal Aviation Regulations (14 C.F.R. Part 77) pursuant to Section 1101 of the Federal Aviation Act of 1958, as amended (49 U.S.C. app. § 1101). Persons who knowingly and willingly violate the Notice requirements of Part 77 are subject to a civil penalty of $1,000 per day until the notice is received, pursuant to Section 901(a) of the Federal Aviation Act of 1958 as amended (49 U.S.C. app § 1471(a)) as well as the fine (criminal penalty) of not more than $500 for the first offense and not more than $2,000 for subsequent offenses, pursuant to Section 902(a) of the Federal Aviation Act of 1958, as amended (49 U.S.C. app § 1472(a)).

I HEREBY CERTIFY that all of the above statements made by me are true, complete, and correct to the best of my knowledge. In addition, I agree to obstruction mark and/or light the structure in accordance with established marking & lighting standards as necessary.

Date: 12/21/98

Typed or Printed Name and Title of Person Filing Notice: Keith Avery, Vice President

Signature: [signature]

FOR FAA USE ONLY

FAA will either return this form or issue a separate acknowledgement.

The Proposal:

[ ] Does not require a notice to FAA.

[X] Is not identified as an obstruction under any standard of FAR, Part 77, Subpart C, and would not be a hazard to air navigation.

[ ] Is identified as an obstruction under the standards of FAR, Part 77, Subpart C, but would not be a hazard to air navigation.

[X] Should be obstruction [ ] marked [X] lighted per FAA Advisory Circular 70/7460-1, Chapters 4, 5 & 13 see below

[ ] Obstruction marking and lighting are not necessary.

Supplemental Notice of Construction, FAA Form 7460-2, is required any time the project is abandoned, or

[X] At least 48 hours before the start of construction.

[X] Within five days after the construction reaches its greatest height.

This determination expires on July 7, 2000 unless:

(a) extended, revised or terminated by the issuing office;

(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit is made to the FCC on or before the above expiration date. In such cases the determination expires on the date prescribed by the FCC for completion of construction, or on the date the FCC denies the application.

NOTE: Request for extension of the effective period of this determination must be postmarked or delivered to the issuing office at least 15 days prior to the expiration date.

If the structure is subject to the licensing authority of the FCC, a copy of this determination will be sent to that agency.

Remarks: Single steady burning red obstruction light is approved as requested on every other turbine

NAD 83 Coordinates (Use these coordinates for any future correspondence with the FAA)

Latitude 20° 48' 35.47" Longitude 156° 32' 49.83"

Issued in: Hawthorne Ca

Signature: [signature]

Jan 7, 1999

NSN: 0052-00-012-0007

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8. Appendices

8.1

Zond Systems Brochure

so many choice

how do you choose a wind turbine these days?

we asked ourselves the same question...

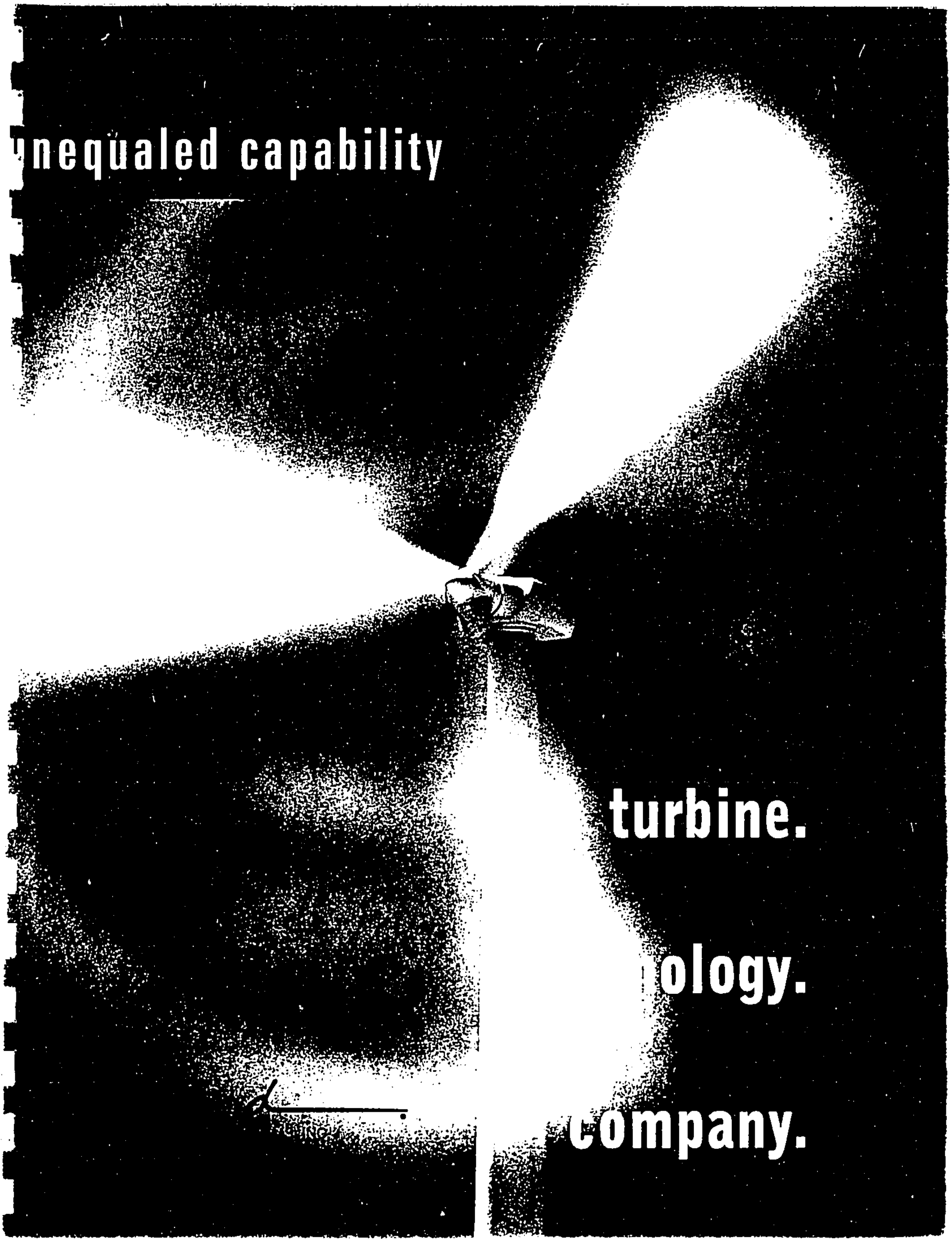
...then

we went

to work

designing.

Today our robust Z-Class wind turbines are setting new standards for efficient, trouble-free wind power generation. In fact, our variable speed Z-750 kW Series wind turbines were recently found to be the turbines of choice for construction of the three largest wind generation projects in the world.


nequaled capability
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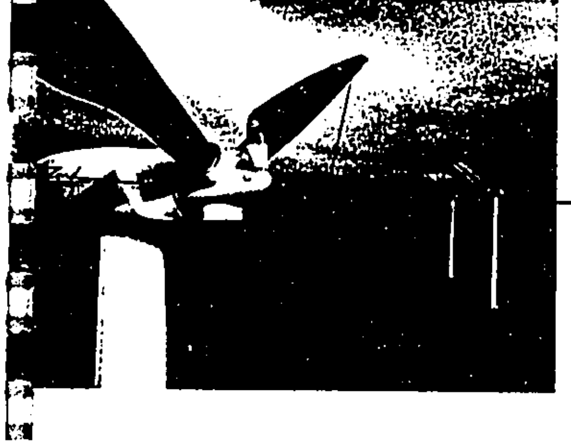
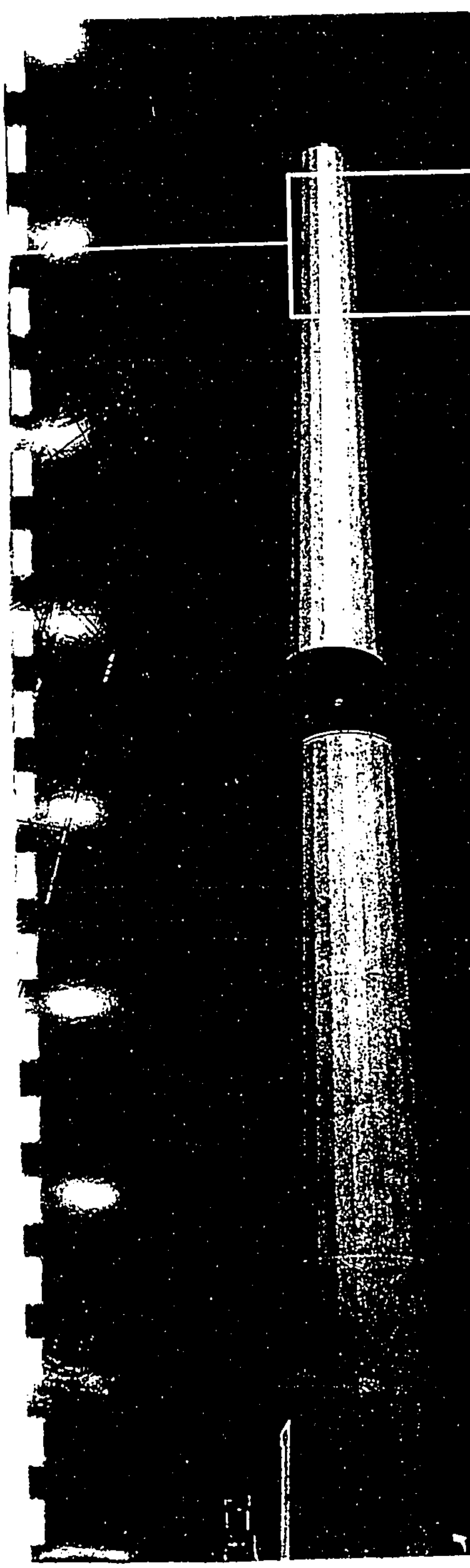
company.



We focused our efforts toward designing life-cycle effective, high quality, high reliability and high efficiency wind turbines. We strived for longevity — a 30 year design life when the industry standard was 20. Added strength to withstand hurricane force winds. And made sure they would adhere to the most stringent standards, including the Institute of Electrical Engineer's Standard 519 requirements.

But we didn't stop there. We wanted to achieve variable speed operation at lower cost, and optimize wind power generation even in lower wind regimes. And we did. Our Z-750 kW Series variable speed wind turbines with Zond's patented IGBT converter and wound rotor generator system do just that. In fact, they mitigate loads, provide higher efficiency, and support the utility grid.

RECEIVED AS FOLLOWS

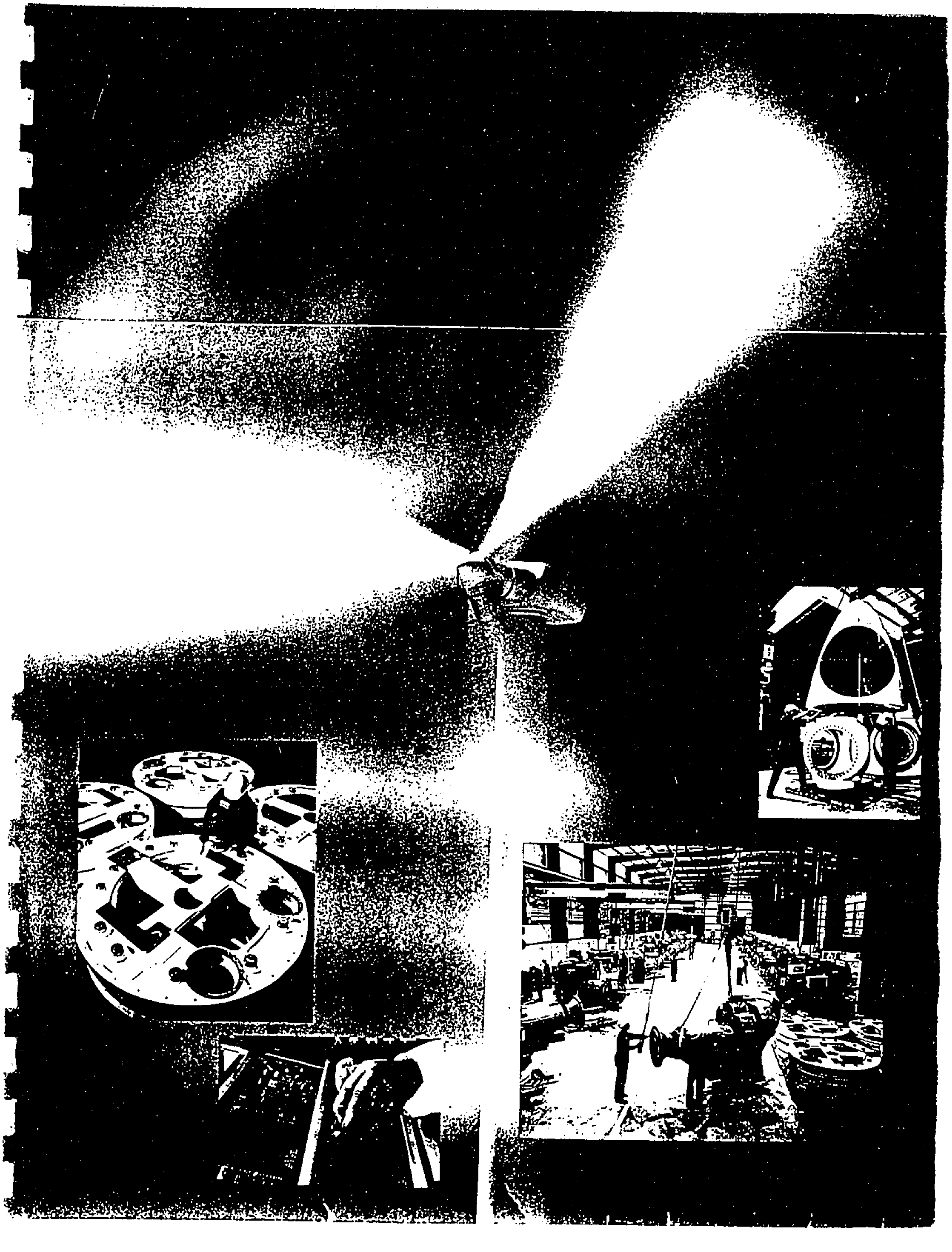


but, we all know that quality doesn't happen by chance

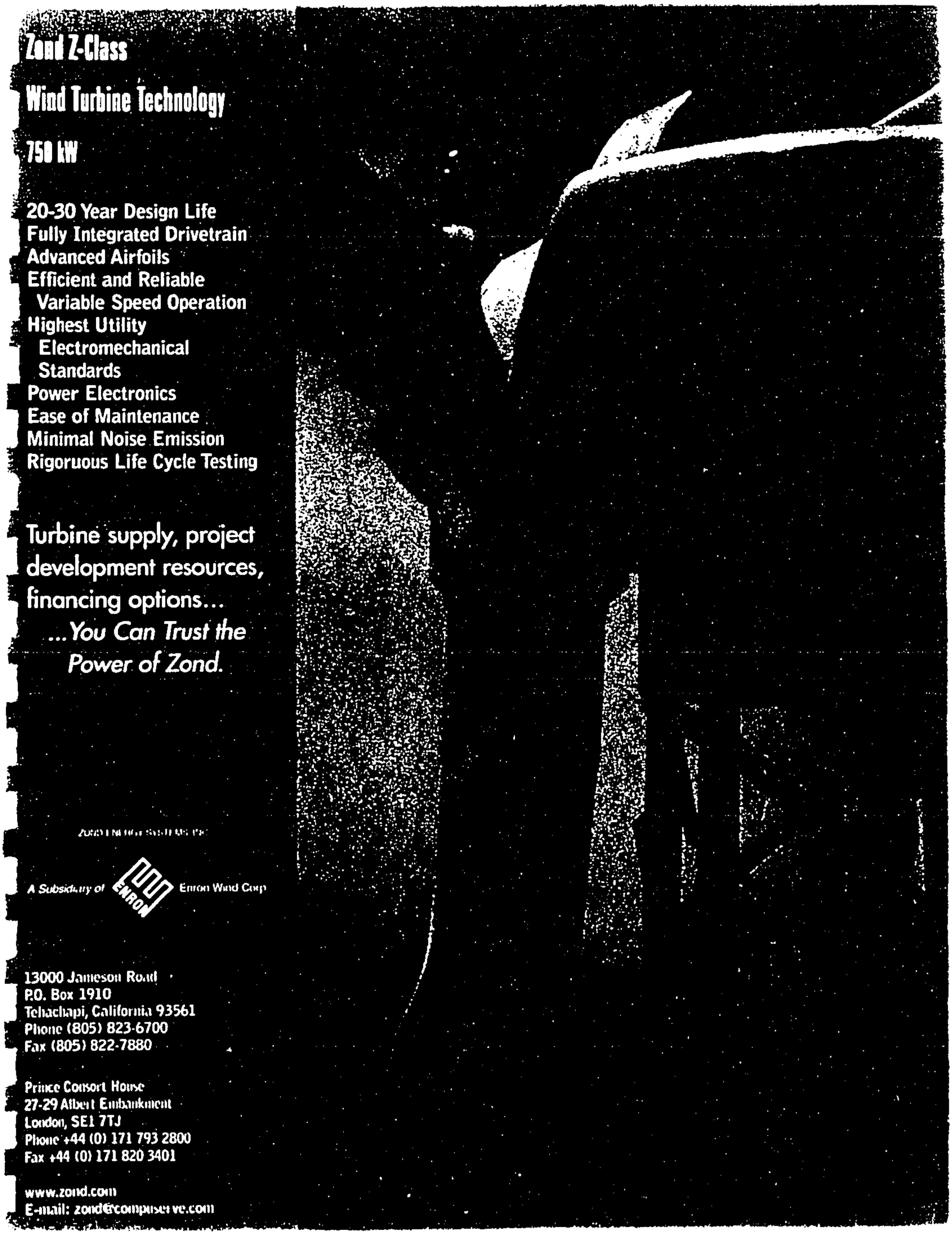
Since 1980, Zond has been a leading name in wind power generation. We have installed, operate and maintain, at better than 97% system availability, over 2,500 wind turbines. That's more than 260 megawatts of experience, dedication and committment to excellence in wind technology and project development.

Now, as a subsidiary of Enron Corp., one of the largest independent developers and producers of electricity in the world, our committment to provide wind generation at the lowest cost possible is strengthened. Our increased capabilities, financial strength, and financing options are providing new avenues for successful, environmentally sound and profitable solutions to the world's energy needs.

RECEIVED AS FOLLOWS



RECEIVED AS FOLLOWS



Technical Description and Data

Z-750 kW SERIES WIND TURBINE GENERATORS

These specifications are subject to change
by seller at its reasonable discretion

Z-46, Z-48, Z-50

Because average wind speeds may vary significantly from wind site to wind site, the Z-750 Series wind turbines are designed to optimize power generation in a wide range of wind regimes.

Zond

Zond Energy Systems, Inc. ENRON A subsidiary of Enron Wind Corp.

13000 Jameson Road
P.O. Box 1910
Tehachapi, California 93561
Phone (805) 823-6700
Fax (805) 822-7880

Prince Consort House
27-29 Albert Embankment
London, SE1 7TJ
Phone +44 (0) 171 793 2800
Fax +44 (0) 171 820 3401

1, Tegeas & Aeroporias Str.
Gr. - 16452 ARGYROUPOLIS
Athens, GREECE
Phone (301) 99.65.110
Fax (301) 99.68.574

www.zond.com
E-mail: zond@compuserve.com

TECHNICAL DATA

Major components in the Z-46, Z-48, and Z-50 wind turbine

	Z-46	Z-48	Z-50
Wind Speed Class	IEC Class I	IEC Class II	IEC Class III
Design Life	30 Year	30 Year	30 Year
Performance			
Cut-in wind speed	4.5 m/s	3.5 m/s	3 m/s
Cut-out wind speed	29 m/s	29 m/s	29 m/s
Rated wind speed	12.1 m/s	11.6 m/s	11.2 m/s
Rotor			
Number of blades	3	3	3
Diameter	46.0 m	48.0 m	50.0 m
Swept area	1662 m²	1810 m²	1963 m²
Rotor speed range (12.3)	34.0 rpm	34.0 rpm	32.3 rpm
Maximum Tip speed	82 m/s	85 m/s	85 m/s
Blade Length	22.2 m	23.2 m	24.2 m

Tower, Tubular (tapered) or Lattice

Hub height	50 m, 60 m, 65 m
Access to the tower and nacelle cabin	Through lockable door and ladder

Blades

Material	Fiberglass (Epoxy)
Airfoil	NREL S816, S817, S818

Pitch System

Actuation	Hydraulic
Linkage	Rod through mainshaft, spider, & bell cranks
Rotor Speed Regulation	Pitch Controlled

Drivetrain

Type.	Integrated gearbox
Gearbox	2 stage with parallel shafts
Ratio	1:40.65
Lubrication	Mechanical oil pressure pump
Oil sump	200 liters

Operating Brake

Type	4 disks / fail-safe / dual torque
Location	Highspeed shaft

Yaw System

Type	Helical / Planetary drives
Slew ring	Internal gear teeth
Damping system	Frictional, adjustable

Hydraulic Power Unit

Oil pump capacity	11.7 ltr/min
Oil capacity	75 ltr

Generator

Type	6-pole, doubly fed, IP54 or IP23
Insulation Class	"H"
Nominal output	750 kW
Voltage	468 V AC +8%/-5% (50-60 Hz)
Power factor: 10% to 100% of full load	1.0
Life of bearings	130,000 hours

Wind Turbine Control System

Type	Zond distributed multi-microcontroller
Power Electronics	Vector controlled PWM converter
Power Quality	IEEE 519 - 1992

Optional Accessories

- Cold weather package
- Corrosion protection package
- Hot climate cooling package
- Space heater for nacelle
- Service tent for work on the controller

Z-750 KW SERIES TECHNOLOGY

Zond's Z-750 kW Series variable speed wind turbines are three blade, upwind, active yaw, and pitch regulated with power/torque control capability. The rotor utilizes blade pitch regulation and variable speed operation to achieve optimum power output. The variable speed operation minimizes power and torque transients delivered from the rotor to the drivetrain. Results include improved long-term reliability as well as improved aerodynamic efficiency, particularly at lower wind speeds.

HIGHEST DESIGN STANDARDS

The Z-750 kW Series wind turbines are designed in accordance with the International Electrotechnical Committee 1400-1 Standard and Germanischer Lloyd's Rules and Regulations for Wind Turbine Design. All components of the machine (rotor, drivetrain, and tower) have been designed using verified input loads and finite element modeling and analysis techniques. This ensures an efficient structure to carry the design's extreme and fatigue loads.

The turbines feature an integrated drivetrain design where all nacelle components are attached to the gearbox. The entire gearbox assembly easily mounts on top of the yaw system without need for major component alignment. Turbine assembly is completed with the attachment of the nacelle housing, and mounting of the rotor.

The Z-750 kW Series wind turbines are based on Zond's state of the art, tried and tested Z-40 wind turbine design. Zond's wind turbine design integrates more than a decade of experience with the installation, operation and maintenance of more than 2,500 wind turbines. The design principle of the rotor, integrated gearbox, yaw system, control and monitoring system, and tower provides high efficiency, cost effective and reliable operation, as well as ease of assembly and maintenance.

VARIABLE SPEED GENERATOR SYSTEM

The Z-750 kW Series wind turbines' variable speed system uses a proprietary doubly-fed generator (DFG) and power converter system to ensure the delivery of constant frequency power to the grid. Zond's variable speed technology provides maximum energy capture, torque control, elimination of voltage flicker and power pulsations, as well as power factor control. In addition, dynamic power factor adjustment is available to help support and stabilize grid voltage.

A major atribute of Zond's variable speed technology is its ability to mitigate torque spikes. Torque transients, which cause voltage flicker and damage to drivetrain components, are attentuated by allowing an increase in rotor speed, thereby "storing" the additional energy of a wind gust in the rotational inertia of the rotor blades. This energy can be extracted and fed into the grid by reducing the rotor speed as the wind gust dies. Thus, variable speed operation can dramatically reduce torque transients which translates to lower costs and longer life of the wind turbine drivetrain.

INTEGRATED DRIVETRAIN

Zond's integrated drivetrain combines the mainshaft and gearbox into a single unit, increasing strength and minimizing the number of turbine parts. The gear geometry utilizes a dual path approach that reduces gear loads on the high speed shaft. The machining and hardening during fabrication is in accordance with standard codes and principles for heavy duty drivetrains. The excellent efficiency of the transmission is reflected by the extreme low levels of noise emission, vibration and temperature rise during operation.

GENERATOR

The generator is a high efficiency, 6-pole, IP54, doubly-fed generator (IP23 generators are also available) flange mounted to the rear of the gearbox. A recess on the flange provides a well defined alignment with the high speed shaft for mounting. The rotor torque is transmitted through a torque limiting coupling. The generator efficiency is in excess of 90% at loads above 15% of rated power.

The generator is built with "Class H" insulation. This helps prevent unnecessary stops due to high ambient temperatures or other operational conditions and prolongs generator life.

BRAKE SYSTEM

The brake system provides for redundancy with aerodynamic and dynamic mechanical fail-safe systems which consist of a full span blade pitch control (air brakes) and a mechanical brake.

YAW SYSTEM

The yaw system is electrically operated and controlled by the wind turbine controller based on information received from the wind vane mounted on top of the nacelle housing. The yaw system consists of a yaw deck made of ductile iron, a slewing ring with inside gear, two electrical yaw drive units, and an adjustable friction system to dampen the yaw movements. The complete system is mounted on a cylindrical flange provided at the top of the tower.

ROTOR

The rotor consists of three blades with full span control, pitch bearings, and the hub. The variable speed pitch rotor is up-wind orientated and allows fine adjustment of the blade operating angle to optimize for wind energy capture. The maximum output is regulated by the combination of full span pitch regulation and variable speed operation. One of the important characteristics of the rotor airfoils is their resistance to surface roughness degradation. This results in lower operating costs due to reduced blade wash frequency. The rotor airfoils were specifically developed for wind applications, and are more efficient over a wider range of wind speeds.

TOWER

Zond's Z-750 kW Series wind turbines are available with either tubular or lattice towers. Each tower has certain advantages. The lattice tower is the most economical, while the turbular tower offers protection to maintenance workers servicing the turbine in adverse weather conditions. The tubular tower configuration has been designed in accordance with the Uniform Building Code, the International Electrotechnical Committee's 1400-1 Standard, Germanischer Lloyd's Rules and Regulations for Wind Turbine design (DIBT), and a type approval under German Bauamt Office (DIBT). Additional, specific tower approval requirements can be met.

NACELLE

The nacelle functions as a housing to protect the integrated drivetrain, generator, hydraulic brake and yaw gears from the outside environment. It is manufactured of fiberglass, and the color is built-in and has an outer gelcoat layer similar to that of the blades.

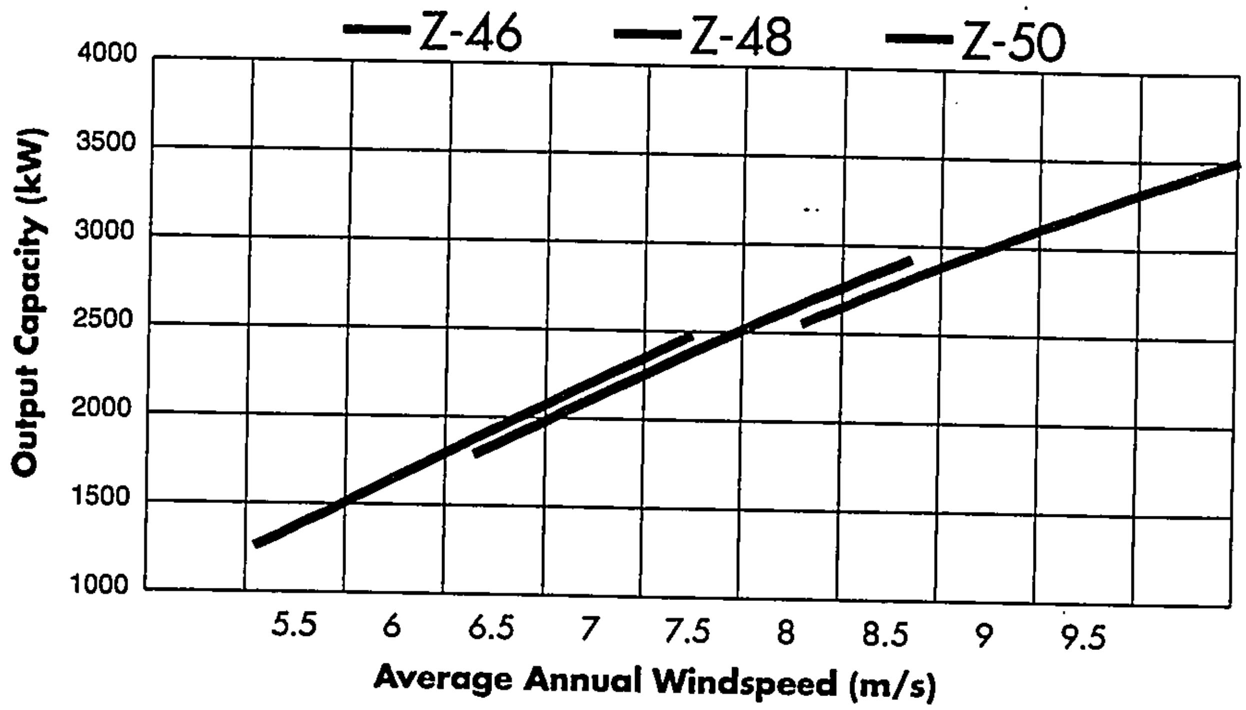
Most service and maintenance work can be carried out from inside the nacelle. The nacelle is well illuminated with interior electric lights and skylight hatches which provide additional lighting and ventilation. A hinged hatch at the front end of the nacelle gives easy and safe access to the blades and hub. When the rotor is stopped and secured in the right position, there is access through a top hatch in the spinner to the inside of the hub for maintenance functions. The nacelle mounts to the top side of the yaw deck. All flanges are sealed to provide effective containment.

WIND TURBINE CONTROL SYSTEM

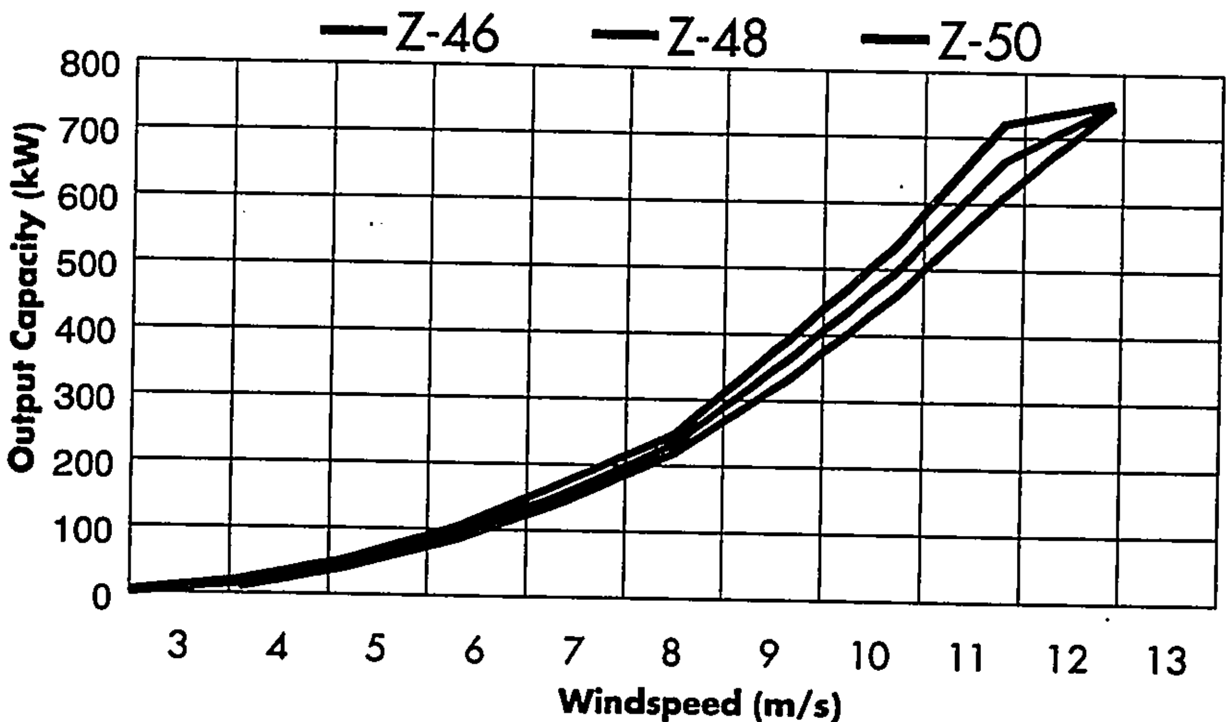
The control system is based on Zond's patented, distributed microcontroller based system. Multiple microcontrollers are used for overall system monitoring and control including pitch and speed regulation, mainshaft and yaw brake application, yaw and pump motor application and fault monitoring. The controller is designed for operation in harsh environments including temperatures between -20 and +50 degrees Centigrade and 0 to 100% humidity with condensing atmosphere.

The control system includes a variable pitch and speed regulation subsystem mounted on the inside of the nacelle. This system, called the Variable Pitch Controller, interfaces with a master controller through a high speed serial port. This controller provides real time proportional pitch position as well as turbine speed regulation using a proprietary proportional, integral, derivative (PID) algorithm.

Annual Production Curves



Power Curves



Curves only covers up to rated speed. Actual curves are according to list.

8.2

Enron Wind Corporation Written Hazard Communication Program

Written Hazard Communication Program

Enron Wind Corp.
13000 Jameson Rd.
Tehachapi, CA 93561

I. Introduction

The OSHA Hazard Communication Standard was Promulgated to ensure that all chemicals would be evaluated and that information regarding hazards would be communicated to employers and employees. The goal of the standard is to reduce the number of chemically related occupational illnesses and injuries.

In Order to comply with the Hazard Communication Standard, this written program has been established for Enron Wind Corp. All divisions and sections of the company are included within this program. Copies of this written program will be available (for review by any employee) in the following locations.

All base station radios
Safety Manger's office
Site supervisor's office
Manufacturing safety office

The basic components of this program include:

1. Hazard chemical inventory list
2. Labels and other forms of warning
3. Material safety data sheets
4. Employee information and training
5. Non routine tasks
6. Unlabeled pipes
7. On site contractors
8. Program review

II. Hazard Determination

All hazardous chemicals in this facility are purchased materials; there are no manufactured or intermediate hazardous chemicals. Therefore, Enron Wind Corp. will rely on the hazard determinations made by the chemical manufacturer as indicated on the MSDS.

III. Hazardous chemical inventory list

A list of all known hazardous chemical products used at Enron Wind Corp. is contained in Appendix A of this written program. A list of all hazardous chemicals used by each department is kept with material safety data sheets in the respective departments as listed above.

IV. Labels and other forms of warning

The Hazard Communication Standard requires that hazardous chemicals be labeled by manufactures. The label must contain the following information:

1. Chemical Identity
2. Appropriate hazard warnings
3. Name and address of the chemical manufacturer, importer, or other responsible party.

When chemicals are ordered by purchasing, the purchase order will indicate the need for the above stated information to be included on the labels or Enron Wind Corp. will refuse acceptance of the shipment. Upon delivery of chemicals, the safety manager will ensure that the chemicals are labeled properly. Any chemicals without proper labeling will not be accepted. When chemicals are transferred from the manufacturer's containers to secondary containers, the supervisor of each section within the company will ensure that the containers are labeled with the identity of the chemicals. Appendix C is an example of Enron Wind Corp. in-house labeling.

V. Material safety data sheets

When chemicals are ordered, the purchasing department will specify on the purchase order that the chemicals are not to be shipped without corresponding Material Safety Data Sheets (MSDS). When MSDS's arrive they will be reviewed by the safety manager. A complete file of MSDS's for all hazardous chemicals to which employees of this company may be exposed will be kept in labeled binders in the following locations:

1. Base Station Radio
2. Safety Managers Office
3. Site Supervisor Office

Should the MSDS be incomplete, a letter will be sent immediately to the manufacturer requesting the additional information.

MSDS's for hazardous chemicals used by departments will be kept in labeled binders in the office of the respective departments. MSDS's will be available for employees during each work shift. Should MSDS's be unavailable, please immediately contact the safety manager at (805) 823-6785.

MSDS's will be reviewed annually by the safety manager.

VI. Employee information and training

Prior to starting work, new employees of Enron Wind Corp. will attend a health and safety orientation program. The safety manager will conduct this training The format for the training will be an oral and video presentation. The following topics will be covered:

1. An overview of the requirements of the Hazard Communication Standard
2. Chemicals present in the work environment
3. Physical and health effects of hazardous chemicals used in the company's operation.
4. The labeling system and how to use it.
5. How to review MSDS's and where they are kept.
6. Methods and observation techniques used to determine the presence or release of hazardous chemicals in the area.
7. Personal protective equipment and work practices to prevent exposure to chemicals
8. Steps the company has taken to prevent exposure to chemicals.
9. Safety / Emergency procedures to follow if exposure occurs.
10. Location and availability of the Written Hazard Communication Plan.

Following each training session, the employee is required to sign and date the training record verifying attendance. Appendix D contains this record. Before any new employee can begin work which requires the use of or potential exposure to hazardous chemicals, training as indicated above must be completed.

VII. Non-routine tasks

Prior to any employee beginning a hazardous non-routine task, he or she must report to the safety manager to determine the hazards involved and the protective equipment required.

VIII. On-site contractors

Often one or more contractors work on-site at Enron Wind Corp. Contractors will be provided with the following information.

1. Hazardous chemicals to which the contractor's employees may be exposed.
2. Precautions necessary to protect employees during normal operating conditions and foreseeable emergencies.
3. In house labeling system used in the workplace.

It is the responsibility of the safety manager that all MSDS's of chemicals to which the contractor's employees may be exposed to are made available to contractor, along with an example of the in house labeling system in use.

IX. Program review

This written Hazard Communication Plan for Enron Wind Corp., will be reviewed by the safety manager annually and updated as necessary.

APPENDIX A
MSDS

COMPRESSED GASES/WELDING ROD: 1

1. ACETYLENE
2. ARGON
3. ARGON (25% CARBON DIOXIDE, 75% ARGON)
4. OXYGEN
5. L-TEC SOLID STEEL WELDING ELECTRODES
6. WELD ROD ENI-CI
7. WELD ROD E6010
8. WELD ROD ER705-6, EHIIK
9. WELD ROD E70T-7
10. WELD ROD E7018
11. NITROGEN, COMPRESSED

OILS: 2

1 ALBAVIS 10
2 MOBILUX EP 1
3. MOBILGEAR SHC 6800
4. MOBIL SCH 632
5 MOBIL SCH 634
6 MOBILITH SCH PM
7. MULTIFAK EP 2
8. RANDO HD 32
9. RANDO HDZ 32
10. MOBIL ALMO 525 (PNEUMATIC OIL)
11 HYDRAULIC FLUID ISO 68

PAINTS: 3

1. EPOXY WHITE - DC 224F3501
2. EPOXY CONVERTER - DC 224G0903
3. PRIMER T7471
4. RUST - OLEUM AEROSOL
5. 457 LACQUER THINNER
6. PSX 700 FD CURE
7. PSX 700 RESIN
8. POLYCOR - SILVER MIST - EXTERIOR
9. LUPERSOL DDM - 9
10. POLYCOR - SILVER MIST - INTERIOR

LUBRICATES: 4

1. ANTI SEIZE AEROSOL
2. ANTI SEIZE THREAD COMPOUND
3. BREAK - FREE AEROSOL
4. NON CHLORINATED BRAKLEEN
5. COLD GALVINIZATION
6. THREADLOCKER 242 REMOVABLE
7. THREADLOCKER 271
8. PNEUMATIC/HYD. SEAL 545
9. 567 PIPE SEALANT
10. PARKER O - LUBE
11. SAFETY KLEEN 105 SOLVENT
12. 732 MULTI - PURPOSE SEALANT
13. SP - 350 AEROSOL
14. SP - 400 AEROSOL
15. WD - 40 AEROSOL
16. ZINC - IT AEROSOL
17. LPS - 2 INDUSTRIAL STRENGTH LUBRICANT
18. PERMATEX CLEAR RTV SILICONE
19. RUST VETO 342
20. GASKET ELIMINATOR - 518 FLANGE SEALANT
21. SIKAFLEX 1A
22. TAP MAGIC EP - EXTRA FORMULA
23. JPC 140 SAFETY SOLVENT

CLEANERS / MISC: 5

1. ABSORBENT MATERIAL
2. EYE SALINE SOLUTION
3. SUPER BONDER 495
4. MAGIC SORB
5. ORANGE TOUGH 40
6. SECOND SHIFT
7. SIMPLE GREEN
8. STEEL WOOL
9. REGULAR CLOROX BLEACH
10. CLOROX CLEAN - UP CLEANER WITH BLEACH
11. EMERY CLOTH
12. TOUGH ON GREASE
13. SPILLMATE
14. VISIONAID RAINBOW II
15. SILICON CARBIDE COATED 120 GRIT DISC
16. ALUMINUM OXIDE COATED 120 GRIT DISC
17. BUCKEYE WORKOUT
18. KLEENSALL

19. LEMON SPRAY WAX POLISH
20. NU SHEEN
21. STEAM CARPET CLEANER
22. QUICK STRIP
23. REFLECT - A - CLEAN
24. FOUR K
25. CARPET SPOT AND STAIN REMOVER
26. GLISTEN
27. IT'S ALIVE
28. REFLECT A GLO
29. SPRAY BUFF
30. MIRROR BRITE
31. DEO - QUAT
32. AEROSOL - APPLE BLOSSOM
33. SAN - O - PHENE (AEROSOL)
34. AEROSOL - CHERRY BLOSSOM
35. AEROSOL - CITRUS DELIGHT
36. AEROSOL - GARDEN BOUQUET
37. URINAL SCREEN
38. RIM CAGE
39. VINYL SCREEN
40. LEMON PEEL
41. AEROSOL - VANILLA TROPICS
42. AEROSOL - VANILLA SPLASH
43. AEROSOL - ORANGE MIST
44. SKIN LOTION
45. ANTI BACTERIAL LOTION SOAP
46. MULTI - DUTY HAND CLEANER
47. PEARLIZED HAND SOAP
48. AHS
49. RIG WASH
50. BUCKEYE AERO - MASTER
51. BUCKEYE 2002
52. GLASS CLEANER
53. CITRI SOLVE
54. PREMIERE ICE MELTER
55. BAHAMA BREEZE - FLOOR SWEEP

Appendix B
Responsibilities

Hazard Communication Training	Dennis W. Smith	Manager, Safety
Hazardous Chemical Inventory	Dennis W. Smith	Manager, Safety
Hazardous Communication Review	Dennis W. Smith	Manager, Safety
Hazardous Chemical Ordering	Mark Papasergia	Manager, Purchasing

Appendix C
In-House Labeling

All in-house portable containers will be labeled with the proper chemical or manufacture product name that is on the MSDS. Any containers used for recyclable purposes will be marked as above, with the word Recyclable also on the container.

Written Hazard Communication Program
Annual Update

No additions at this update

Dennis W. Smith
Manager, Safety
Enron Wind Corp.

April 14, 1998

8.3

Botanical Survey

A botanical survey of six proposed wind testing sites on leeward West Maui.
Submitted April 29, 1996.

To: Zond Pacific Inc.
485 Waiale Road
Wailuku, Maui, Hawai`i 96793

From: Arthur C. Medeiros, Biologist
1090 Mahanani Place
Makawao, Maui, Hawai`i 96768

On April 23, 1996, I accompanied Keith Avery on a botanical survey of six sites on southwestern West Maui selected for construction of wind testing apparatus. The sites are located on the sloping headlands formerly used as cattle pasture just west of Manawainui drainage. The vegetation of these six sites is predominantly composed of non-native species, mostly pasture grasses and cattle resistant shrubs. No plant or animal species listed as Endangered by the U.S. Fish and Wildlife Service was encountered at or near any of the six sites. The four uppermost elevation sites (nos. 3,6,9,12) are dominated by non-native pasture species, especially grasses such as Rattail grass (Sporobolus africanus) and Kikuyu grass (Pennesetum clandestinum). The two lowermost elevation sites (nos. 1 and 2) contain more native vegetation than the uppermost four sites.

During the selection of sites 1 and 2, the location was changed on two occasions to minimize damage to native plant species during construction and access. Uncommon native species (such as the native grass Trisetum inaequale) were reported to onsite personnel and marked conspicuously with flagging tape to avoid damage during construction.

If this project should proceed to its final construction stage, care should be taken near sites 1 and 2 to assure the least damage to native species through careful site selection. Areas of relictual native shrublands can be easily avoided as nearby comparable sites with little native vegetation are generally readily accessible.

SITE 1
(native species marked in bold)

GRASSES and SEDGES:	
Avena sativa	COMMON OAT
Cenchrus ciliaris	BUFFELGRASS
Cenchrus echinata	COMMON SANDBUR
Cynodon dactylon	*MĀNIENIE*
Digitaria ciliaris	HENRY'S CRABGRASS
Melinis minutiflora	MOLASSES GRASS
Rhychelytrum repens	NATAL REDTOP
Sporobolus africanus	RATTAIL GRASS
HERBS:	
Anagallis arvensis	SCARLET PIMPERNEL
Conyza bonariensis	HAIRY HORSEWEED
Emilia fosbergii	*PUALELE*
Hypochoeris radicata	HAIRY CATS EAR
Indigofera suffruticosa	INDIGO
Oxalis corniculata	*'IHI'AI*, YELLOW WOOD SORREL
Plantago lanceolata	NARROW-LEAVED PLANTAIN
Sonchus oleracea	*PUALELE*
Stachytarpheta urticifolia	*'OI*
Waltheria indica	***'UHALOA***
SHRUBS:	
Acacia farnesiana	KLU
Dodonaea viscosa	***'A'ALI'I***
Lantana camara	LANTANA
Leucaena leucocephala	*KOA HAOLE*
Opuntia ficus-indica	*PĀNINI*
Osteomeles anthyllidifolia	***'ŪLEI, U'ULEI***
Santalum ellipticum	***'ILIAHIALO'E*, SANDALWOOD**
Sida fallax	***'ILIMA***

SITE 2
(native species marked in bold)

GRASSES and SEDGES:

Melinis minutiflora	MOLASSES GRASS
Rhychelytrum repens	NATAL REDTOP
Sporobolus africanus	RATTAIL GRASS
Trisetum inaequale	

HERBS:

Anagallis arvensis	SCARLET PIMPERNEL
Bidens cf. micrantha	**KO`OKO`OLAU**
Chamaecrista nicitans	PARTRIDGE PEA
Emilia fosbergii	*PUALELE*
Hypochoeris radicata	HAIRY CATS EAR
Oxalis corniculata	*`IHI`AI*, YELLOW WOOD SORREL
Plantago lanceolata	NARROW-LEAVED PLANTAIN
Waltheria indica	***`UHALOA***

SHRUBS:

Lantana camara	LANTANA
Osteomeles anthyllidifolia	***`ŪLEI, U`ULEI***
Sida fallax	***`ILIMA***
Wikestroemia cf. oahuensis	***`AKIA***

SITE 3
(native species marked in bold)

GRASSES and SEDGES:

Bromus sp.	
Carex wahuensis	
Cynodon dactylon	*MĀNIENIE*
Digitaria ciliaris	HENRY`S CRABGRASS
Mariscus cf. hillebrandii	
Melinis minutiflora	MOLASSES GRASS
Pennesteum clandestinum	KIKUYU
Rhychelytrum repens	NATAL REDTOP
Sporobolus africanus	RATTAIL GRASS

HERBS:	
Centaurea erythraea	BITTER HERB
Chamaecrista nicititans	PARTRIDGE PEA
Cocculus trilobus	***HUEHUE***
Conyza bonariensis	HAIRY HORSEWEED
Desmodium sandwicense	SPANISH CLOVER
Emilia fosbergii	*PUALELE*
Hypochoeris radicata	HAIRY CATS EAR
Indigofera suffruticosa	INDIGO
Oxalis corniculata	*`IHI`AI*, YELLOW WOOD SORREL
Plantago lanceolata	NARROW-LEAVED PLANTAIN
Polycarpon tetraphyllum	
Pteridium aquilinum	***KILAU***
Sonchus oleracea	*PUALELE*
Salvia coccinea	TEXAS SAGE
Triumfetta semitriloba	SACRAMENTO BUR
Waltheria indica	***`UHALOA***
SHRUBS:	
Acacia farnesiana	KLU
Lantana camara	LANTANA
Leucaena leucocephala	*KOA HAOLE*
Osteomeles anthyllidifolia	***`ŪLEI, U`ULEI***
Psidium guajava	GUAVA
Sida fallax	***`ILIMA***
Styphelia tameiameiae	***PŪKIAWE***

SITE 6
(native species marked in bold)

GRASSES and SEDGES:	
Carex wahuensis	
Cynodon dactylon	*MĀNIENIE*
Digitaria ciliaris	HENRY`S CRABGRASS
Kyllinga brevifolia	*KILI`O`OPU*
Melinis minutiflora	MOLASSES GRASS

Pennesteum clandestinum	KIKUYU
Rhychelytrum repens	NATAL REDTOP
Sporobolus africanus	RATTAIL GRASS
HERBS:	
Anagallis arvensis	SCARLET PIMPERNEL
Chamaecrista nicititans	PARTRIDGE PEA
Conyza bonariensis	HAIRY HORSEWEED
Heterotheca californica	CALIFORNIA TELEGRAPH PLANT
Hypochoeris radicata	HAIRY CATS EAR
Medicago lupulina	BLACK MEDICK
Pteridium aquilinum	***KILAU***
Verbena littoralis	*`OI*
Vicia sativa	COMMON or SPRING VETCH
Waltheria indica	***`UHALOA***
SHRUBS:	
Acacia farnesiana	KLU
Lantana camara	LANTANA
Leucaena leucocephala	*KOA HAOLE*
Osteomeles anthyllidifolia	***`ŪLEI, U`ULEI***
Psidium guajava	GUAVA
Styphelia tameiameiae	***PŪKIAWE***

SITE 9
(native species marked in bold)

GRASSES and SEDGES:	
Andropogon virginicus	BROOMSEDGE
Carex wahuensis	
Cynodon dactylon	*MĀNIENIE*
Danthonia sp.	
Digitaria ciliaris	HENRY'S CRABGRASS
Kyllinga brevifolia	*KILI'O'OPU*
Melinis minutiflora	MOLASSES GRASS
Pennesteum clandestinum	KIKUYU
Rhychelytrum repens	NATAL REDTOP
Sporobolus africanus	RATTAIL GRASS
HERBS:	
Anagallis arvensis	SCARLET PIMPERNEL
Chamaecrista nicititans	PARTRIDGE PEA
Cocculus trilobus	***HUEHUE***
Conyza bonariensis	HAIRY HORSEWEED
Desmanthus virgatus	SLENDER MIMOSA
Desmodium sandwicense	SPANISH CLOVER
Emilia fosbergii	*PUALELE*
Heterotheca californica	CALIFORNIA TELEGRAPH PLANT
Hypochoeris radicata	HAIRY CATS EAR
Indigofera suffruticosa	INDIGO
Macroptilium lathyroides	WILD BEAN, COW PEA
Malvastrum coromandelianum	FALSE MALLOW
Medicago lupulina	BLACK MEDICK
Oxalis corniculata	*'IHI'AI*, YELLOW WOOD SORREL
Plantago lanceolata	NARROW-LEAVED PLANTAIN
Polygala paniculata	
Pteridium aquilinum	***KILAU***
Silene gallica	SMALL-FLOWERED CATCHFLY
Sonchus oleracea	*PUALELE*
Triumfetta semitriloba	SACRAMENTO BUR
Waltheria indica	***'UHALOA***

SHRUBS:

Acacia farnesiana	KLU
Lantana camara	LANTANA
Leucaena leucocephala	*KOA HAOLE*
Osteomeles anthyllidifolia	***`ŪLEI, U`ULEI***
Psidium guajava	GUAVA
Schinus terebinthifolius	CHRISTMASBERRY
Styphelia tameiameiae	***PŪKIAWE***

SITE 12
(native species marked in bold)

GRASSES and SEDGES:	
Bromus sp.	
Carex meyenii	
Cynodon dactylon	*MĀNIENIE*
Danthonia sp.	
Digitaria ciliaris	HENRY'S CRABGRASS
Kyllinga brevifolia	*KILI'O'OPU*
Melinis minutiflora	MOLASSES GRASS
Paspalum sp.	
Pennesteum clandestinum	KIKUYU
Rhychelytrum repens	NATAL REDTOP
Sporobolus africanus	RATTAIL GRASS
HERBS:	
Anagallis arvensis	SCARLET PIMPERNEL
Bidens pilosa	SPANISH NEEDLE
Chamaecrista nicititans	PARTRIDGE PEA
Conyza bonariensis	HAIRY HORSEWEED
Hypochoeris radicata	HAIRY CATS EAR
Oxalis corniculata	*'IHI'AI*, YELLOW WOOD SORREL
Plantago lanceolata	NARROW-LEAVED PLANTAIN
Pteridium aquilinum	***KILAU***
Sonchus oleracea	*PUALELE*
Triumfetta semitriloba	SACRAMENTO BUR
SHRUBS:	
Acacia farnesiana	KLU
Lantana camara	LANTANA
Leucaena leucocephala	*KOA HAOLE*
Osteomeles anthyllidifolia	***'ŪLEI, U'ULEI***
Styphelia tameiameiae	***PŪKIAWE***

BOTANICAL SURVEY OF PROPOSED ROAD CONSTRUCTION CORRIDOR, SE WEST MAUI

NOVEMBER 22, 1998

To: Keith Avery, Zond Energy Systems, Inc., Enron Wind Corp.
13681 Chantico Road
Tehachapi, CA 93561

From: Art Medeiros
1090 Mahanani Place
Makawao, Maui, Hawai'i 96768

Summary:

With one exception, largely the proposed route does not impact native vegetation as it passes through weed or pasture vegetation. Both the eastern and western termini of the proposed road are pastures. However, the interior of the gulch, especially on the steep western slopes above the proposed road has a stretch of fairly intact native leeward shrublands. No plant species were encountered during the survey are listed as Endangered by the U.S. Fish and Wildlife Service.

The proposed road site passes near (~50m) the Manawainui plant sanctuary exclosure, which can have both positive and negative effects for the sanctuary. The positive and negative impacts of the proposed road are likely balanced and perhaps even beneficial for facilitating access to the plant sanctuary for management purposes.

Mr Renee Sylva accompanied us on the site and discussed an exclosure/planting intending to protect a grove of leguminous shrubs, the *māmane* (Sophora chrysophylla), unique to that area. I agree with his assessment of the biological appropriateness of his suggestion.

Primary concerns regarding native plants:

1. The project necessitates direct destruction of a section of native leeward shrubland, including some uncommon native plant species. Other adjacent native shrublands may also become degraded by road construction activities and invasion of non-native plants. Due to impacts on native biota, some type of mitigation appears warranted.

2. importation of invasive non-native plants and invertebrates during initial road construction and in the future due to increased site visitation, in close proximity to the Manawainui plant sanctuary, one of the State of Hawai'i most important dryland forest conservation efforts.

LIST OF VASCULAR PLANT SPECIES ENCOUNTERED ALONG PROPOSED ROAD CORRIDOR, HANAULA, WEST MAUI (11/21/98):

SITE ABUNDANCE CODE:
This code, assigned to each plant species recorded in the survey, is used to give a rough estimate of the abundance of the plant species along the proposed road corridor only.
C = common
L = localized, i.e. common in limited area
S = scattered
R = rare

SCIENTIFIC NAME	HAWAIIAN or COMMON NAME and STATUS		SITE ABUNDANCE
(Latin names underlined; Hawaiian names in italics)			
PTERIDOPHYTES (ferns and allies):			
Adiantum hispidulum	FIVE-FINGER MAIDENHAIR	non-native	L
Adiantum raddianum	COMMON MAIDENHAIR	non-native	S
Asplenium adiantum-nigrum	*'IWA 'IWA*	indigenous	S
Blechnum occidentale		non-native	L
Doodia kunthiana	*'OKUPUKUPU LAU'I'I*	endemic	L
Doryopteris cf. decipiens	*'IWA 'IWA*	endemic	S
Dryopteris sp.		endemic	R
Microlepia strigosa	*PALAPALAI*	endemic	L
Pityogramma calomelanos	GOLDFERN	non-native	S
Pleopeltis thunbergiana	*EKAHA AKOLEA*	indigenous	S
Pteris X hillebrandii		endemic	R
Sadleria cyatheoides	*'AMA'U*	endemic	L
Sphenomeris chinensis	*PALA'A*	indigenous	S
ONOCOTYLEDONES (monocots):			
Cyperaceae (sedges)			
Carex meyenii		endemic	S
Carex wahuensis		endemic	R
Mariscus cf. hypochlorus	'AHU'AWA	endemic	L
Juncaceae			
Luzula hawaiiensis		endemic	L
Poaceae(grasses)			
Andropogon virginicus	BROOMSEDGE	non-native	S
Cynodon dactylon	*MANIENIE HAOLE*	non-native	C
Digitaria ciliaris	HENRY'S CRABGRASS	non-native	C
Digitaria setigera	ITCHY CRABGRASS	non-native	S
Eragrostis variabilis	*EMO LOA*	endemic	L
Melinis minutiflora	MOLASSESGRASS	non-native	C
Oplismenus hirtellus	*HONOHONO KUKUI*	non-native	L

Paspalum conjugatum	HILO GRASS	non-native	L
Paspalum cf urvillei	VASEY GRASS	non-native	S
Rhynchelytrum repens	NATAL REDTOP	non-native	C
Sporobolus africanus	RATTAIL GRASS	non-native	C
Pennisetum clandestinum	KIKUYU	non-native	C
Trisetum inaequale		endemic	L
DICOTYLEDONES (dicots):			
Anacardiaceae			
Schinus terebinthifolius	CHRISTMAS BERRY	non-native	C
Apocynaceae			
Alyxia oliviformis myrtillifolia	*MAILE LAU LI'I*	endemic	L
Asteraceae			
Bidens pilosa	SPANISH NEEDLE	non-native	C
Bidens micrantha subsp. micrantha	*KO'OKO'OLAU*	endemic	L
Conyza bonariensis	HAIRY HORSEWEED	non-native	S
Conyza canadensis pumila	HORSEWEED	non-native	S
Erigeron karvinskianus	DAISY FLEABANE	non-native	L
Hypochoeris radicata	GOSMORE	non-native	S
Caryophyllaceae			
Cerastium fontanum	CHICKWEED	non-native	S
Casuarinaceae			
Casuarina glauca	LONGLEAF IRONWOOD	non-native	R
Ebenaceae			
Diospyros sandwicensis	*LAMA*	endemic	L
Epacridaceae			
Styphelia tameiameiae	*PUKIAWE*	indigenous	L
Ericaceae			
Vaccinium calycinum	*OHELO*	endemic	R
Fabaceae			
Acacia farnesiana	*KLU*	non-native	S
Chamaecrista nictitans	PARTRIDGE PEA	non-native	S
Desmodium sandwicense	SPANISH CLOVER	non-native	S
Indigoifera suffruticosa	INDIGO	non-native	S
Leuceana leucocephala	*KOA HAOLE*	non-native	C
Gentianaceae			
Centaurium erythraea	BITTER HERB	non-native	S
Lamiaceae			
Salvia coccinea	*LILIWAI*	non-native	S

Menispermiaceae			
Cocculus trilobus	*HUEHUE*	indigenous	S
Myrsinaceae			
Myrsine lanaiensis	*KOLEA*	endemic	R
Myrsine lessertiana	*KOLEA*	endemic	L
Myrtaceae			
Psidium guajava	GUAVA	non-native	C
Metrosideros polymorpha	*'OHI'A-LEHUA*	endemic	L
Oxalidaceae			
Oxalis corniculata	*'IHI*	indigenous?	C
Plantaginaceae			
Plantago lanceolata	NARROW-LEAVED PLANTAIN	non-native	S
Polygalaceae			
Polygala paniculata	BUMBLEGUM WEED	non-native	S
Primulaceae			
Anagallis arvensis	SCARLET PIMPERNEL	non-native	S
Proteaceae			
Grevillea robusta	SILK OAK	non-native	R
Rosaceae			
Oseomeles anthyllidifolia	*ULEI*	indigenous	C
Rubiaceae			
Coprosma foliosa	*PILO*	endemic	L
Sapindaceae			
Dodonaea viscosa	*'A'ALI'I*	indigenous	C
Sterculiaceae			
Waltheria indica	*UHALOA*	indigenous	S
Thymeliaceae			
Wikestroemia oahuensis	*'AKIA*	endemic	S
Tiliaceae			
Triumfetta semitriloba	SACRAMENTO BUR	non-native	S
Verbenaceae			
Lantana camara	LANTANA	non-native	S
Stachytarpheta sp		non-native	S

8.4

Downed Wildlife Survey at Six Leeward West Maui Wind Monitoring Towers

(Report #1)

Downed Wildlife Survey at
Six Leeward West Maui Wind Monitoring Towers

Project Location:
Kaheawa/Ukumehame, Maui, Hawaii.

Submitted To:
Zond Pacific, Inc.

March 3, 1997

Submitted By:
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Acknowledgment

I would like to thank Joy Tamayose for her assistance with the surveys when I was unable to do them. She is a person of great integrity and could be depended upon when needed.

INTRODUCTION

This report will present results of a downed wildlife survey at six wind monitoring towers at Kaheawa/Ukumehame, Maui. This survey was conducted to inspect all six wind monitoring towers for downed wildlife over a three month period from May through July, 1996. This report does not represent a study, either in literature or in the field, on the effects or potential impacts of the wind monitoring towers and turbines at Kaheawa/Ukumehame; however, recommendations for mitigative measures for several native species of birds and one bat that may be negatively impacted by the project are given.

The project site is located in the area between Kealaloa Ridge and Papalaua Gulch between 3,000ft and 2,300ft elevation stretching over about 1.5mi on a ridge above McGreggor's Point Lighthouse. The site is accessed on the ground by an approximately 7mi unimproved road from Honoapiilani Hwy.

The wind monitoring towers are constructed from 10ft interconnecting sections of metal tubing that are about 8in in diameter. Tower heights range from about 90-140ft and are supported by guy cables in four directions. Four anchor points for each tower are set into the ground with the tallest towers at about 22 meters from the center and the shortest towers at about 14m from the center.

SURVEY METHOD

The interval between survey checks was set by Zond Pacific, Inc. (ZPAC) and Hawaii Department of Land and Natural Resources (DLNR) to be at twice per week. Surveys of the wind monitoring towers were to be conducted on Tuesdays and Fridays, except where inclement weather or other unavoidable circumstances would prevent routine checks. Surveys were to be conducted in the late afternoon. The time was determined more by convenience to the surveyor than by a need for standardization.

Once at the site, data on the general weather conditions were recorded on preprinted data sheets (Appendix A). These included percentage of cloud cover, estimated temperature, and precipitation. Other incidental data included survey start and end times for each tower, bird species detected, date, wind direction, and estimated wind speed. Elevation at each tower was recorded once near the beginning of the survey period. In addition, any relevant observations of miscellaneous items were noted.

As the surveyor drives up to a tower, the survey begins with an inspection of the guy wires and center column for birds or bats that may be caught. The surveyor then parks the vehicle and begins an inspection of the area around the tower by walking in a spiral manner from approximately 5 meters beyond the guy wire anchors until he/she reaches the center column. Another inspection is made approximately 40 meters beyond the leeward guy wire anchors which incidentally happens to be on the down slope side as well. This inspection is made in a "half moon" fashion generally from one anchor to another on the same side and was done to uncover any birds or bats that may have been traveling at high speeds when it struck the upper reaches of the wire. All possible signs of downed wildlife was recorded and discarded or collected.

Information on grounded subjects included tower number, species, disposition (Ex. "lying on bare ground, on left side, with right wing extended over head", etc.), compass heading and distance from the center column, description of injury, probable cause of injury and supportive evidence, description of any evidence of scavenging, and what actions were taken. All of this information was recorded on preprinted data forms (Appendix A). Equipment available during the surveys included a compass, measuring tape, altimeter, and binoculars. In addition, a medium sized box and some newspaper were available for the transport of injured wildlife.

RESULTS AND DISCUSSION

Twenty six (26) survey days were completed over the three month survey period, and no downed subjects or evidence of such were discovered during that time, with only two separate instances in which a single unidentified feather was found at tower no. 4. Both occurrences were interpreted to be normal and did not indicate groundings or strikes with guy wires. More than likely a strike with either the guy wire or the center column would result in more than a single downy body feather. Furthermore, the area under this tower was frequented by a family of ring necked pheasants which consisted of one hen and several chicks. A search beyond the normal inspection area was made in both instances and resulted in no signs of strikes.

No significant observations on incidental weather data collected were made. The average time for a tower to be inspected was 6 minutes (range: 1 to 21). (Three 1min inspection times were not rounded properly.) Although this may appear to be rather short for an inspection time, it was long enough to sufficiently cover the area directly below the guy wires as well as the leeward areas 40 meters beyond the guy wire anchor points. The main reason for this short inspection time was due to the type of terrain and vegetation found at each of the wind monitoring towers. Except for some sparsely scattered bushes at the sites, the area was mainly dominated by non-native grasses and was not cluttered by any rock formations. This allowed for easy and quick inspections. Had the monitoring towers been erected over heavy brush, the inspection could have easily taken 5 times longer. Of the six monitoring towers, two were approximately 120 to 135 feet high and the other four were about one-half to two-thirds that length. The taller towers required a broader anchor base for the supporting guy wires which meant that a larger area of ground required inspection. The diameter of the circumference which ran along the guy wire anchor points was approximately 28m for the two shorter towers and 44m for the tallest tower. Only two circles needed to be walked at the shorter towers in order to inspect the entire area.

There were several species of birds detected in the area during the survey (Table 1). Identification was determined primarily by vocalizations; although, several visual observations of birds were made as well. Most notable was a pair of Hawaiian Short Eared owls or Pueo (*Asio flammeus sandwichensis*) at tower no. 1 (May 10, 1996). These birds appeared to be flying acrobatically around the guy wires without coming in contact with them.

Table 1. List of Bird Species Detected.

Common Name	Scientific Name	Detections*
Eurasian Skylark	*Alauda arvensis*	22
Ring-Necked Pheasant	*Phasianus colchicus*	18
Black Francolin	*Francolinus francolinus*	12
House Finch	*Carpodacus mexicanus*	9
Common Myna	*Acridotheres tristis*	7
Hawaiian Short-Eared Owl or Pueo	*Asio flammeus sandwichensis*	5
Nutmeg Manikin	*Lonchura punctulata*	4
Gray Francolin	*Francolinus pondicerianus*	3
Northern Cardinal	*Cardinalis cardinalis*	1
Spotted Dove	*Streptopelia chinensis*	1

* Number of days species was detected over 26 survey days.

RECOMMENDATIONS

Hawaiian Short-eared Owl or Pueo

Predicting how the Pueo will ultimately respond or become affected by any new obstruction in their environment is difficult. However, they seem to have adjusted to the existing power lines and support poles that span over miles in this habitat as many individuals were observed in the study area, and they have been observed using power lines and poles as perches in the areas adjacent to the study area as well (pers. obs.). It should be mentioned though that no effort was made in this survey to inspect areas under existing power lines.

The habitat in which the turbines are slated for is composed of low growing vegetation of mostly grasses (see Medeiros botanical report to ZPAC). Any structure that stands above this will become attractive to owls as perches. Steps to eliminate the possibility of electrocutions and collisions with turbine blades should be taken. Raptors seem to be especially susceptible to these types of incidences as these are the second leading cause of mortality (Colson and Associates, 1995). It is assumed that ZPAC has made appropriate research in order to uncover the latest turbine advancements on mitigating such incidences and that appropriate action will be taken.

One unfavorable response that could occur with the Pueo to the amount of turbines targeted for this area is that they no longer utilize the area in search of food or nests, because of the amount of obstructions or the increased level of human activity there. In a summary of studies on avian interactions with wind energy facilities, Colson and Associates (1995) noted that a temporary decrease in activity of some avian species has occurred during installation of wind turbines and meteorological towers, while others have become permanently displaced. Their summary was derived from projects that permanently impacted only up to 10% of the habitat. It is presumed that a considerably higher percentage of the habitat at the project site will be impacted. Great care and sensitivity should be given when installing the turbines in this area. One suggestion might be to not begin construction of these turbines until well after the breeding season has finished and to halt construction a reasonable time before the next breeding season. In addition, the level of human activity should be kept to a minimum once the turbines are put in place and that activity be limited to essential areas only.

Thought should be given to the spatial distribution of the turbines as well. It's difficult to determine how much unobstructed space these birds require in order to be unaffected by clutter that the number of turbines will bring. One suggestion might be to install the turbines targeted for this area in a stepwise manner rather than all at once. This way observations on Pueo (as well as other species) activity and presence can be made after each phase of turbine installment. Pueo breeding and foraging ecology will need to be studied in this area to determine the maximum density of turbines that can be tolerated here before Pueo become unacceptably displaced.

Wedge-tailed Shearwater and Hawaiian Dark-rumped Petrel

In Hawaii, the federally endangered Hawaiian Dark-rumped Petrel (*Pterodroma phaeopygia sandwichensis*) have been known to nest at elevations above the project elevation. In the early fall, fledglings make their first journey down from these elevations as they head to the sea in search of food. This first flight is taken in the evening or early morning. It is very plausible that these birds can collide with either the turbines or monitoring towers during this time. Lights used on the towers may make them more visible to birds flying at night but studies in Hawaii (Cooper and Day, 1994 and Telfer et al., 1987 in Ainley et al., 1995) have indicated that they may cause some fledglings to become grounded. Urban lights, especially street lamps, are known to increase fallout of the Newell's Shearwater on Kauai (Cooper and Day, 1994). Similarly, during the Fall, fledglings of both the Hawaiian Dark-rumped Petrel and the Wedge-tailed Shearwater (*Puffinus pacificus*) become grounded on Maui with many of these occurring over the night in lighted locations (pers. obs.). However, Reed et al. (1985) concluded that procellariiforme birds were attracted to the light sources themselves rather than to the areas that they lit. Therefore, it is recommended that until a light source that does not negatively affect birds can be found, shades to direct radiation downward to the ground should be used on lamps placed on any of the turbines and structures needed to support them.

In addition, since wind monitoring towers must be used in conjunction with the turbines, the guy wires on them must be made more visible. For example, the wires could be threaded through one inch PVC pipes or a material that has a higher UV light tolerance. The aluminum tape that is currently being used is not sufficient. Most of these tags had fallen off after only three months.

Because of the potential for shearwaters and petrels to be negatively impacted by this project, it is recommended that additional night surveys be conducted during the breeding season of the Hawaiian Dark-rumped Petrel and Wedge-tailed Shearwater with special emphasis given during the Fall fledging season, because this is the period when grounding occur most with at least three major seabird species in Hawaii. At least three separate periods of time during the breeding season with at least three non-consecutive nights of observation should be completed in order to gain insight into the species present and the amount of activity in the project area. The greater the amount of time given to survey for activity and presence the better the insight that can be achieved. For example, this may help to determine whether adult seabirds use the project area as a flyway to the sea. Colson and Associates (1995) noted that installing turbines and towers perpendicular to these flyways may increase the risk of collisions.

In addition, periodic surveys for grounded wildlife near turbines and towers is recommended. Sufficient data can be obtained by instructing maintenance personnel to make quick inspections of the area during routine maintenance trips. This type of "survey" will provide information on whether or not a full survey is necessary.

Observing any number of downed wildlife during sporadic inspections like this probably indicates only a fraction of the number of birds that may have actually fallen, given that this area probably contains a high number of scavengers such as cats, rats, and mongooses.

Pacific Golden Plover

The Pacific Golden Plover (*Pacificus fulva*) was absent from the islands during the time of the survey. Nearly all individuals should have already left for their arctic breeding grounds by the start of the survey and would begin returning to Hawaii just after its end. Their activity in the project area when they are in the islands is, therefore, unknown. The habitat seems to be the type preferred by these birds, mostly open areas with low vegetation and large areas of grass. It is recommended, therefore, that at least one additional survey be conducted to determine their presence and level of activity in the area sometime between the months of August through April.

Hawaiian Hoary Bat

Activity of the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) is highest during the Summer months, with foraging activity observed to be highest in the early evening, beginning immediately after sunset (pers. obs.). Most of the surveys reported here were conducted in the late afternoon and no bats were observed. However, this cannot be taken as a sampling of the bat activity in the area and absolutely no inferences can be made from this information. In order to gain insight into the level of bat activity in the project area a more suitable protocol must be followed. For instance, "bat detectors" that can pick up the popping and squeaking, inaudible to humans, that bats produce to locate prey and each other can be used during evening observations. Experts in this field need to be consulted with before a sampling protocol can be developed.

Hawaiian Goose or Nene

Although the Nene (*Branta/Nesochen sandwicensis*) was observed some ½ mile above and none within the project area, there is still a potential that this bird can be negatively affected by the project. Nene are not agile flyers like seabirds and do not seem to maneuver as quickly on the wing. They tend to prefer grassy areas for flocking and foraging—the type of habitat that is proposed for the turbines. However, steps to mitigate collisions with guy wires by seabirds, mainly the use of PVC pipes to make them more visible, should reduce dramatically the potential for Nene collisions as well. This project area sits just below where the state has set up a release pen for the introduction of Nene in Hanaula. The potential for Nene strikes with guy wires will increase as Nene become more established.

Establishment of Grounded Wildlife Protocol

As was recommended in a letter to ZPAC dated 7 May 1996, a protocol for grounded wildlife should be developed to ensure timely and appropriate care for any injured wildlife found at the project site. The level of detail for such a document need not be lengthy. Most importantly a veterinarian must be selected and approved by ZPAC and DLNR. This protocol can be adopted for use by ZPAC for their staff to follow in the event that wildlife are discovered while turbines are being serviced or wind monitoring towers' data are collected.

CONCLUSION

Although no incidence of downed wildlife was recorded during this survey, several mitigative measures were recommended. First, the wind monitoring towers must be designed such that the guy wires are more visible both in daylight and at night which can be achieved by fitting them with PVC pipes and that the turbines, electrical distribution poles, and lines are designed such that owls cannot perch on them or be electrocuted. In addition, until a light source that does not negatively affect seabirds can be found, light sources on any of the turbines and electrical transfer structures should be shaded. Second, supplemental activity surveys are recommended to gain insight into bird and bat presence and activity. Third, careful consideration must be given to the seasonal timing for installment and spatial distribution and density of turbines in order to reduce negative impact on the Pueo. Finally, a grounded wildlife protocol is recommended in order to ensure timely and appropriate care for any injured wildlife found at the project site by ZPAC personnel.

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Appendix A: Sample survey form

Grounded Wildlife Survey Form

Zond Pacific, Hanaula Project

Page No. ___ of ___

SURVEYOR'S NAME:				DATE:
Temp (F):	Wind Direction:	Wind Speed:	Precipitation:	Cloud Cover:
Prevailing Weather System Since Last Check:				

Tower Number 1 Upper Most Tower	Time Start:	Time End:
Tower Number 2	Time Start:	Time End:
Tower Number 3	Time Start:	Time End:
Tower Number 4	Time Start:	Time End:
Tower Number 5	Time Start:	Time End:
Tower Number 6 Lower Most Tower	Time Start:	Time End:

Species Detected in Area:
Comments:

Incidence Report

Tower No.:	Species:	
Bearing From Tower:	Dist. From Tower (m):	Disposition:
Cond. of Subj. or Descr. of Item:		
Description of Injury:		
Probable Cause:	Supportive Evidence:	
Describe Evidence of Scavenging:		
Action Taken:		

Tower No.:	Species:	
Bearing From Tower:	Dist. From Tower (m):	Disposition:
Cond. of Subj. or Descr. of Item:		
Description of Injury:		
Probable Cause:	Supportive Evidence:	
Describe Evidence of Scavenging:		
Action Taken:		

Tower No.:	Species:	
Bearing From Tower:	Dist. From Tower (m):	Disposition:
Cond. of Subj. or Descr. of Item:		
Description of Injury:		
Probable Cause:	Supportive Evidence:	
Describe Evidence of Scavenging:		
Action Taken:		

Notes: Be careful of native Bidens from just beforeTower No. 5 and below. Road turns 100° right below Tower No. 5.For endangered wildlife incidences (ie. nene or Haw. bat) call these numbers below: Hawaii DOFAW-Myer Ueoka 984-8100 Zond Pacific-Kieth Avery 244-9389 or (503) 482-0854 If any grounded animal is discovered alive, place in box and take to Zond Pacific/DOFAW authorized veterinarian.

Report #3

Native Bird Activity at Proposed Access Road

Project Location:
Kaheawa/Ukumehame, Maui, Hawaii.
(Pu'u Anu)

Submitted To:
Zond Pacific, Inc.

November 21, 1998

Submitted By:
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Kahului, Maui, Hawaii 96732

Introduction

A quick and non-comprehensive survey was conducted at the proposed new road site for native birds on 21 November 1998. This report will present findings and concerns associated with the proposed road as they relate to impact to native birds. No attempt was made to collect data in a formal way. The discussion that follows will present a preliminary assessment of the site based on a single visit. The area inspected runs from the main mauka-makai access road at the base of Pu'u Anu, down into Manawainui Gulch on the west side, and up to the opposite ridge to the first, mauka-most anemometer tower. The proposed road actually follows and old unused road that is now eroded and overgrown with plants.

Discussion

Of the native or indigenous birds suspected to be present at the site, only the Pacific Golden Plover (*Pluvialis fulva*) was seen. Since the ridge proposed for the wind farm was previously burned in a wild fire, sightings of the plover was made easy. Although up to a dozen birds were seen on the ground or flying through the area, the plover will probably be only lightly impacted by the new road. No mitigation measures are recommended at this time.

Although the Nēnē (*Branta sandvicensis*) was not seen at the site, the habitat which the proposed road will travel through is the type that these birds prefer for nesting. Nēnē forage and flock in many types of habitat, including some very wet ones. But drier locations with shrubs, such as pūkiawe (*Styphelia tameiameia*) and 'a'ali'i (*Dodonea eriocarpa*) and the density of these plants present at the site, provide the kind of habitat that Nēnē prefer to nest in. Since the proposed road runs through the lower reaches of this habitat, concern for fragmentation is reduced, but it should not be overlooked. It would be wise to consider an access road that is farther away from this habitat, especially since the State is actively releasing new birds into this area. As the numbers of Nēnē increase, even these outer zones may begin to be used for nesting. Also, like many animals, Nēnē prefer to nest in secluded areas. An access road at the lower end of the habitat in addition to the already existing road at the upper end will only degrade conditions for nesting. Keeping the habitat as unfragmented as possible should be given careful consideration.

No active or previously active seabird burrows (in particular, the Hawaiian Dark-rumped petrel, *Pterodroma phaeopygia sandwichensis* or the Wedge-tailed shearwater, *Puffinus pacificus*) were found at the site. For this reason, the proposed road will probably not have any impact to these birds.

Conclusion

Unlike assessing the flora at a site, avifauna assessment can be much more difficult since animals and especially birds tend to move in an out of areas whereas plants remain stationary. This is made even more difficult when the birds in question are seasonal with respect to their use of an area. The findings or lack thereof presented here should not be taken as an absolute conclusion on the presence or absence of native birds or their activity at the site. Furthermore, since the greater area is currently used to implement an endangered species recovery plan, potential future generations of birds as they expand in both numbers and area used must be considered. Therefore, it is recommended that a more suitable site that is preferably lower down the mountain and in mostly non-native habitat be considered for the access road. If this proves to be impossible, then careful consideration must be given in deciding on whether to build a new access road at Pu'u Anu versus using the existing roads. If usage of existing roads is nominal at worst after considering the construction needed to improve them and its physical impact, and the amount, length of time, and kinds of equipment that will be used on them, and how all this impacts the habitat and animals there, then perhaps this may be better than permanently fragmenting and increasing human activity at the lower reaches of the habitat.

8.5

Archaeological Survey

An Archaeological Reconnaissance Survey for 27 Wind Turbines in the Ukumehame Uplands, Island of Maui

by
M.J. Tomonari-Tuggle

INTERNATIONAL ARCHAEOLOGICAL RESEARCH INSTITUTE, INC.

APRIL 1998

AN ARCHAEOLOGICAL RECONNAISSANCE SURVEY FOR 27 WIND TURBINES IN THE UKUMEHAME UPLANDS, ISLAND OF MAUI

by
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April 1998

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INTRODUCTION

At the request of Warren Bollmeier, consultant to Zond Pacific, Inc., International Archaeological Research Institute, Inc. (IARII) has conducted an archaeological reconnaissance survey of an approximately 2.3 km long transect on the upper slopes of the *ahupua'a* of Ukumehame on the island of Maui (TMK 4-8-1:01) (Fig. 1). The survey is part of an environmental assessment (EA) for 27 wind turbines that are proposed for installation in an articulated string of three segments from about 2,000 to 3,200 feet above sea level (asl). The archaeological survey transect follows an alignment of anemometer towers that are collecting data to assess the potential for wind generation; at the time of the survey, one of the six towers had been lowered for safety reasons.

PROJECT AREA DESCRIPTION

The project area is owned by the State of Hawaii and is administered through the Department of Land and Natural Resources (DLNR) through the Maui District Land Division. It is designated conservation land and there are no present active uses. A lease to Perreira Ranch for cattle grazing was terminated in the mid-1990s; cattle are currently grazed on Wailuku Agribusiness lease lands to the east of the project area.

At the seaward edge of the project area is a recently installed MECO transmission line that runs from Ma'alaea to Lahaina. Seaward of the transmission line is the Lahaina Pali Trail, an historic trail managed by the Na Ala Hele Statewide Trail and Access Program and open to the public.

PROJECT AREA ENVIRONMENT

The project area is located at the southern end of the West Maui mountain and encompasses approximately 0.7 sq km on a tableland along a ridge separating Papalaua gulch on the west from Manawainui gulch on the east. The tableland is typical of the high, intervalley ridges of this portion of the mountain, the south rift of the West Maui volcano.

The upper edge of the project area is defined by the near convergence of Papalaua and Manawainui gulches, narrowing the tableland at its northern edge to a steep, sharply edged ridge that terminates at the sheer wall of Ukumehame valley. The southern edge of the tableland is marked by the heads of numerous dry gulches that descend a steep, southwest-facing slope to the ocean; Manawaipueo gulch is the largest and longest of these drainages.

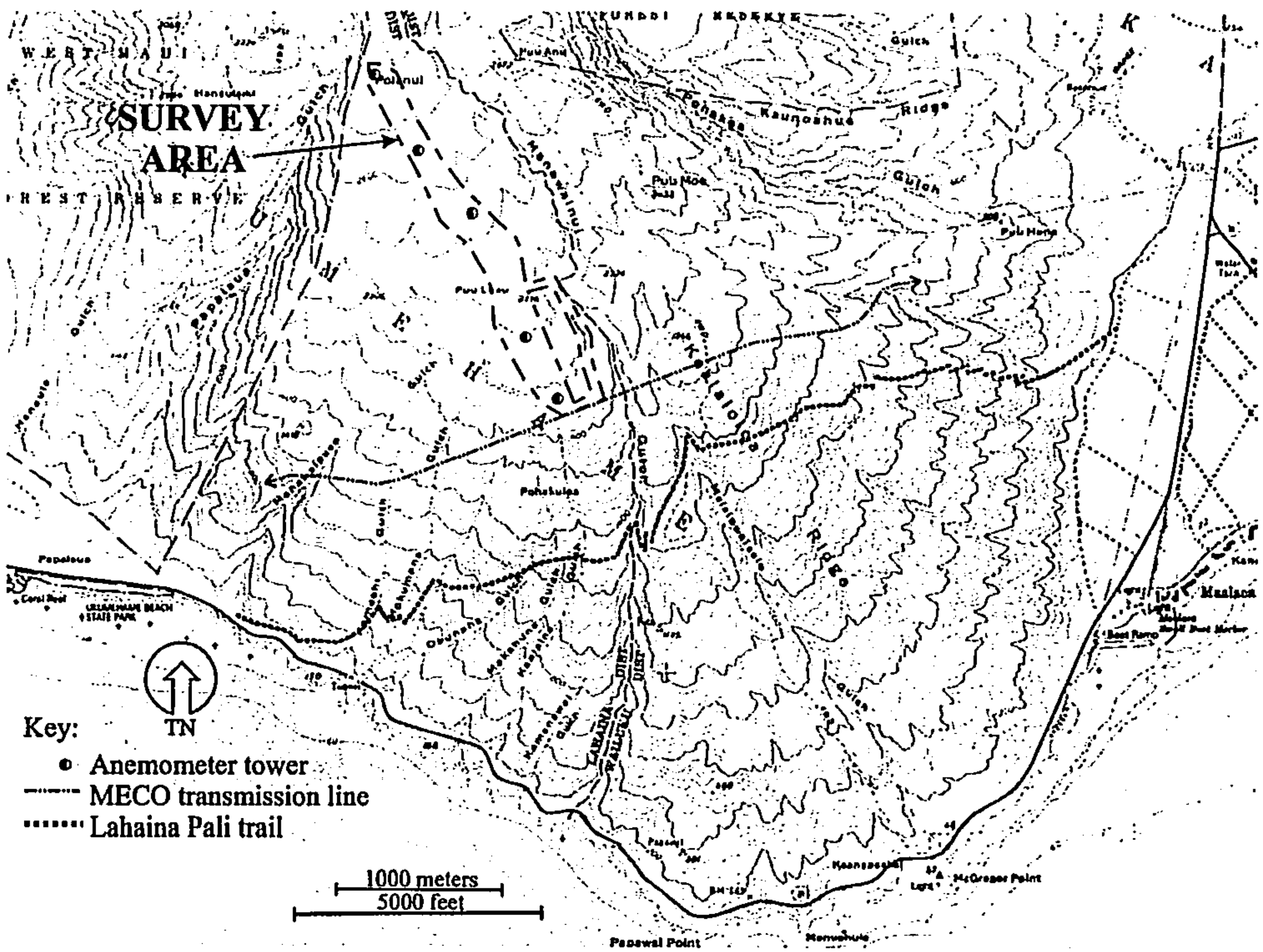

Figure 1. The Maui wind turbines project area (USGS 7.5 minute Maalaea quadrangle).

The tableland is relatively level, although it becomes steep at the upper end and drops significantly at the lower end below the prominent hill called Pu'u Lu'au. The terrain is slightly undulating (Photo 1) and is mildly dissected by feeder channels to Manawainui gulch and to the small gulches to the south, especially Manawaipueo; the fourth anemometer tower is near the head of Manawaipueo. The broad, level-topped Pu'u Lu'au separates the head of Mokumanu gulch on the west from Manawainui gulch. The area below the *pu'u* is steep, rocky, and punctuated by numerous boulder outcrops.

There are three soil zones in the project area. The upper edge of the area is Olelo silty clay, which is a well-drained upland soil formed in "material derived from basic igneous rock" and occurring on narrow to broad ridgetops (Foote et al. 1972:101). The central portion of the project area, inland of Pu'u Lu'au, consists of Naiwa silty clay loam, which is a well-drained upland soil developed in volcanic ash and weathered igneous rock (Foote et al. 1972:97). The lowest portion of the project area, including Pu'u Lu'au, consists of Oli silt loam, part of a soil series consisting of well-drained, moderately deep to deep soils that are developed in volcanic ash overlying basic igneous rock (Foote et al. 1972:102-103). The adjacent gulches are classified as rough broken and stony land in very steep gulches. The section of Manawainui gulch southeast of the project area is classified rock land where exposed rock covers 25 to 90 percent of the surface.

The top of Pu'u Lu'au and scattered areas along the upper edge of Manawainui gulch are deflated, with exposed dirt and boulders and cobbles (Photo 2).

Mean annual rainfall ranges from 750 mm at the lower edge of the project area to 1,500 mm at the upper edge of the area (Giambelluca et al. 1986:112).

The project area is primarily grasslands (Photo 3), with scattered Christmas berry (*Schinus terebinthifolius*) and scrub *'ōhi'a* (*Metrosideros polymorpha*) in the upper portion and lantana (*Lantana camara*), *'ilima* (*Sida fallax*), *koa haole* (*Leucaena leucocephala*), and *klu* (*Acacia farnesiana*) in the lower portion. The vegetation below Pu'u Lu'au is largely dense, tall scrub lantana. There are scattered small groves of ironwood trees (*Casuarina equisetofolia*) on the grass-covered slopes. Above the uppermost anemometer tower, the vegetation changes from grassland to increasingly larger and denser stands of *'ōhi'a* and Christmas berry. Taller vegetation in the project area clearly show the sculpting effect of the near constant winds. The reader is referred to the botanical survey for the wind turbine project for a detailed review of the project area vegetation.

The present extent of grasslands largely reflects the former use of this tableland for cattle grazing. In pre-modern times, Ukumehame uplands were probably covered in a mix of grasses and shrubs, including *'a'ali'i* (*Dodonaea viscosa*) and low-growing *'ōhi'a* (*Metrosideros polymorpha*) (Cuddihy and Stone 1990:13), which were observed during the present project. Pritchardia palms were also a likely part of the vegetation mix; *Kanaloa hawaiiensis* was probably present as well (see Athens 1997).

Photo 1. Project area from the east side of Manawainui Gulch, looking west. Pu‘u Lu‘au is the high, level hill at the left of the photograph.

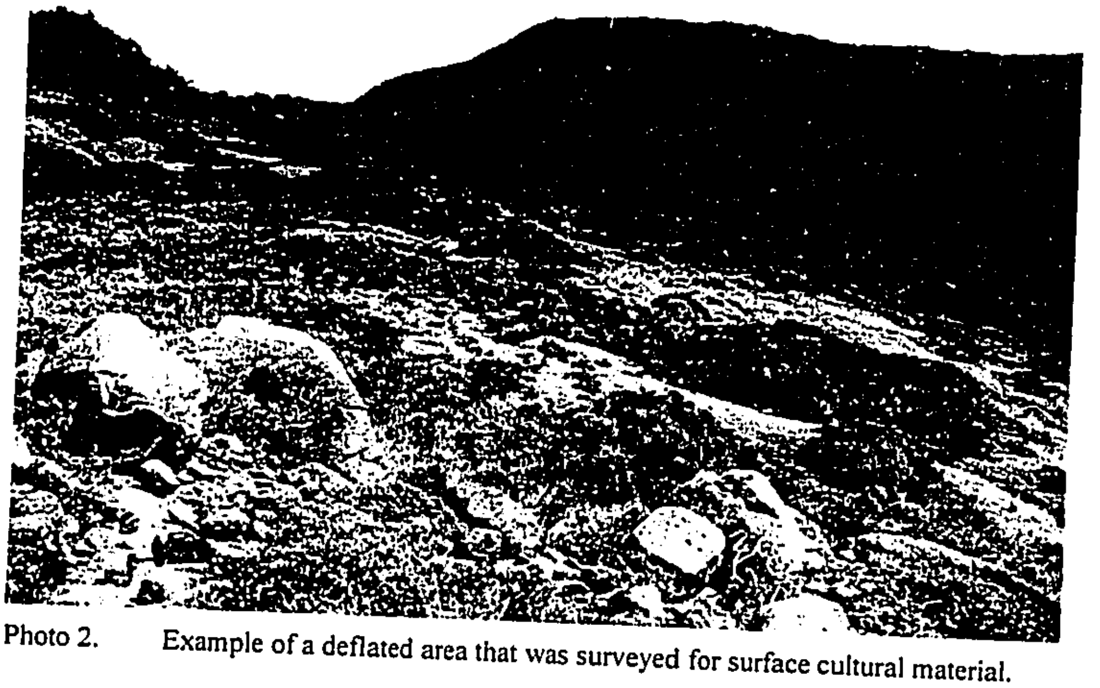

Photo 2. Example of a deflated area that was surveyed for surface cultural material.

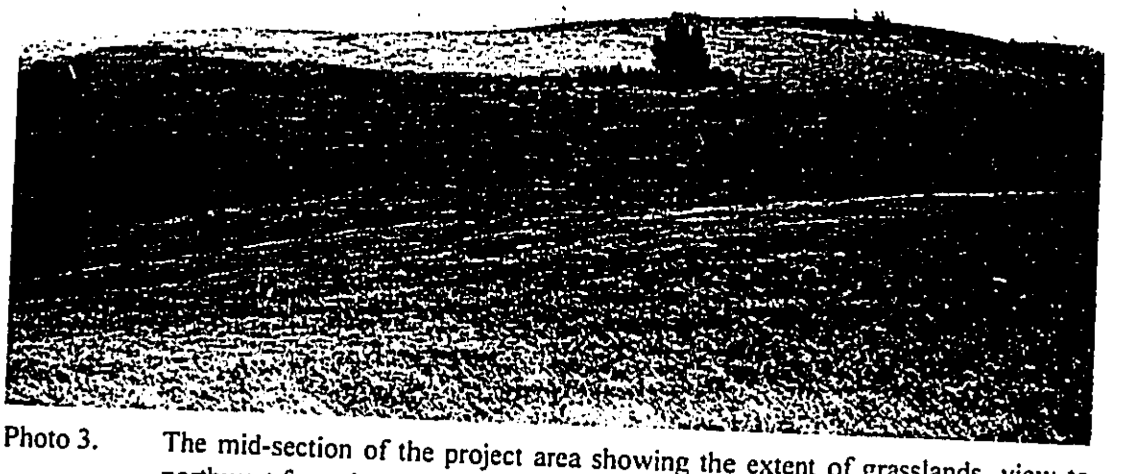

Photo 3. The mid-section of the project area showing the extent of grasslands, view to northwest from the northwest slope of Pu'u Lu'au.

A dirt road extends the length of the project area, probably built for earlier cattle ranching activities and modified for more recent DLNR management operations and for construction of the MECO transmission line. There is also a 1 inch diameter metal pipeline that runs along the west side of the project area; it is clearly related to past cattle use of the area. A concrete watering trough is located about 100 m inland and above the uppermost anemometer tower.

LAND USE HISTORY

The project area is located at the upper reaches of the traditional land area of Ukumehame, the easternmost *ahupua'a* of the district of Lahaina (Fig. 2). The *ahupua'a* consists of three general areas: Ukumehame valley and the broad coastal plain that fronts the valley; the steep mountainous area, including the several intervalley tablelands like the one on which the wind turbines are proposed; and the eastern slopes of the ridge descending toward Ma'alaea. Primary traditional Hawaiian settlement of the *ahupua'a* was probably on the broad coastal plain and in Ukumehame valley itself, with secondary settlements in the smaller valleys to the east of Ukumehame (Makaiwa, Hanaula, and Papalaua) and on the Ma'alaea coast.

The upland tablelands may have been a resource area for the collection of native birds and served as an access route to the higher elevations of the West Maui mountain (Robins et al. 1994:22). If *pili* grass (*Heteropogon contortus*), common to leeward lowlands, had grown in this area, it would have been a prime resource since this was the most desired material for house thatching. A botanical survey carried out for the MECO transmission line observed *pili* in the general area seaward of the present project parcel (Char 1993:8-9).

In general, however, the tablelands were relatively inhospitable for intensive settlement or agriculture. As Tomonari-Tuggle and Tuggle (1991:8) note: "Surface water is virtually non-existent and there are few fresh water sources. The slopes are steep and rugged. Access to the ocean is limited to small, narrow, and rocky gulches."

The project area falls within the *ahupua'a* of Ukumehame, translated as "to pay in *mehame* wood" (*uku* is translated as "tax;" *mehame*, *Antidesma pulvinatum*, is a native hardwood that was used for anvils to process the fibers of *olona*, *Touchardia latifolia*) (Pukui et al. 1974:214). Two specific areas within the project parcel have traditional Hawaiian names. Pu'u Lu'au is the prominent hill in the lower portion of the project area. Pukui et al. (1974:200) translate this to mean "taro tops hill." The other place is called Polanui, which is located above the uppermost anemometer tower. Pukui et al. (1974:188) translate this as "large *pola*," with *pola* meaning flap, as in the front portion of a *malo*. Tomonari-Tuggle and Tuggle (1991:10-11) translate other place names between Ukumehame and Ma'alaea.

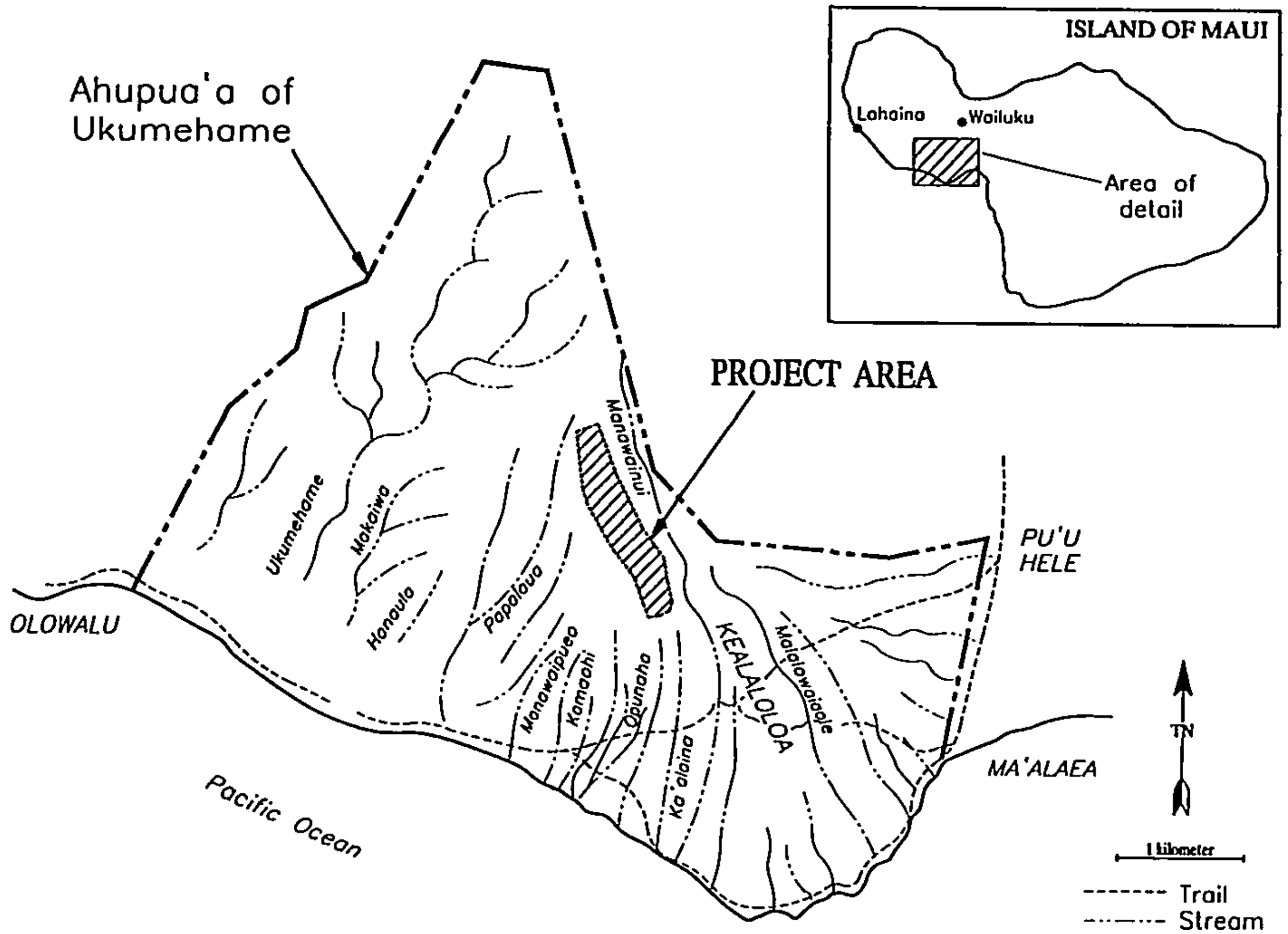

Figure 2. The *ahupua'a* of Ukumehame, showing the project area location.

In the mid-1800s, the traditional Hawaiian land tenure system was codified, with lands divided among the king, the chiefs, and the government. Commoners were given the opportunity to claim those lands which they used. In this Mahele, the 11,040 acres of Ukumehame *ahupua'a* were claimed by the king and designated part of his Crown Lands. Commoners' claims to land within the *ahupua'a* are clustered in the valley of Ukumehame.

In the second half of the 19th century, Crown Lands were often leased and Ukumehame was no different. An 1865 letter from William Enos and Joseph Sylva clarified a lease for the "pali of Ukumehame," which was defined as "from the foot of the mountain on the west, or Lahaina, side to its boundaries on this, or east side, for 10 years at $60 per year. $30 payable every six months in advance" (Enos and Sylva 1865). An earlier 1858 letter from E. Duvauchelle to William Webster, the king's land agent on Maui, requested the Wailuku side of Ukumehame mountain[1], noting that Joe Sylva had told him that he was not going to renew his lease on this area; this suggests that Sylva had an interest in the entire Ukumehame mountain from at least eight years previous to his 1865 letter. An accounting of receipts for leases on Crown Lands (Nahaolelua 1872) lists J. Sylva's rent payment for the "pali of Ukumehame" as $100, paid on October 28, 1871.

A note in Duvauchelle's 1858 letter suggests that these leases were for cattle ranching: "as for the other side of the big gulch on the mountain [presumably Manawainui gulch] and the Ukumehame side I do not want the lease as it is too far from the run of cattle on this side" (Duvauchelle 1858).

In a record of Crown Lands activities dating to 1886 (Brown 1886), the west half of Ukumehame "from Olowalu to mountain gulch known as the half way gulch" [again presumably Manawainui gulch] is listed as leased to Olowalu Plantation Company and the eastern half of the *ahupua'a* is listed as leased to "Richardson and Kahahawai;" the description of the eastern *ahupua'a* as "from mountain gulch to Waikapu" roughly matches Duvauchelle's lease request. The 1884 McKenney's Hawaiian Directory (Bagot 1884) lists John Richardson as the proprietor of the Maalaea Bay Stock Ranch, with an estimated 15,000 acres of grazing and mountain land, 200 head of cattle, and 100 head of horses.[2] This same directory lists three Sylvas, of which two are resident in Waikapu: William Sylva is an overseer of Waikapu Sugar Company and Antone Sylva is a stock raiser, suggestive of a possible relationship with the earlier Joe Sylva.

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1 "Ukumehame mountain" probably refers to the landform formed by the south rift eruptions of the West Maui mountain, defined by Ukumehame valley on the west, Waikapu valley on the north, the island isthmus on the east, and the ocean on the south. Kealaloloa ridge, which lies across Manawainui gulch from the project area, is the common name for the crest of the south rift.

2 The Maalaea Stock Ranch appears in subsequent directories, at least until 1900.

An 1885 Hawaiian Government Survey map (Alexander 1885) shows three trails crossing the lower slopes of this mountain area, well below the present project area. There is, however, no indication of any land uses, including ranching.

After annexation by the U.S. government, Crown Lands became public lands under the administration of the Territorial government. Cattle grazing apparently continued in this mountain area until the mid-1990s, through leases managed by the State Department of Land and Natural Resources. Wailuku Agribusiness lands to the east are still used for cattle.

The project area is presently not used, although there is evidence for some activity by motorized dirt bikers. On the southeastern lower slopes of Pu'u Lu'au is a small, heavily eroded, bowl-shaped area with numerous narrow, winding tracks forming a course of some sort. One track ascends the slope toward the top of the hill and is marked by an 8 to 10 m long alignment of cobbles set about 20 cm apart (Photo 4). Another track cuts up an almost vertical dirt face. There are several tracks on the level, grass-covered area above this bowl. It is not clear how dirt bikers access this area.

KNOWN ARCHAEOLOGICAL SITES

There have been two archaeological surveys carried out in the general area of the project parcel. Tomonari-Tuggle and Tuggle (1991) conducted a survey for the Na Ala Hele Statewide Trail and Access Program of the Lahaina Pali Trail, in preparation for its opening as a public interpretive trail. Robins et al. (1994) surveyed the alignment of the MECO transmission line. Neither survey located any sites in the near vicinity of the wind turbines project area.

The nearest known archaeological site is the Lahaina Pali Trail (Fig. 3), of which Tomonari-Tuggle and Tuggle (1991:13) relate that:

> ... evidence suggests that the Lahaina Pali trail was constructed for horse traffic around 1841, and was used for some fifty years as the shortest route between Lahaina and the isthmus of Maui. It fell out of use around the turn of the century following construction of a carriage road along the base of the pali.

The section of the trail closest to the project area crosses Manawainui gulch (Photo 4). In this section, the trail is well-defined, curbed, and in generally excellent condition. At the point that the trail crosses the gulch is Site 2825, a complex of petroglyphs (historic names) and retaining walls that are built into a natural outcropping on the east side of the gulch; the main wall extends discontinuously upstream about 70 m to an old wooden fence post.

Most of the sites that were located during the Lahaina Pali Trail survey are probably related to construction and use of the trail. The nearest of these sites is Site 2826, a complex covering an area of about 16 by 5 m and consisting of a well-constructed, terraced enclosure about 3 m across and adjacent walls varying from 40 to 100 cm high. There is scattered historic bottle glass around the site, which is located seaward of the Lahaina Pali Trail at the nose of the ridge on the east side of Malalowaiaole gulch (see Fig. 3). Another site is Site 2827, a small, roughly constructed enclosure measuring 1.5 m across; it consists of stacked rock against two large, in situ boulders.

Tomonari-Tuggle and Tuggle (1991:26) comment that:

> The paucity of traditional Hawaiian sites along this trail is not unanticipated. The trail is located in a steep, dry, rocky environment, with limited access to the ocean. It is at the periphery of the productive area of the ahupua'a (the Ukumehame coastal flat) and, further, crosses the area that was the border between two traditional districts of the island.

Photo 4 Probable dirt bike track on the eastern slope of Pu'u Lu'au.

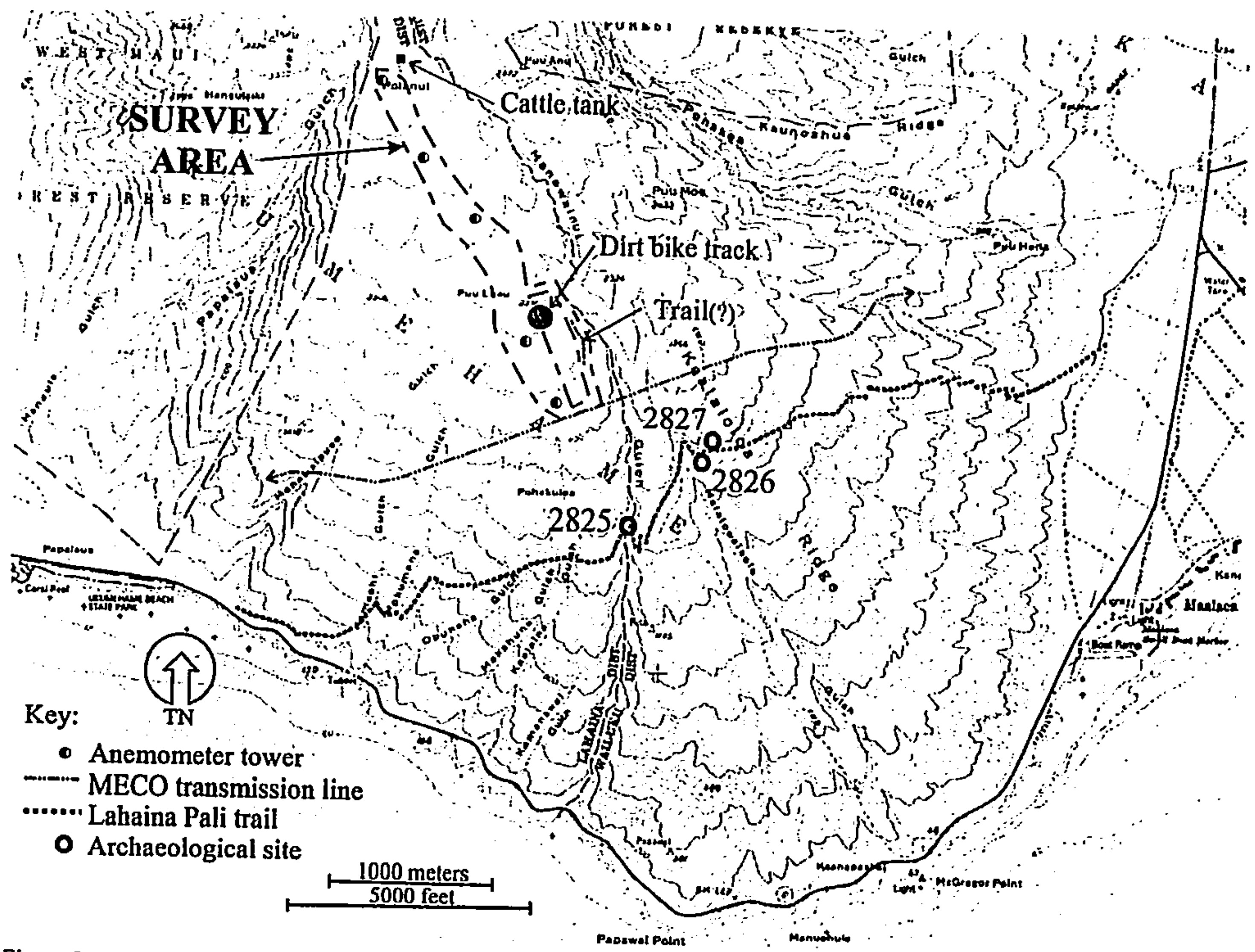

Figure 3. Area surveyed in the Maui wind turbines project area, showing archaeological sites in the vicinity.

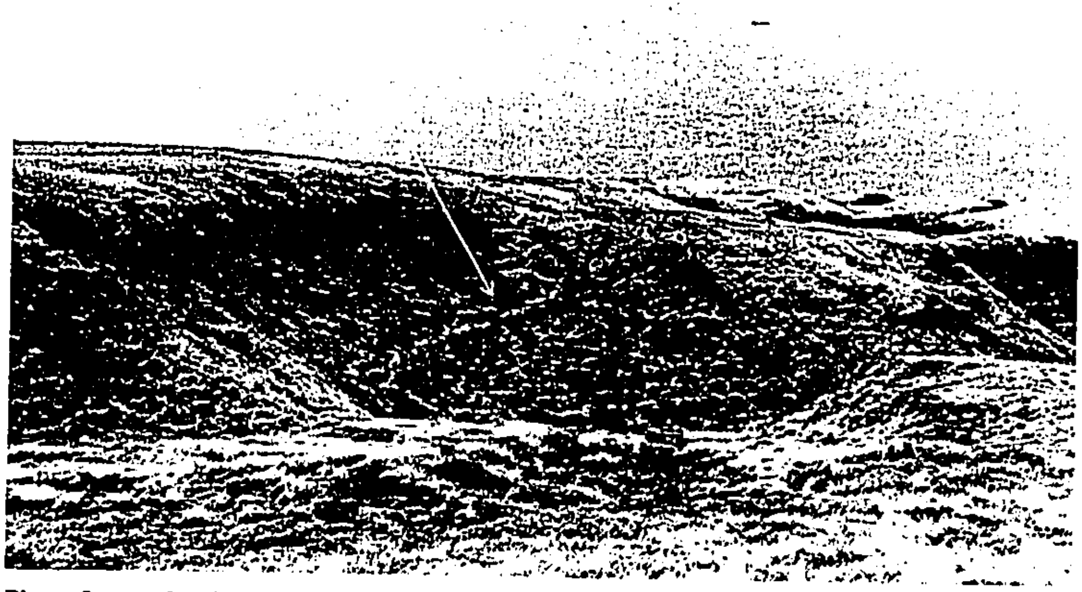

Photo 5. Section of the Lahaina Pali Trail on the east slope of Manawainui gulch, view to southeast from the MECO transmission line.

SURVEY METHODS

A one-day reconnaissance survey of a transect defined by the five standing anemometer towers was carried out on March 27, 1998 by Myra Jean Tuggle of IARII and Warren Bollmeier, consultant to Zond Pacific, Inc. The plan was to survey within a 200 foot corridor defined by a centerline of the alignment of the five towers. However, thick fog and mist at the beginning of the survey obscured the towers and, as a result, the transect from the uppermost tower to the top of Pu'u Lu'au roughly followed the edge of Manawainui gulch. At the lower reaches of the project area, visibility improved and the transect returned to the original plan. The return transect followed the anemometer towers as planned. Figure 3 shows the areas that were surveyed.

A supplementary survey was also carried out along the mid-slopes of Manawainui gulch (Photos 6 and 7) extending from the MECO transmission line inland to the west side of Pu'u Lu'au. This was done in anticipation of possible planning for a new road from the McGregor Point access road near the Lahaina Pali Trail to the lower end of the wind turbine project area.

Photo 6. Survey area along the west slope of Manawainui gulch, view to north.

Photo 7. Survey area along the west slope of Manawainui gulch, view to south from a point east and below Pu'u Lu'au.

Survey visibility was excellent because of low ground cover (see Photo 3), ensuring that any surface archaeological structures would be exposed. However, the ground surface itself was hidden by thick grass. Wherever possible, therefore, deflated surfaces were examined for evidence of human activity such as surface scatters of artifacts or midden.

SURVEY RESULTS

No traditional Hawaiian archaeological sites were identified in the reconnaissance survey of the wind turbine project area. A concrete watering trough is located about 100 m above the uppermost anemometer tower and about 10 m east of the dirt road that extends down the ridge. This area is labeled Polanui on the USGS 7.5 minute Maalaea quadrangle (see Fig. 1). The trough is 1.7 by 3.1 m, with a long axis aligned at 85 degrees TN (Photo 8). It is 60 cm deep on the interior, and stands 80 cm above the exterior ground surface. The trough sits on a level area that has been excavated into the gentle, south-sloping terrain. Vegetation in the area is grass, with scattered high stands of Christmas berry. There is a similar trough located just below the Lahaina Pali Trail, on the west side of the McGregor Point access road.

Photo 8. Concrete trough located above the Maui wind turbines project area, view to southeast.

No archaeological sites were located along the single transect on the steep western slope of Manawainui gulch. There is a short segment of roughly defined trail but this is probably a cattle track (see Fig. 3).

ASSESSMENT AND RECOMMENDATIONS

As a result of this one-day survey, it is highly unlikely that any archaeological sites are located within the Maui wind turbine project area. This area was probably not used intensively by Hawaiians and thus, would retain little, if any, evidence of prehistoric or early historic activity. Except for the watering trough and pipeline, there are no remains of cattle ranching, the only identified use of this area in historic and modern times. The trough lies almost 100 m away from the nearest anemometer tower.

It is recommended that no further archaeological investigations be undertaken in the main project area. Should plans for a new access road across Manawainui gulch be developed, a survey of the alignment should be carried out (since the present survey was limited to only a portion of the west side of the gulch).

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International Archaeological Research Institute, Inc.

PREHISTORIC & HISTORIC INVESTIGATIONS • CULTURAL RESOURCES ASSESSMENTS & PLANNING • PALEOENVIRONMENTAL STUDIES

December 2, 1998

Mr. Warren S. Bollmeier II
WSB Hawaii
46-040 Konane Place, No. 3816
Kaneohe, Hawaii 96744

Subject: Addendum to *An Archaeological Reconnaissance Survey for 27 Wind Turbines in the Ukumehame Uplands, Island of Maui* (Tomonari-Tuggle 1998)

Dear Mr. Bollmeier:

At your request as consultant to Zond Pacific Inc., International Archaeological Research Institute, Inc. has conducted additional archaeological reconnaissance survey in the Ukumehame uplands of West Maui. This survey is supplemental to the March 27, 1998 reconnaissance survey of the proposed Zond wind turbine site (reported in *An Archaeological Reconnaissance Survey for 27 Wind Turbines in the Ukumehame Uplands, Island of Maui*, by M.J. Tomonari-Tuggle, International Archaeological Research Institute, Inc., April 1998).

The supplemental survey was performed on November 20, 1998 by archaeologist Michael Desilets, M.A. The survey area consists of an approximately 6.1 m (20 ft) by 1,000 m (3,280 ft) corridor extending west from a complex of cattle pens at Pu'u Anu, across Manawainui Gulch, and terminating at the northernmost anemometer tower of the proposed wind turbine site (see attached figure). This survey corridor is the alignment of a potential access road for construction and maintenance of the proposed wind turbines.

Detailed information concerning environmental conditions, land use history, and previously recorded archaeological sites within and adjacent to the project area can be found in the April 1998 survey report (Tomonari-Tuggle 1998:1-11).

Survey Methods

The survey corridor was centered on an old road that was constructed some 20 years ago. Since that time, severe erosion has reduced the road to little more than an earthen foot path.

The pedestrian survey was conducted in two transects. The first transect extended from Pu'u Anu to the northernmost anemometer and focused on the upslope (northern) half of the corridor. The second transect was surveyed during the return trip from the anemometer back to Pu'u Anu, and focused on the downslope (southern) half of the corridor. Due to severe erosion along most of the corridor, ground visibility was very good. The survey corridor was constrained in places by the steep gulch slopes.

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Two alluvial drainages, Manawainui Gulch and one of its minor tributaries, were crossed in the course of the survey. These low areas were densely vegetated but surface visibility remained good.

In addition to the surface survey, hill-cut profiles (from previous road construction) were exposed in several locations along the upslope transect. These cuts were inspected for buried cultural deposits.

Survey Results

The supplemental archaeological survey resulted in the identification of no cultural resources in the proposed road access corridor. The determination that cultural resources are absent in the corridor is made with a high degree of confidence due to the exposed nature and consequent good surface visibility of the landscape. Furthermore, the severe erosion present along the corridor suggests that any cultural remains would likely have long since washed into Manawainui Gulch or its tributaries. In addition to the surface survey, inspection of exposed hill-cut profiles produced no evidence for buried deposits in the upslope (northern) half of the corridor.

In sum, the supplemental archaeological survey produced no evidence for traditional or historic period Hawaiian cultural resources in the proposed road corridor.

Thank you for this opportunity to assist you in the wind turbine project. If you have any questions or need further information on any aspect of this survey, please contact Michael Desilets or Steve Athens at 946-2548. I can be reached by phone at (520) 744-3634, by FAX at (520) 744-1807, or by e-mail at mtuggle@azstarnet.com.

Sincerely,

Myra Jean F. Tuggle
Project Director

cc: Keith Avery, Zond Pacific, Inc.

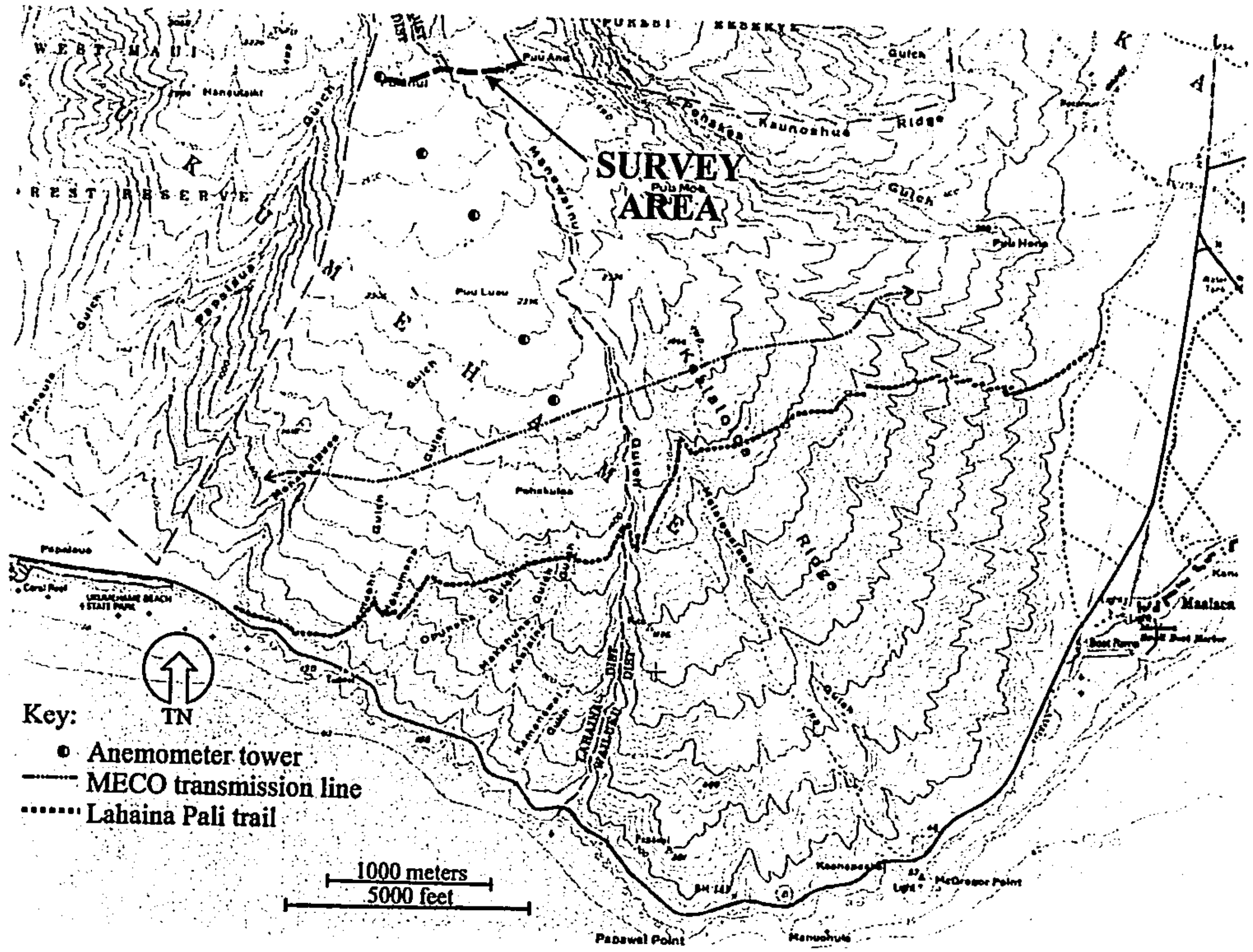

Figure 1. Location of supplemental survey corridor; Ukumehame Uplands, West Maui (USGS 7.5 minute Maalaea quadrangle).