Revised Draft Environmental Impact Statement

KAHEAWA WIND POWER II
WIND ENERGY GENERATION FACILITY

UKUMEHAME, MAUI, HAWAI'I

PREPARED FOR:
Kaheawa Wind Power II, LLC

PREPARED BY:

PLANNING SOLUTIONS

NOVEMBER 17, 2009

Revised Draft Environmental Impact Statement

KAHEAWA WIND POWER II
WIND ENERGY GENERATION FACILITY

UKUMEHAME, MAUI, HAWAI'I

SIGNATORY CERTIFICATION:

This Revised Draft Environmental Impact Statement and all ancillary documents were prepared under my direction or supervision, and, to the best of my knowledge, the information submitted fully addresses the document content requirements as set forth in HAR §11-200-18.

Charles L. Mayo for /
Perry J. White November 17, 2009

PREPARED FOR:
Kaheawa Wind Power II, LLC

PREPARED BY:

PLANNING SOLUTIONS

NOVEMBER 17, 2009

PROJECT SUMMARY

Project:	Kaheawa Wind Power II
Applicant	Kaheawa Wind Power II, LLC c/o First Wind 33 Lono Avenue, Suite 380 Kahului, HI 96732 Contact: Kelly O'Brien Phone: (808) 695-3310
Approving Agency	Office of Conservation and Coastal Lands Department of Land and Natural Resources State of Hawai‘i P.O. Box 621 Honolulu, HI 96809 Contact: Sam Lemmo Phone: (808) 587-0381
Location	Kaheawa Pastures, Mā‘alaea, Ukumehame Ahupua'a, Lahaina District, Island of Maui
Tax Map Key	Preferred Alternative: 3-6-001:014 and 4-8-001:001 Alternative 2: 4-8-001:001 (Note: access road is in 3-6-001:014 for both alternatives)
Parcel Area	Preferred Alternative: 3,413.985 acres and 1,387.71 acres Alternative 2: 1,387.71 acres
Project Site Area	Preferred Alternative: 143 acres Alternative 2: 333 acres
State Land Use District	Conservation
County Zoning	Not Applicable (State Conservation District)
Proposed Action	Construction of a new 21 MW wind power facility within the State Conservation District. The facility will be adjacent to the existing Kaheawa Wind Power facility above Mā‘alaea, Maui, Hawai‘i.
Associated Actions Requiring Environmental Assessment	Use of State-owned Conservation District Lands.
Required Permits & Approvals	Conservation District Use Permit, NPDES Construction Permit, PUC Approval, FAA Clearance, ESA Section 10 Incidental Take Permit, State Incidental Take License, Land Lease & Easements
Parties Consulted	The applicant consulted the State Department of Land and Natural Resources Office of Conservation and Coastal Lands, Division of Forestry and Wildlife, Land Division, State Historic Preservation Division, and the U.S. Fish and Wildlife Service during the preparation of this EIS. In addition, a copy of the Draft EIS was mailed to the recipients listed in Table 10.4.
Determination	Acceptance of Environmental Impact Statement
Consultant	Planning Solutions, Inc. 210 Ward Ave, Suite 330 Honolulu, HI 96814 Contact: Perry White Phone: (808) 550-4483

SUMMARY

S-1.0 PROJECT DESCRIPTION

S-1.1. PROPOSED ACTION

Kaheawa Wind Power II, LLC (KWP II LLC) is proposing to establish a 21 megawatt (MW) wind power generating facility and related improvements at Kaheawa Pastures above Mā‘alaea, Maui, Hawai‘i. If the Preferred Alternative is approved, the wind energy generation facility, Kaheawa Wind Power II (KWP II), would be located west of the existing 30 MW Kaheawa Wind Power project (hereinafter called KWP I). Like KWP I, KWP II would supply wind-generated electricity to Maui Electric Company Ltd. (MECO).

If the land use approvals and environmental permits are granted for the Preferred Alternative, KWP II LLC will:

- Obtain a lease from the State Department of Land and Natural Resources for approximately 135 acres of land within parcel (2) 3-6-001:014 and 8 acres of land within parcel (2) 4-8-001:001. This property is contiguous to the existing State-owned road that was improved during construction of KWP I, and for which KWP I retains an easement.
- Obtain an easement for use of the existing main access road (which is in parcel (2) 3-6-001:014) from DLNR and execute licensing agreements with KWP I to use existing road and construct proposed Baseyard Compound within the KWP I lease area.
- Install 14 General Electric (GE) 1.5 MW wind turbine generators (WTGs).
- Construct an electrical substation and install interconnection facilities to connect the facility to the existing MECO power transmission system that pass over the substation site using a short overhead cable.
- Construct overhead collection lines spanning the gulch, to connect the underground collection system from the WTGs to the substation.
- Install underground electrical power lines connecting all of the turbines with the new substation.
- Install a Battery Energy Storage System (BESS) adjacent to the electrical substation.
- Construct a new operations and maintenance building to house operations personnel, equipment and facility spare parts.
- Construct one unguyed permanent meteorological tower and a temporary 65-meter test tower prior to construction of the WTGs.

KWP II is designed to provide a source of affordable, renewable energy to Maui’s residents. It would provide economic benefits in the form of cost savings compared to fossil fuel-driven energy, as well as a hedge against future fossil or bio-fuel cost increases. It would also provide environmental benefits in the form of reduced emissions of green house gases and other pollutants. The expected life span of the facility is 20 years, after which time the owner will either exercise an option to extend the lease or remove the facilities.

S-1.2 ALTERNATIVES EVALUATED IN DETAIL

KWP II LLC prepared a Draft EIS (DEIS) for the proposed project in February 2009. That document focused on what it referred to as the Downwind Siting Area. Other locations had been considered but had been eliminated as infeasible. KWP II LLC continued to collect wind data from the meteorological monitoring towers at Kaheawa while the DEIS was being reviewed and public and agency comments were being received. As the data accumulated, it became apparent that the wind lower on the mountainside was potentially superior to the wind resource in the Downwind/Downstring areas. Based on this new information, KWP II LLC has determined that the

Downroad option is preferable to the Downwind/Downstring option. KWP II LLC has defined a proposed action, which is its Preferred Alternative, for detailed analysis in this Environmental Impact Statement (EIS) that utilizes the Downroad siting area. The Downwind/Downstring siting area has now become the Alternative 2 option. Both alternatives and the No Action alternative are described below.

Preferred Alternative: 21 MW Facility in Downroad Siting Area at Kaheawa Pastures:

The Preferred Alternative consists of KWP II LLC constructing 21 MW of wind energy generating capacity. Fourteen (14) General Electric (GE) 1.5 MW wind turbine generators (WTG) would be added to the site in a string along the existing access road approximately 2,000 feet southeast of the southern end of the existing KWP I turbine string.

This proposal places the WTGs closer to the highway and immediately adjacent to the existing access road. By doing so, it eliminates the need for most of the new road construction that would have been required for the Downwind/Downstring plan. The reduced road construction and more uniform (relative to the previous plan) terrain allow the facilities that make up the Preferred Alternative to be constructed with much less (<50 percent) earthwork than would be needed for the previous plan, reducing the potential effects of such activities. It would meet all the objectives listed in Section 1.3 and is KWP II LLC's preferred course of action.

Alternative 2: 21 MW Facility in Downwind and Downstring Siting Areas at Kaheawa Pastures: Alternative 2 consists of KWP II LLC's constructing 21 MW of wind energy generating capacity in the siting areas to the west and south of the existing KWP I facility (i.e., the Downwind and Downstring areas). Fourteen (14) WTGs would be added to the site; 11 of these would be in a line roughly parallel to the existing turbines (i.e., the "Downwind" siting area). The remaining three turbines would be constructed in the "Downstring siting area" just south of the existing KWP I turbines that is in a rough continuation of the line of existing WTGs (i.e., the KWP I turbines). Connector roads would be installed to access the new turbines.

This alternative is less visible from most areas than is the Preferred Alternative, however, it places WTGs closer to the existing nēnē release pen and native vegetation; would require a larger amount of earthwork and development not already disturbed during construction of KWP I; and constructions costs would be slightly higher.

No Action Alternative: This alternative would not meet the project objectives listed in Section 1.3 but is included in conformance with HAR, §11-200-17(f)(1). It also provides a baseline against which the proposed action can be compared. It assumes that no additional wind generating capacity will be constructed at Kaheawa Pastures in the foreseeable future.

S-2.0 BENEFICIAL & ADVERSE IMPACTS

S-2.1 PROBABLE IMPACTS OF THE PREFERRED ALTERNATIVE AND ALTERNATIVE 2

KWP II LLC commissioned multiple studies to determine the nature and extent of KWP II's potential impacts on natural and cultural resources such as biota, historic and archaeological sites, cultural beliefs and practices, soil, and air quality. Table S-1 below summarizes the kinds of impacts that could result from both alternatives, and these are discussed in further detail in Chapter 4. In general, the analyses showed that impacts were relatively small in comparison to the benefits that the proposed addition of renewable energy to Maui's grid would provide. Where impacts were determined to be likely or possible, KWP II LLC identified appropriate measures to avoid, minimize, and mitigate them to the maximum extent practicable.

S-2.2 PROBABLE IMPACTS OF THE NO ACTION ALTERNATIVE

The No Action alternative foregoes adding additional wind energy generating capacity at Kaheawa Pastures and its associated environmental and economic benefits. It would delay or eliminate the potential to add another source of renewable energy to the island's electrical grid, and this would force the continued combustion of fossil fuels and their accompanying greenhouse gas emissions. No action would be inconsistent with the State and County goals of rapid deployment of renewable energy generating capacity. It also foregoes the opportunity to utilize a site with proven wind resources and existing infrastructure (e.g., existing access road, proximity to MECO transmission system, existing turbines). KWP II LLC strongly believes that the no action alternative is undesirable from a long-range energy planning standpoint, as discussed in detail in Chapter 5.0 of this EIS.

S-3.0 PROPOSED AVOIDANCE, MINIMIZATION, & MITIGATION MEASURES

Over the course of its impact analysis for the KWP II project, KWP II LLC identified categories of potential impacts and evaluated their nature and magnitude. In cases where some level of impact was determined to be unavoidable (i.e., ground disturbance, visual impacts, and impacts to terrestrial and avian biota), KWP II LLC incorporated design features and practices into its proposal in order to minimize and mitigate these impacts to the maximum extent practicable (e.g., minimizing new road construction, adopting erosion control and revegetation plans, developing a Habitat Conservation Plan for protected fauna, etc.). In other cases where adverse impacts were determined unlikely but could not be completely ruled out (i.e., archaeological and cultural impacts, construction-period air quality impacts), KWP II LLC likewise identified appropriate avoidance strategies and mitigation measures in accordance with the recommendations of the resource studies it commissioned. Proposed mitigation measures are discussed in detail under each relevant impact topic in Chapter 4. KWP II LLC will follow all avoidance, minimization, and mitigation measures recommended in the commissioned studies during construction and operation of the project.

S-4.0 CONSISTENCY WITH LAND USE POLICIES AND PLANS

Both alternative project sites are located adjacent to the existing KWP I wind power generating facility and are consistent with State and County land use plans and controls. It would be constructed and operated in accordance with applicable environmental regulations. Table 6.1 lists the permits and other approvals that KWP II LLC will need to obtain to construct and operate the new facility.

S-5.0 OTHER CHAPTER 343 TOPICS

Notwithstanding the environmental and economic benefits associated with increased renewable energy capacity, the KWP II project would not lead to significant growth or changes in the character of economic activity on Maui (e.g., the opening of new industries not previously practical) that might have secondary impacts. Likewise, the KWP II project will not generate significant new employment opportunities. Hence, it does not have the ability to cause significant secondary impacts.

Constructing and operating the proposed wind energy generation facility would provide renewable energy to Maui's grid, thereby helping to reduce pressures on the existing grid and alleviate some of the island's dependence on imported fossil fuels. The facility would not preclude other uses of the property that might be more productive over the long term, nor does it preclude the use and development of other energy sources.

The construction of the proposed facility does not irrevocably commit any party to the continued use of the site for wind energy generation or to the continued use of wind energy to add power to MECO's grid. At the end of the estimated project lifetime of 20 years the land lease and power purchase agreements can be renegotiated or terminated.

At present, there are no known unresolved issues. However, numerous permits and approvals must still be obtained, and it is possible that issues may arise as applications for these are prepared and processed.

S-6.0 RATIONALE FOR PROCEEDING

Chapter 4 describes the environmental effects that could result from construction and operation of the proposed wind power generating facility. KWP II LLC is committed to avoiding, minimizing, or mitigating adverse effects to the greatest extent practicable. KWP II LLC does not believe that there are alternatives that would achieve the same goals with fewer environmental effects. Consequently, it proposes to proceed with the Preferred Alternative.

S-7.0 PARTIES CONSULTED

KWP II LLC distributed the EISPN to the individuals and organizations listed in Table 10.1 and requested their comments on the proposed scope of the analysis and on the completeness of the alternatives that KWP II LLC proposed to evaluate. It distributed the Draft EIS to the parties listed in Table 10.4. KWP II LLC also conducted community outreach through meetings and site visits with representatives of the Maui community, which are summarized in Chapter 10. The public will have an opportunity to review and comment on this Revised Draft EIS in accordance with HRS Chapter 343.

Table S-1 Construction Period Impacts

EIS Section	*Impact Topic*	*Preferred Alternative*	*Alternative 2*
4.1	**Geology, Topography and Soils**	The existing road network serving Kaheawa Pastures will be extended and sites for the proposed facilities will be graded. The preliminary engineering plans indicate that this will require the disturbance of 43 acres of land and over 406,000 cubic yards of cut and fill. These are preliminary estimates and therefore conservative; the actual area of disturbance and cut and fill volumes will be minimized to the extent practical during the final design process. Approximately one-third of the disturbed area will be revegetated following construction; the remainder will remain as gravel roads, facility footprints, and other stabilized areas.	The preliminary engineering plans indicate that Alternative 2 will require the disturbance of 60 acres of land and over 830,000 cubic yards of cut and fill. As with the Preferred Alternative, these are preliminary estimates and therefore conservative; the actual area of disturbance and cut and fill volumes would be minimized to the extent practical during the final design process. Based on these estimates construction of the Alternative 2 layout will require an increase in earthwork disturbance (406,000 cubic yards instead of 830,000 cubic yards) compared to the Preferred Alternative.
4.2	**Impacts on Air Flow and Climate**	There will be no significant changes to air flow and climate.	Same as Preferred Alternative.
4.3	**Air Quality**	Project-related construction activities will generate fugitive dust from earthmoving operations and exhaust emissions from construction vehicles; the former will be limited to the project area. Small quantities of construction-related fugitive dust emissions will also result from vehicles carrying equipment and workers up and down the existing KWP I access road.	Same as Preferred Alternative.

Table S-1 Construction Period Impacts

EIS Section	*Impact Topic*	*Preferred Alternative*	*Alternative 2*
4.4	**Hydrology and Water Resources**	No hydrologic or water resources will be directly affected by the proposed project. Site and access road grading will alter storm water runoff paths, but the runoff will continue to flow into existing drainage basins. The KWP II project will not significantly increase the volume or alter the quality of storm water runoff leaving the project site. All water used on site during construction and operation would be trucked in; the small amount of domestic wastewater will be collected in a septic tank or portable toilets and trucked away for disposal.	Same as Preferred Alternative.
4.5	**Natural Hazards**	Proposed facilities are outside flood hazard areas and tsunami inundation zones. The facilities would be exposed to seismic, hurricane, high wind and lightening strike hazards but minimal impacts are anticipated due to planned preventive and response measures.	Same as Preferred Alternative.
4.6	**Terrestrial Flora**	No sensitive or endangered flora inhabit the areas to be directly affected by construction. The KWP II project includes a plan for immediate revegetation to control soil erosion along the edges of turbine pads and along road cuts and fill slopes. KWP II LLC will also implement measures to minimize and control invasive species in the proposed project area.	Same as Preferred Alternative except that Alternative 2 site is closer to native vegetation. As a result, KWP II LLC will supplement their plan for immediate revegetation and invasive species control by conducting long-term revegetation with reintroduction of native plants.

Table S-1 Construction Period Impacts

EIS Section	*Impact Topic*	*Preferred Alternative*	*Alternative 2*
4.7	**Terrestrial & Avian Fauna**	The KWP II project will have no significant impact on non-protected species. However, "incidental take" of protected species may occur as a result of colliding with the WTGs, equipment, vehicles and other proposed facilities. This is being addressed through a Habitat Conservation Plan that includes measures to avoid, minimize and mitigate take. The four protected species that could be impacted are the Hawaiian Petrel, Newell's Shearwater, nēnē, and Hawaiian Hoary Bat.	The risk of incidental take of the four species is believed to be similar for both sites, with the exception of nēnē. Nēnē have been observed more often in the vicinity of Alternative 2 and so are believed to be at greater risk of take there.
4.8	**Noise Impacts**	Construction noise from excavators, trucks, and other heavy equipment will occur at the project site. Because mechanical equipment alone will not be able to fracture all areas of rock, it is expected that some use of explosives (i.e., drill-and-shoot) will be required. No noise-sensitive uses are located nearby, but a construction noise permit may be required. If a permit is obtained, the contractor will employ reasonable and standard practices to mitigate noise.	Same as Preferred Alternative except there is a lower probability that explosives will be used during construction.
4.9	**Archaeological, Historic, & Cultural Resources**	The proposed development would not affect the *heiau* adjacent to the existing wind farm, the Lahaina Pali Trail, or the Mā'alaea branch of the trail. No artifacts or burials were encountered during construction of KWP I which indicates a low probability of encountering subsurface remains at the KWP II project site. If any archaeological deposits or human burials are encountered, the contractor will halt work and contact the State Historic Preservation Division (SHPD). Cultural consultation and impact assessment conducted for the project show that so long as the measures that KWP II has agreed to are implemented it will not have a significant adverse effect.	Same as Preferred Alternative except that Alternative 2 is closer to the *heiau* and has no direct impact on the Mā'alaea branch of the Lahaina Pali Trail.

Table S-1 Construction Period Impacts			
EIS Section	***Impact Topic***	***Preferred Alternative***	***Alternative 2***
4.10	**Land Use & Socioeconomic Effects**	The KWP II project will not interfere with other existing or potential uses of the State land that the proposed facilities would occupy. The presence of the WTGs, site access roads and related facilities would not limit access to other land served by the existing access road. The parcels in which the proposed project and existing access road are situated are designated as Section (b) Ceded Lands, and OHA will therefore receive a portion of the amount that KWP II LLC pays to the Department of Land and Natural Resources for the lease of the project site. Direct socio-economic effects of the proposed facilities include: (1) construction employment and business activity; (2) ongoing employment of facility staff (which would be relatively limited); (3) ongoing expenditures for materials and outside services; and (4) State revenues in the form of taxes and lease revenues.	Same as Preferred Alternative except that the overall construction costs for Alternative 2 are approximately $6 million (about 7 percent) more.
4.11	**Scenic and Aesthetic Resources**	During construction, visible components of the KWP II project will include construction equipment, transport and assembly of facility parts, and temporary dust and smoke from construction vehicles. The contractor will be required to minimize fugitive dust in accordance with applicable law, and the other visible activities during construction will be minor and temporary in nature.	Same as Preferred Alternative.

Table S-1 Construction Period Impacts

EIS Section	*Impact Topic*	*Preferred Alternative*	*Alternative 2*
4.12	**Hazardous Materials**	Construction will involve the use of small amounts of several hazardous materials that require special handling and storage. These will be identified, along with measures for containment and spill prevention, in a SPCC Plan for the KWP II facility. The risk of harm will be minimized by requiring the contractor to follow best management practices.	Same as Preferred Alternative.
4.13	**Public Infrastructure & Services**	The KWP II project has little potential to adversely affect public infrastructure and services adversely. It would consume only small amounts of electrical power. All of the water needed for the facility would be trucked up to the site; no new potable water service would be required. Minor traffic delays could result during transport of large parts & components (i.e., WTGs) to the site. KWP II LLC will require its contractors to coordinate and implement the traffic control measures described in Chapter 4 to minimize potential delays. No significant impacts on telecommunications or other utilities are anticipated.	Same as Preferred Alternative.

Source: Compiled by Planning Solutions, Inc.

Table S-2. Operational Period Impacts

EIS Section	*Impact Topic*	*Preferred Alternative*	*Alternative 2*
4.1	**Geology, Topography and Soils**	The design features that have been incorporated into KWP II to minimize erosion (i.e., minimal road construction, drainage culverts under site roads, minimization of cut/fill volumes), in addition to the revegetation plan in place for the facility will insure that the potential for erosion is minimized during operation of the proposed facility.	Same as Preferred Alternative.
4.2	**Impacts on Air Flow and Climate**	The proposed WTGs do not have the potential to affect temperature, rainfall, humidity, or most other meteorological parameters. The KWP II project will reduce the combustion of fossil fuels and, therefore, the emissions of greenhouse gases that are contributing to global warming.	Same as Preferred Alternative.
4.3	**Air Quality**	Once operational, the proposed facilities have limited potential to affect air quality aside from the indirect benefits of reducing fossil fuel consumption and minor emissions from certain project-related activities such as maintenance work, vehicle-trips made by staff and vendors traveling to and from the site, and the operation of the electrical substation and BESS equipment.	Same as Preferred Alternative.
4.4	**Hydrology and Water Resources**	Same as construction period.	Same as construction period.
4.5	**Natural Hazards**	Same as construction period.	Same as construction period.
4.6	**Terrestrial Flora**	Same as construction period.	Same as construction period.

Table S-2. Operational Period Impacts

EIS Section	*Impact Topic*	*Preferred Alternative*	*Alternative 2*
4.7	**Terrestrial & Avian Fauna**	The WTGs will have greater potential to affect protected species once they begin operating than they will during the construction period (when the rotors are not turning).	
4.8	**Noise Impacts**	The proposed project would be in general compliance with the 55 dBA daytime limit. It will exceed the State nighttime property line sound level limit of 45 dBA where the Lahaina Pali Trail intersects the line of new turbines between WTG #4 and #5. Hikers would be exposed to the turbine sound for only a small portion of the trail and would not interfere with communication or other necessary activities. The areas that might experience sound levels in excess of 45 dBA are uninhabited.	KWP II may exceed the State nighttime property line sound level limit of 45 dBA at the parcel boundary but would be in general compliance with the 55 dBA daytime limit. Sound from the proposed turbines may be audible along parts of the Lahaina Pali Trail but are predicted to be lower than the 45 dBA night-time limit. The areas that might experience sound levels in excess of 45 dBA are uninhabited.
4.9	**Archaeological, Historic, & Cultural Resources**	Once in operation, the KWP II project will have virtually no potential to negatively impact archaeological or historic sites or cultural resources so long as the preservation plan for the *heiau*, Lahaina Pali Trail and Mā‘alaea branch of the trail is approved and implemented. In addition, outreach programs that have been initiated in conjunction with the existing wind generation facilities are being continued and expanded upon. The KWP II project would not preclude or limit access to the area by cultural practitioners beyond existing conditions.	Same as Preferred Alternative except that Alternative 2 is closer to the *heiau* and has no direct impact on the Mā‘alaea branch of the Lahaina Pali Trail.
4.10	**Land Use & Socioeconomic Effects**	Same as construction period.	Same as construction period.
4.11	**Scenic and Aesthetic Resources**	Proposed WTGs of the Preferred Alternative would be constructed lower on the Kaheawa Pastures hillside and slightly east of the existing KWP I facility, and would therefore become more visible from populated areas and public vantage points. Once constructed, the KWP II facility will produce no visible airborne emissions.	In general, the proposed WTGs are nearly identical in size and character to those existing at KWP I, and will be less visible to the more populous areas of Maui because they are situated further west. Once constructed, the KWP II facility will produce no visible airborne emissions.

Table S-2. Operational Period Impacts			
EIS Section	***Impact Topic***	***Preferred Alternative***	***Alternative 2***
4.12	**Hazardous Materials**	Operation of the KWP II facility will require on-site storage of cleaning products and mineral, hydraulic and lubricating oils for maintenance of the substation and WTG equipment. Best management practices, including a SPCC Plan, will be employed to minimize the risk of harm and for containment and spill prevention for the KWP II facility.	Same as Preferred Alternative.
4.13	**Public Infrastructure & Services**	The proposed KWP II project does not require utility connections and would place no additional burden on public services. It would generate fewer than 20 vehicle-trips per day.	Same as Preferred Alternative.
Source: Compiled by Planning Solutions, Inc.			

TABLE OF CONTENTS

****

LIST OF FIGURES

LIST OF TABLES

THIS PAGE WAS INTENTIONALLY LEFT BLANK

1.0 PURPOSE AND NEED

1.1 INTRODUCTION & OVERVIEW

1.1.1 APPLICANT BACKGROUND

Kaheawa Wind Power II, LLC (KWP II LLC) is the project entity formed by Hawai‘i Holdings, LLC, which is comprised of First Wind Holdings, LLC (formerly UPC Wind Partners, LLC), a Boston-based wind energy company, and Makani Nui Associates, LLC, a Maui-based company dedicated to the development and operation of renewable energy projects, primarily wind energy, throughout the State of Hawai‘i. First Wind currently has six projects in operation for a total of approximately 478 megawatts (MW) of wind energy generation in operation and currently has a considerable pipeline of prospective projects under development.

1.1.2 PROJECT OVERVIEW

KWP II LLC is proposing to construct and operate a new 21 MW wind energy generation facility on State Conservation District land at Kaheawa Pastures above Mā‘alaea, Maui, Hawai‘i (see Figure 1.1). The proposed project, which is known as Kaheawa Wind Power II (KWP II), is situated immediately adjacent to the existing 30 MW Kaheawa Wind Power (KWP I) project, which commenced operation in the summer of 2006. Like the existing KWP I project, KWP II would supply wind-generated electricity to Maui Electric Company Ltd. (MECO) under the terms of a Public Utilities Commission (PUC) approved power purchase agreement (PPA).

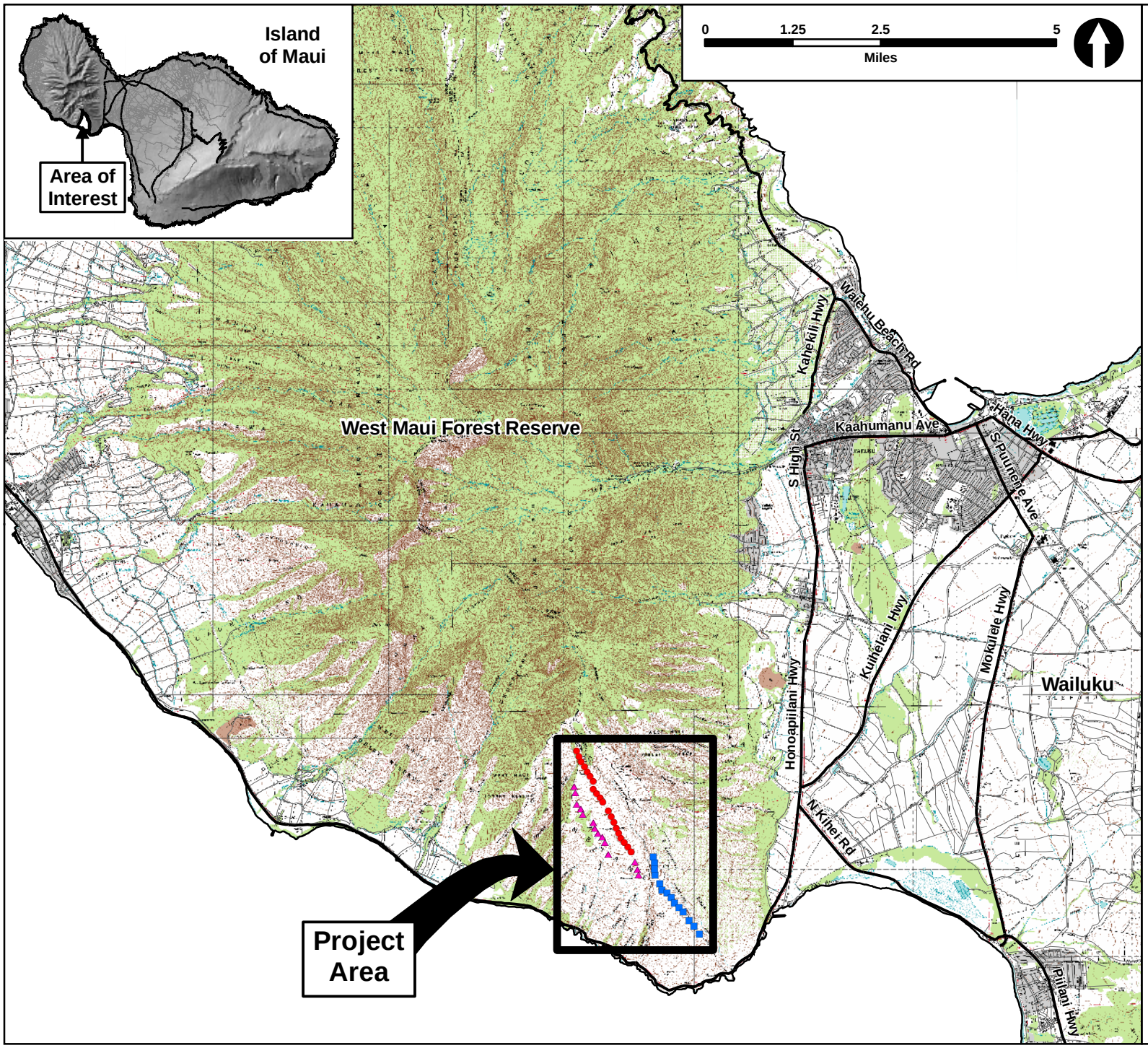
KWP II will consist of 14 General Electric (GE) 1.5 MW wind turbine generators (WTGs), an operations and maintenance building, underground cables carrying electrical power from the individual wind generators to a new electrical substation, a Battery Energy Storage System (BESS), a short overhead transmission line connecting the substation with the MECO transmission system, an overhead collection line crossing Manawainui Gulch, a communications system, wind monitoring equipment, and service roadways to connect the new facilities to the existing main access road serving KWP I.

For the past year, KWP II LLC has collected meteorological data at the site to determine suitable siting areas for the proposed WTGs. The results of that data show that the most favorable locations are to the west and south of the existing KWP I turbines. Due to the characteristics of the wind resource, ease of constructability, and other factors, KWP II LLC has identified two areas that it believes are practicable locations. As described in more detail in the following chapter of this report, its “Preferred Alternative” places the WTGs along the existing KWP I access road below the existing WTGs; this report refers to this as the “Downroad Alternative”. A second arrangement, which it refers to as the “Downwind Alternative” places the 14 additional WTGs to the west of the existing turbines and involves the construction of additional access roads that connect the siting area with the existing Kaheawa Pastures access road. The boundaries of the two siting areas are depicted in Figure 1.2). Chapter 2 of this report describes the alternatives in detail. That chapter also discusses other alternatives that were considered but eliminated without detailed analysis.

The remainder of this chapter is divided into two major parts:

Section 1.2 explains the purpose of the project and describes the benefits associated with adding wind energy generating capacity to Maui’s electrical system.

Section 1.3 lists the overall objectives that were used to define the proposed action and alternatives.



Legend:

- Existing KWP I Turbines
- Prposed KWP II Turbines: Preferred Alternative
- Prposed KWP II Turbines: Alternative 2

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Sources:

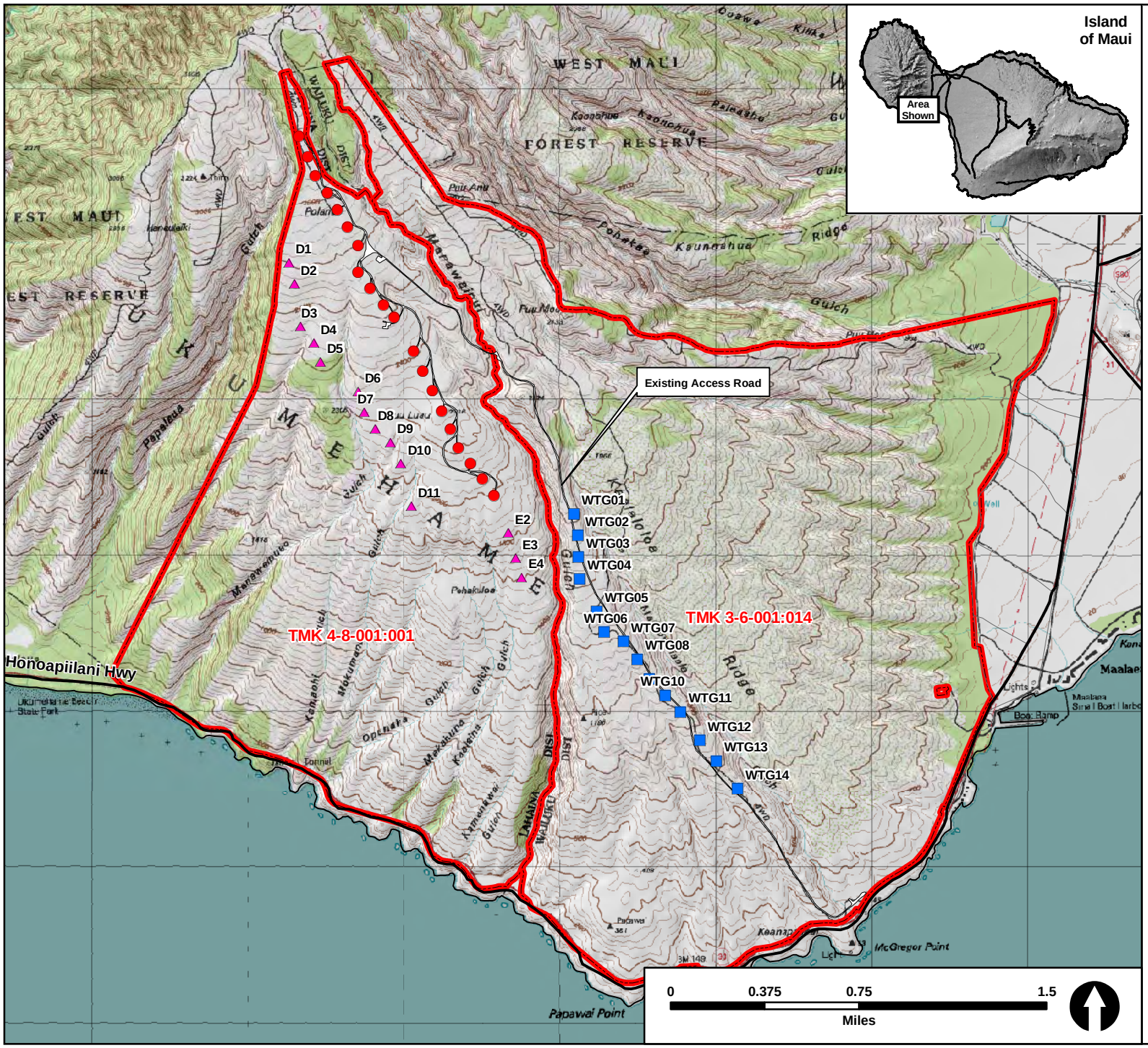
-First Wind
-State of Hawai'i GIS

Figure 1.1:

Location Map

Kaheawa Wind Power II

Figure 1-1 Location Map 2009-09-09.mxd



Legend:

- Existing KWP I Turbines
- Proposed KWP II Turbines: Preferred Alternative
- Proposed KWP II Turbines: Alternative 2
- Highways
- Roadways

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Sources:

-First Wind
-State of Hawai'i GIS
-USGS 7.5' Quad Map
-SSFM, Inc.

Figure 1.2:

Vicinity Map

Kaheawa Wind Power II

Figure 1-2 Vicinity Map 2009-09-08.mxd

1.2 PURPOSE & NEED FOR THE PROJECT

Maui presently depends heavily upon fossil fuels for its electrical energy needs. The geographic isolation of the State of Hawai‘i, coupled with its lack of an indigenous fossil fuel source, makes it particularly vulnerable to any interruption in the supply of fossil fuels to the islands. The importance of improving Hawai‘i’s energy security and its sustainable future has gained acceptance and momentum among the general public and elected officials leading to a number of renewable energy initiatives and incentives for energy conservation and efficiency.

The purpose of the proposed KWP II project is to reduce Maui’s current dependence on fossil fuels by generating additional electrical energy from wind. As currently proposed, the project will provide an estimated 70,000 megawatt-hours of electricity per year (MWh/year) to MECO’s system.[1] It is equivalent to well over 5 percent of the electricity produced on the island in 2007 or enough electricity to power about 7,700 average Maui homes (at 750 kilowatt-hours per month). By substituting an “indigenous renewable” fuel source for imported fossil fuel, the project will help Maui to meet its goals of 95 percent of its energy needs sustainably while achieving a carbon-neutral footprint.[2] It would also help the State move toward its goal of energy independence and sustainability. Based on the best available projections of the cost of fossil fuel, it could also provide electricity to Maui’s residents at a lower cost than would be possible using fossil fuel. Each of these benefits is discussed in more detail in the following subsections.[3]

1.2.1 CONTRIBUTION TO MECO’S RENEWABLE ENERGY PORTFOLIO

As recently as 2005, less than 7 percent of Hawai‘i’s energy was provided by renewable sources (DBEDT 2006). Oil was used to produce 80 percent of electricity sold by the State’s utilities in that year. The remaining electricity generation was supplied by coal (13.9 percent), municipal solid waste (2.6 percent), geothermal (2 percent), hydroelectricity (0.7 percent), bagasse (sugarcane waste) (0.6 percent), wind (0.1 percent), and a very small amount from solar photovoltaics.

Since that time, the situation has changed significantly. On June 2, 2004, Hawaii’s governor signed Act 95 (Session Laws of Hawai‘i 2004) into law. Act 95 replaced the previous renewable portfolio standard (RPS) goal with an enforceable standard. These standards require utilities to make renewable energy generation an increasing percentage of their portfolio. In June 2009, the Governor signed HB 1464 which increased the amount of renewable electrical generation required by utilities in 2020 and 2030. The RPS is now:

- 8 percent of net electricity sales by December 31, 2005;
- 10 percent of net electricity sales by December 31, 2010;
- 15 percent of net electricity sales by December 31, 2015;
- 25 percent of net electricity sales by December 31, 2020; and
- 40 percent of net electricity sales by December 31, 2030.

[1] This conservatively assumes that the turbines operate at an average of nearly 40% capacity over the course of a year. The actual number of megawatt-hours per year (MWh/year) is expected to be somewhat higher than this.

[2] Maui County Energy Alliance, Sustainable Energy: Strategies for Implementation, September 2009; www.mauicounty/gov/energyexpo.

[3] For the purposes of consistency and transparency, the following assumptions are utilized in calculations throughout this document (unless otherwise noted): (a) Net capacity factor = 38%; (b) average heat rate for MECO-owned generation = 11,500 BTU/Net kWh; (c) BTU Savings = 803,905-1,148,436 MMBTU/yr; (d) 5.825 MMBTU/BBL of distillate (diesel) fuel oil and 21 MW installed capacity; (e) Annualized energy production = 8760 hours per year * Net Capacity Factor (.38); (f) Oil Prices at $80/barrel.

The law allows utilities to count existing renewables in the total. It also allows an electric utility company and its electric utility affiliates to aggregate their renewable portfolios in order to achieve the renewable portfolio standard.[4]

MECO's most recent Renewable Portfolio Standard Status Report to the State of Hawai'i PUC states that in 2007 the utility achieved a Renewable Portfolio Standard of 24.7 percent.[5] In that year, slightly under two-thirds of the electrical energy that was generated in MECO's system using renewable resources came from KWP I, with the bulk of the remainder coming from Hawaiian Commercial & Sugar Company (HC&S). The remaining third of the renewable portfolio standard credits that MECO reported to the PUC came from programs that displaced electricity from fossil fuel-fired sources (e.g., solar water heating) and from electrical savings achieved by switching to more energy-efficient technologies (e.g., fluorescent lighting).

KWP II LLC is in discussions with MECO to negotiate a power purchase agreement (PPA) for the proposed KWP II facility. The terms of that agreement will determine the amount that will be paid to KWP II LLC and other aspects of energy delivery.

Since the establishment of the RPS, Hawai'i has continued to pass legislation intended to enhance the state's energy self-sufficiency and reduce greenhouse gas emissions. House bills passed in 2006 and 2007 provided Hawai'i with a framework to move toward energy self-sufficiency by focusing on energy efficiency and promoting renewable energy sources. In 2008, the Hawai'i State Legislature established a full-time, temporary renewable energy facilitator position within the Department of Business, Economic Development, and Tourism and provided funding for designated energy program personnel and activities. It also established a renewable energy facility siting process to expedite the review and action upon State and county permits necessary for the siting, development, construction, and operation of a renewable energy facility of at least 200 megawatts of electricity and established a renewable energy facility siting special fund.

The State of Hawai'i and the US Department of Energy (USDOE) have signed a Memorandum of Understanding (MOU) establishing the Hawai'i Clean Energy Initiative (HCEI). The HCEI MOU creates a long-term partnership designed to help transform Hawai'i's energy system into one that utilizes renewable energy and energy efficient technologies to supply 70 percent of its energy needs by 2030 (State of Hawai'i and USDOE 2008).

On October 20, 2008, the State of Hawai'i, the State Department of Business, Economic Development and Tourism (DBEDT), the State Division of Consumer Advocacy, Hawaiian Electric Industries, Inc. and Hawaiian Electric Company, Inc. (HECO), signed an Energy Agreement, which is a detailed agreement to implement the Hawai'i Clean Energy Initiative. The agreement includes a commitment by Hawaiian Electric Industries to encourage and explore the development of known project proposals, including Kaheawa Wind Power II, with the goal of bringing the maximum number of projects and renewable megawatts online as quickly as possible. The parties also agreed to amend Hawai'i Revised Statutes, §269-92 to provide that by 2030, 40 percent of the HECO Companies' total RPS must be from renewable sources, and that through 2015, not more than 30 percent of such total RPS may come from imported biofuels consumed by the utilities' units.

In order to focus the majority of its efforts on implementing the HCEI and Energy Agreement, MECO and the Consumer Advocate filed a joint request to the PUC on November 6, 2008, asking it to suspend MECO's pending Integrated Resource Plan 3 (IRP-3) docket and open a new docket to establish a Clean Energy Scenario Planning (CESP) process. The PUC issued the requested order

[4] This means that the Hawaiian Electric Company affiliates -- Hawaiian Electric, Maui Electric, and Hawaii Electric Light Company -- may add together their renewable energy numbers to meet the goal.

[5] *2007 Renewable Portfolio Standard Status Report for Hawaiian Electric Company, Inc., Hawaii Electric Light Company, Inc., and Maui Electric Company, Limited, for the Year Ended December 31, 2007* as reported at www.heco.com/vcmcontent/StaticFiles/pdf/2007_RPs_Report-to-PUC_draft_080530_FINAL.pdf.

closing the IRP Docket on December 8, 2008 (Docket No. 04-0077). The order suspends all activities pursuant to the IRP Framework citing the desire to focus resources on the development of the CESP framework.

1.2.2 ECONOMIC BENEFITS

Initially, the KWP II project would generate economic activity through construction employment and equipment and material sales. Over the long term, it will create additional operations and maintenance jobs, business activity (by suppliers), and tax and lease revenues. However, the project's most important economic effect on the island will be to stabilize a portion of the energy fuel cost incurred by MECO as it generates electricity for Maui island residents and businesses under its fixed-price contract with MECO.

KWP II LLC forecasts two different kinds of quantifiable economic benefits of the project. One is associated with the construction of the new capital infrastructure that would be installed as part of the project. The second has to do with the economic benefits that will result from the reduced outflow of dollars that accompany lower fossil fuel use.

1.2.2.1 Construction of New Infrastructure

The proposed Downroad Alternative involves the expenditure of approximately $52 million for site construction contracts and services; the second (Downwind/Downstring) Alternative it is considering is more costly, with an estimated cost of $58 million. This will result in local jobs during design, development, and construction. Those expenditures will lead to approximately $1 million in state excise tax revenues;

Over the life of the facility, it will also:

- Produce an estimated $6M of lease revenue to the state for land use; and
- Generate approximately $5M in job-related income (plus associated income tax revenues).

1.2.2.2 Effects of Reduced Fossil Fuel Purchases

Hawai'i's citizens pay the nation's highest energy costs, partly because Hawai'i is the most oil-dependent state. In 2005, Hawai'i relied on imported fossil fuels (petroleum and coal) for 94.5 percent of its primary energy needs, at a cost of $4.62 billion (Maui County 2008). Roughly 13 percent of Hawai'i's oil imports came from U.S. sources in 2005 and the remainder came from overseas. Hawai'i's coal is currently imported from Australia and Indonesia.

KWP II LLC estimates that the proposed project would reduce fossil fuel consumption by an estimated 138,000 barrels per year, significantly lowering Maui's dependence on imported fossil fuels.[6] Fossil fuel pricing has historically been volatile, while over time continuing to increase in real terms. The recent past is no exception, with crude reaching its historical inflation adjusted peak price of $147.27 on July 11, 2008. Fuel prices are subject to fluctuation based on supply and demand conditions as well as political concerns that can affect the long term availability of world supply. KWP II LLC estimates that if fuel prices remained constant over the life of the project, the substitution of wind energy for fossil fuel energy would reduce the amount that MECO spends on imported fuel by approximately $100M (based on oil at $80/barrel). Reducing the proportion of its energy that comes from fossil fuel would also buffer the system from the energy cost fluctuations that accompany volatile oil prices. The power purchase agreement that KWP II LLC is seeking to

[6] This estimate is based on the following: (a) Net capacity factor = 38%; (b) average heat rate for MECO-owned generation = 11,500 BTU/Net kWh; (c) BTU Savings = 803,905-1,148,436 MMBTU/yr; (d) 5.825 MMBTU/BBL of distillate (diesel) fuel oil; and 21 MW installed capacity.

negotiate with MECO would provide MECO energy at rates that are below the utility's current avoided costs.[7]

As fuel costs are a significant component of MECO's quarterly avoided cost calculations, those avoided costs can and do fluctuate dramatically. During the third quarter of 2007, MECO's avoided cost was $197/MWh during peak-use hours and $180/MWh during off-peak hours. As fuel costs go up or down in the future, avoided cost as defined by the Public Utility Regulatory Policy Act of 1978 (PURPA) will change proportionately. KWP II LLC's proposal to MECO offers to sell energy to MECO at a fixed price which is not correlated to avoided cost. Assuming the facility operates at an annual average of 40 percent capacity over its 20-year life span, this pricing structure could save MECO approximately $5M annually in fuel costs over the project lifetime as compared to today's PURPA-based avoided cost. The savings could potentially be greater if fossil fuel prices continue to increase over the term of the contract.

1.2.3 ENVIRONMENTAL AND PUBLIC HEALTH BENEFITS

Reducing the consumption of fossil fuel for energy generation by an estimated 138,000 barrels per year will benefit the environment in a number of ways. The most important of these is by reducing air pollutant emissions associated with the combustion of fossil fuels. Additional emission reductions will stem from the elimination of the need to transport petroleum and coal fuels from distant ports to the island. These reductions in fossil fuel consumption would result in the following environmental benefits:

- Avoidance of approximately 107 million pounds of carbon dioxide (CO_2) annually emitted into the atmosphere.
- Elimination of approximately 0.75 million pounds of sulfur dioxide (SO_2) annually emitted into the atmosphere.
- Elimination of approximately 195,000 pounds of nitrogen oxides (NO_X) annually emitted into the atmosphere.

These gases are known to contribute to various undesirable environmental effects including global warming and acid rain. Additionally it has been shown that these gases are detrimental to human health and the health of other living organisms. In general, the elimination of these harmful pollutants should result in reduced health costs and respiratory illnesses.

[7] The term "avoided cost" means the amount that a utility does not have to spend if it obtains power from an outside source rather than from its own facilities. In this instance, it means the operation, maintenance, transmission, and fuel costs that MECO would not incur if it purchases electrical energy from KWP II. The State of Hawai'i Public Utilities Commission will be the ultimate arbiter of that rate. The avoided-cost concept became a public policy tool in the context of energy efficiency. Under the landmark Public Utility Regulatory Policy Act of 1978 (PURPA), electric utilities were required to consider pricing policies and other means of demand management. Frustrated with the high costs of supply-side means of balancing electrical supply with demand, many state regulators provided utilities with incentives for implementing demand-management strategies. PURPA also required electric utilities to consider purchasing power from qualifying facilities (that is, independent producers not primarily engaged in generating or selling electrical power, and meeting other conditions). PURPA requires utilities to compensate Independent Power Producers (IPPs) fairly by paying them the amount the utility avoids having to spend by not having to generate the power themselves (hence the term "avoided cost"). Avoided cost provides the basis of the rate required to be paid to qualifying facilities for purchased power under PURPA. Since PURPA was enacted, electricity production by independent producers and co-generators has been encouraged.

1.3 OVERALL OBJECTIVES OF THE PROPOSED ACTION

KWP II LLC has identified the following objectives for the proposed action.

(1) Bring on-line at the earliest possible date a 21 MW wind power generating facility on the island of Maui to increase the portion of Maui's energy derived from renewable sources and reduce dependencies on fossil fuels.

(2) Minimize the cumulative costs, environmental and visual impacts of the new facility by sharing key infrastructure (i.e., access road, equipment parts, construction equipment) with the existing KWP I wind farm.

(3) Locate the additional generating capacity in such a way as to minimize the need for additional MECO power interconnection infrastructure, thereby avoiding unnecessary economic and environmental impacts associated with connecting to the MECO system.

(4) Ensure that the size and operating characteristics of the new wind farm are compatible with MECO's overall system requirements to facilitate its integration into the company's grid.

(5) Locate the wind farm in an area with compatible surrounding land uses.

(6) Ensure that the new facility is compatible and compliant with the approvals granted for the KWP I site and all their associated conditions.

(7) Maintain environmental quality and contribute to maintaining energy costs at a reasonable level.

2.0 ALTERNATIVES CONSIDERED

2.1 INTRODUCTION

2.1.1 FRAMEWORK FOR CONSIDERATION OF ALTERNATIVES

Hawai‘i Administrative Rules (HAR), §11-200-17 (a section in the Office of Environmental Quality Control’s Environmental Impact Statement Rules) addresses the content requirements of draft and final environmental impact statements (EIS). Subsection §11-200-17(f) states:

> *(f) The draft EIS shall describe in a separate and distinct section alternatives which could attain the objectives of the action, regardless of cost, in sufficient detail to explain why they were rejected. The section shall include a rigorous exploration of the environmental impacts of all such alternative actions. Particular attention shall be given to alternatives that might enhance environmental quality or avoid, reduce, or minimize some or all of the adverse environmental effects, costs, or risks. Examples of alternatives include:*
>
> *(1) The alternative of no action;*
>
> *(2) Alternatives requiring actions of a significantly different nature which could provide similar benefits with different environmental impacts;*
>
> *(3) Alternatives related to different designs or details of the proposed action which would present different environmental impacts;*
>
> *(4) The alternative of postponing action pending further study; and*
>
> *(5) Alternative locations for the proposed project.*
>
> *In each case the analysis shall be sufficiently detailed to allow a comparative evaluation of the environmental benefits, costs, and risks of the proposed action and each reasonable alternative.*

2.1.2 ALTERNATIVES IDENTIFIED IN THE FEBRUARY 2009 DRAFT EIS

At the time the original Draft EIS was published in February, 2009, KWP II LLC had concluded from meteorological data collected in the area that the Downwind/Downstring siting area was the only one that adequately met the objectives listed in Section 1.3 of this report. That belief was based on the best wind resource data that were available at the time and on the results of analyses of natural resource information suggesting that implementation of the project would not have a significant adverse impact on the environment.

2.1.3 ALTERNATIVE IDENTIFIED SUBSEQUENT TO PUBLICATION OF THE DEIS

2.1.3.1 New Information After Publication of the February 2009 DEIS

KWP II LLC continued to collect wind data from the meteorological monitoring towers at Kaheawa while the DEIS was being reviewed and public and agency comments were being received. As the data accumulated, it became apparent that the wind lower on the mountainside was potentially superior to the wind resource in the Downwind/Downstring areas. Based on this new information, KWP II LLC has determined that the Downroad option is preferable to the Downwind/Downstring option.

Further, resource agencies who reviewed the Draft EIS and HCP indicated the desirability (from a resource standpoint) of giving further consideration to evaluating additional measures to avoid and minimize potential impacts. DOFAW in particular expressed concerns about risk of impacts to the

state and federally endangered nēnē, loss of habitat due to the project's footprint, the size of the area to be disturbed, and potential for introduction of invasive species.

Analysis using information obtained from and/or pursuant to review comments have led KWP II LLC to conclude that locating its facilities lower on the mountainside has several advantages, some of which are substantial and may reduce potential impacts to resources identified by DOFAW and other agencies during the project's review. Because the work would be much closer to the highway and immediately adjacent to the existing access road, costs, logistical effort, and potential impacts of delivering turbine components to and grading/preparing the site would be less. Proximity to the existing road and more uniform terrain would also allow the turbines to be constructed with less earthwork, thus reducing the potential for associated impacts, including soil erosion. The Downroad area is also less frequented by nēnē, a species that can be at risk of colliding with operating turbines; is situated in a more disturbed area that is dominated by non-native grasses; and is farther away from potentially sensitive habitats that tend to occur at higher elevations. Finally, the Downroad location is well away from Heiau 50-50-09-5232, an important cultural resource site that is situated directly west of the existing KWP I project.

2.1.3.2 Identification of Downroad Alternative as the Preferred Alternative

With the new wind information and agency concerns in hand, KWP II LLC reevaluated the siting options for the 14 WTGs and related facilities that are proposed and in doing so identified an alternative location that it considers to be equal to/superior to the original proposal with respect to potential effects on threatened and endangered species and which has a number of other advantages. Situated in what is referred to as the "Downroad Siting Area", the "Downroad Alternative" is now KWP II LLC's "Preferred Alternative".[8]

This Downroad Alternative places the 14 WTGs in a string along the existing access road approximately 2,000 feet southeast of the southern end of the existing KWP I turbine string. The Downroad site places the WTGs closer to the highway and immediately adjacent to the existing access road. By doing so, it eliminates the need for most of the new road construction that would have been required for the Downwind/Downstring plan. The reduced road construction and more uniform (relative to the previous plan) terrain allow the facilities that make up the Downroad Alternative to be constructed with much less (<50 percent) earthwork than would be needed for the previous plan, reducing the potential effects of such activities.

2.1.4 ORGANIZATION OF THE REMAINDER OF THIS CHAPTER

This chapter describes the physical and operational characteristics of the facilities that will be constructed if the proposed project receives all needed approvals. It also describes the alternative means of achieving the objectives for the proposed action identified in Section 1.3 above.

The remainder of this chapter is divided into the following main parts:

Section 2.2 provides detailed descriptions of the two alternatives that KWP II is considering.

Section 2.3 describes other alternatives that were considered but were eliminated from detailed evaluation in the EIS.

Section 2.4 contains a brief introduction to the "No Action Alternative" that is discussed in Chapter 5 of this report.

[8] KWP II LLC's preliminary analyses had indicated that this siting area could accommodate up to four WTGs.

2.2 DESCRIPTION OF THE PROPOSED ACTION

2.2.1 OVERVIEW

KWP II LLC's proposed action consists of constructing a new 21 MW wind power generating facility and related improvements [Kaheawa Wind Power II (KWP II)] at Kaheawa Pastures above Mā'alaea, Maui, Hawai'i. Its "Preferred Alternative" for the project, the Downroad Alternative, calls for the facilities to be located adjacent to the road that provides access to the existing 30-MW KWP I. The "Downwind Alternative," situated at a higher elevation southwest of KWP I at Kaheawa Pastures, is being retained as an alternative (Alternative 2), but it is not the preferred site. Both areas are shown in Figure 2.1.[9] If the required land use approvals and environmental permits are granted, KWP II LLC would undertake the actions summarized in Table 2.1. Conceptual site development plans for the Preferred Alternative and Alternative 2 are shown in Figure 2.4 and Figure 2.5.

Figure 2.2 and Figure 2.3 illustrate the existing conditions on and around the area on which facilities would be developed for the Preferred Alternative and for Alternative 2, respectively.[10] They provide a sense of the topography, vegetation, existing facilities, and overall character of the area within which the proposed project would be constructed. Access to both alternative sites would be from Honoapi'ilani Highway (State Highway 30) would be from the existing State-owned road that was improved during construction of KWP I.

The proposed 14-turbine layout would fall within an overall leased area of approximately 143 acres if the Preferred Alternative is implemented; the leased area will encompass approximately 333 acres if Alternative 2 must be used. Construction of the proposed project components (access roads, WTG pads, substation, and operations and maintenance building) would disturb approximately 46 acres of land if the Preferred Alternative is constructed; roughly one-third more (approximately 60 acres) would be disturbed if Alternative 2 were implemented instead.

Figure 2.6 contains photographs depicting the construction process at KWP I as an example of the nature and extent of activities proposed. Table 2.2 summarizes the area that would be occupied by each of the major components of the proposed project.

2.2.2 METEOROLOGICAL MONITORING TOWERS

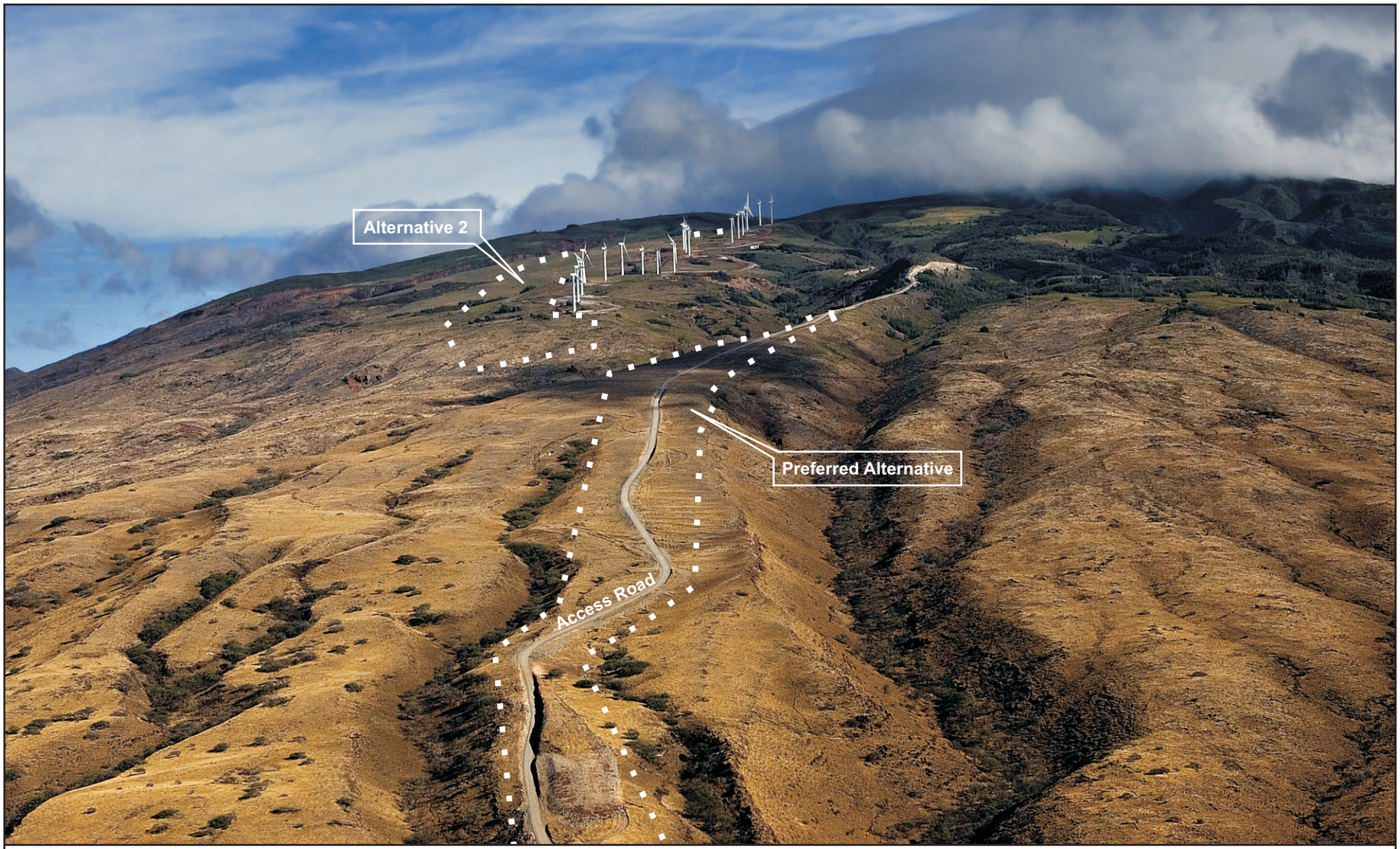
On July 20, 2007, the State of Hawai'i Department of Land and Natural Resources approved the Conservation District Use Permit (CDUP) needed to erect four temporary 60-meter guy wire-supported meteorological towers on the KWP II site in order to gather wind speed and direction information. The temporary monitoring towers were erected in September 2007 and are presently collecting data. Three of these will be removed when construction commences. The fourth will be temporarily relocated to one of the proposed WTG locations and used for "power curve testing", up until the time the WTG is constructed to replace it. One to two (depending upon the alternative that is selected) unguyed permanent meteorological monitoring towers (see photograph to right) will be constructed on the property as well, and their locations are depicted on Figure 2.4 (for the Preferred Alternative) and Figure 2.5 (for Alternative 2).

[9] The proposed turbine locations shown on Figure 2.4 were selected based on constructability, topography, vegetation, and other micro-siting factors, however as additional geotechnical and engineering information becomes available, the WTG locations may shift slightly; this distance is expected to be a few to no more than 50 meters. The site plan also includes an alternate WTG location as a contingency site in case geotechnical explorations or other factors make one of the preferred sites unfeasible. The contingency site is located on similar terrain as the other planned WTGs and does not pose additional concerns in terms of potential environmental impacts. Consequently, it is not discussed in detail in this EIS.

[10] In September 2006, an extensive brush fire affected a large portion of the West Maui Mountains from the coastal highway to the existing facility, including a large portion of the proposed KWP II site. The existing facility was not the cause of the fire. It was protected from damage by multiple firebreaks and by extensive watering, and the roadways constructed for the project were instrumental in providing firefighting crews access to the fire line.

Table 2.1 Summary of Alternatives

Preferred Alternative	***Alternative 2***
Execute a directed lease from the State Department of Land and Natural Resources (DLNR) for approximately 135 acres of land within parcel (2) 3-6-001:014 and 8 acres of land within parcel (2) 4-8-001:001. This property is contiguous to the existing State-owned road that was improved during construction of KWP I, and for which KWP I retains an easement.	Execute a directed lease from the State Department of Land and Natural Resources (DLNR) for approximately 333 acres of land within parcel (2) 4-8-001:001. This property is contiguous to the 200-acre area that the State has leased to KWP I.
Obtain an easement for use of the existing main access road (which is in parcel (2) 3-6-001:014) from DLNR and execute licensing agreements with KWP I to use existing road and construct proposed Baseyard Compound within the KWP I lease area.	Obtain an easement for use of the existing main access road (which is in parcel (2) 3-6-001:014) from DLNR and execute licensing agreements with KWP I to use existing /construct new connector roads within the KWP I lease area.
Reroute portions of the existing access road and construct short service roads that connect the WTG pads to the existing/relocated KWP I access road. Recontour, where feasible, abandoned portions of access road.	Construct new internal service roads that connect the facility to the existing KWP I access road.
Install 14 General Electric (GE) 1.5 MW wind turbines and supporting equipment. Installation includes excavating and constructing foundations and erecting support towers and transformers.	Same as Preferred Alternative.
Install an underground electrical collection network connecting all of the turbines, including excavation and burying of all wires and re-vegetation of the disturbed areas.	Same as Preferred Alternative.
Construct a new electrical substation, install underground electrical power lines connecting all of the turbines with the new substation, and connect the new substation to the existing MECO power transmission lines that pass over the substation site using a short overhead cable.	Same as Preferred Alternative.
Construct overhead collection lines spanning the gulch, to connect the underground collection system from the WTGs to the substation.	No overhead collections lines spanning the gulch.
Construct a BESS adjacent to the substation. This stored energy will be used to improve the ability of the MECO system to absorb additional as-available wind resources.	Same as Preferred Alternative.
Construct a new operations and maintenance building to house operations personnel, wind generating facility controls, and maintenance equipment and spare parts, including shop facilities.	Same as Preferred Alternative.
Construct one permanent meteorological tower and a temporary 65-meter test tower prior to construction of the WTGs.	Construct 1-2 permanent meteorological towers and a temporary 65-meter test tower prior to construction of the WTGs.
Note: Both alternatives include a provision for small adjustments in WTG locations based on final site engineering.	



Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

Kaheawa Wind Power II

Figure 2.1:

Aerial Photo of Project Area

Kaheawa Wind Power II

Figure 2-1 Aerial Photo of Project Area 2009-10-12.cdr

Table 2.2 Area Disturbed by Construction of Proposed Facilities

Project Component	***Approximate Area Occupied (in acres)***	
	Preferred Alternative	***Alternative 2***
14 WTG Foundations & Pads[1]	21	21
Trenching for Underground Electrical Cables[2]	2	2
Permanent Meteorological Towers	0.2 (one tower)	2 (2 towers)
Baseyards (O&M Building, Substation, BESS)	2	3
Access Roads[3]	16	30
Temporary Lay-Down Area[4]	2	2
TOTAL	43	60

Notes:

(1) Individual foundations occupy approximately 2,500 square feet each; total disturbed area is estimated as 1.5 acres per turbine.

(2) Trenches for underground cables will be 2' wide and 4' deep and backfilled to finish grade. This disturbed area will be revegetated post-construction.

(3) Estimate based on 36-foot wide strip of "disturbance" (16' road surface and two 10' shoulders).

(4) One construction lay-down area for equipment staging (150' x 250' area). This disturbed area will be revegetated post-construction.

Source: KWP II LLC (2009); AECOM, April 21, 2009, ECI (Oct 27, 2009), and SSFM (October 16, 2009).

A. View south, downslope along the access road toward the Lahaina Pali Trail from the vicinity of proposed WTG-1.

B. View north, upslope along the access road toward the Lahaina Pali Trail from the vicinity of proposed WTG-1.

C. View south, downslope along the access road from the vicinity of proposed WTG-7.

D. View south, downslope along the access road from the vicinity of proposed WTG-9.

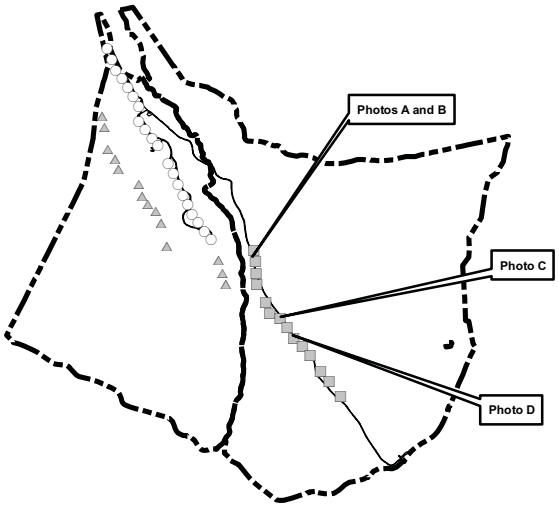


Figure 2.2: Photographs of Existing Conditions: Preferred Alternative

Prepared For:
Kaheawa Wind Power II

Prepared By:
PLANNING SOLUTIONS

Source:
First Wind

Project:
Kaheawa Wind Power II

Figure 2-2 Photographs of Existing Conditions - Preferred Alternative 2009-10-27.cdr

A. View South across Manawaipueo Gulch.

B. View South down access road towards O/M building.

C. Existing 1.5 MW turbines at KWP I.

D. View South towards proposed KWP II Alternative 2 site.

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

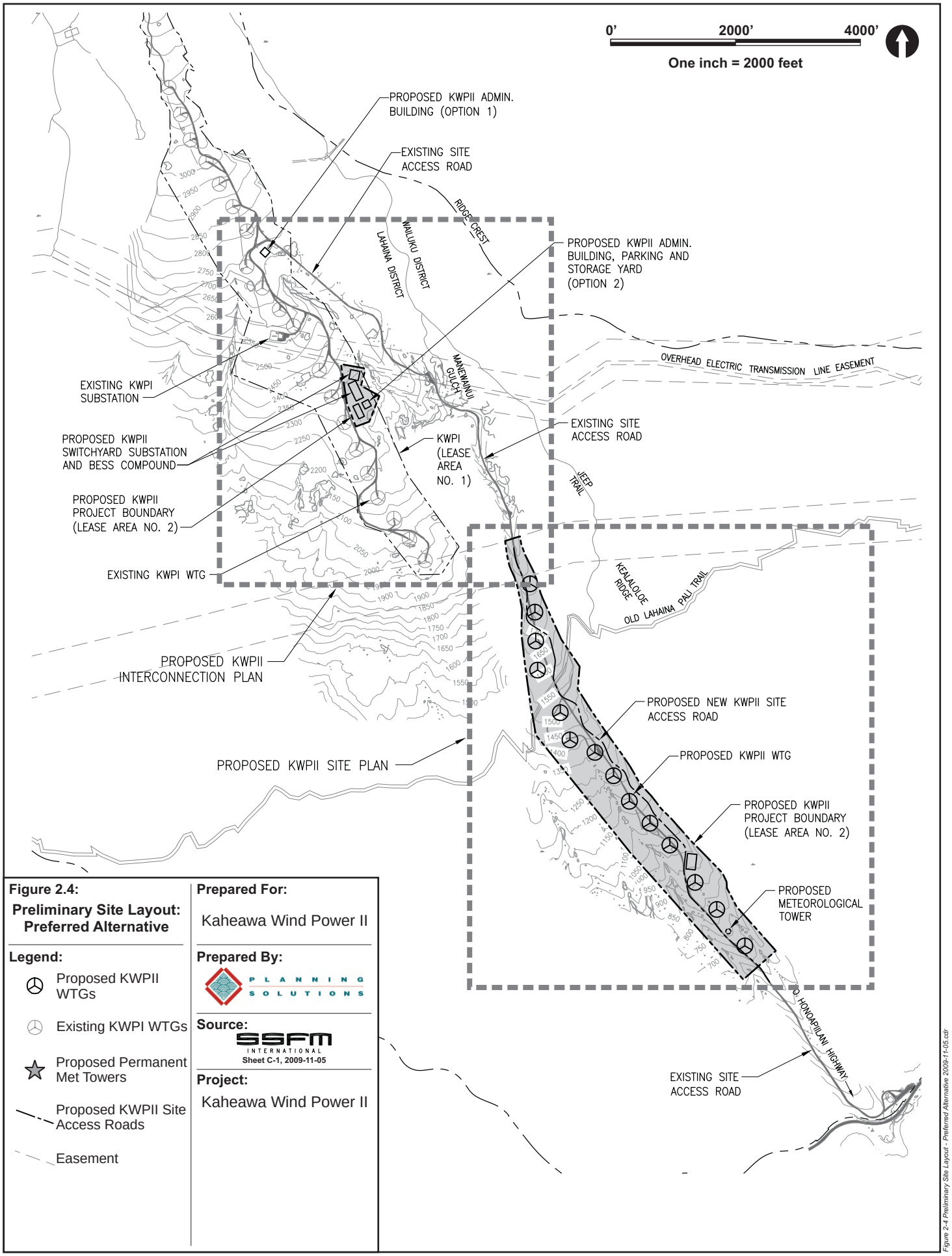
--Kaheawa Wind Power II (2006-09-09)
--Planning Solutions, Inc. (2006-09-06)
--Makana Nui Associates, LLC

Figure 2.3:

Photographs of Existing Conditions: Alternative 2

Kaheawa Wind Power II

Figure 2-3 Photographs of Existing Conditions - Alternative 2 2009-09-11.cdr


0'
2000'
4000'
One inch = 2000 feet
PROPOSED KWPII ADMIN. BUILDING (OPTION 1)
EXISTING SITE ACCESS ROAD
RIDGE CREST
WAILUKU DISTRICT
LAHAINA DISTRICT
PROPOSED KWPII ADMIN. BUILDING, PARKING AND STORAGE YARD (OPTION 2)
OVERHEAD ELECTRIC TRANSMISSION LINE EASEMENT
MANENAHAHU GULCH
EXISTING KWPI SUBSTATION
PROPOSED KWPII SWITCHYARD SUBSTATION AND BESS COMPOUND
KWPI (LEASE AREA NO. 1)
EXISTING SITE ACCESS ROAD
JEEP TRAIL
PROPOSED KWPII PROJECT BOUNDARY (LEASE AREA NO. 2)
EXISTING KWPI WTG
KEALALOLOE RIDGE
OLD LAHAINA PALI TRAIL
PROPOSED KWPII INTERCONNECTION PLAN
PROPOSED NEW KWPII SITE ACCESS ROAD
PROPOSED KWPII SITE PLAN
PROPOSED KWPII WTG
PROPOSED KWPII PROJECT BOUNDARY (LEASE AREA NO. 2)
PROPOSED METEOROLOGICAL TOWER
Q. HONOAPIILANI HIGHWAY
EXISTING SITE ACCESS ROAD
Figure 2.4:
Preliminary Site Layout: Preferred Alternative
Legend:
Proposed KWPII WTGs
Existing KWPI WTGs
Proposed Permanent Met Towers
Proposed KWPII Site Access Roads
Easement
Prepared For:
Kaheawa Wind Power II
Prepared By:
PLANNING SOLUTIONS
Source:
SSFM INTERNATIONAL
Sheet C-1, 2009-11-05
Project:
Kaheawa Wind Power II
Figure 2-4 Preliminary Site Layout - Preferred Alternative 2009-11-05.cdr

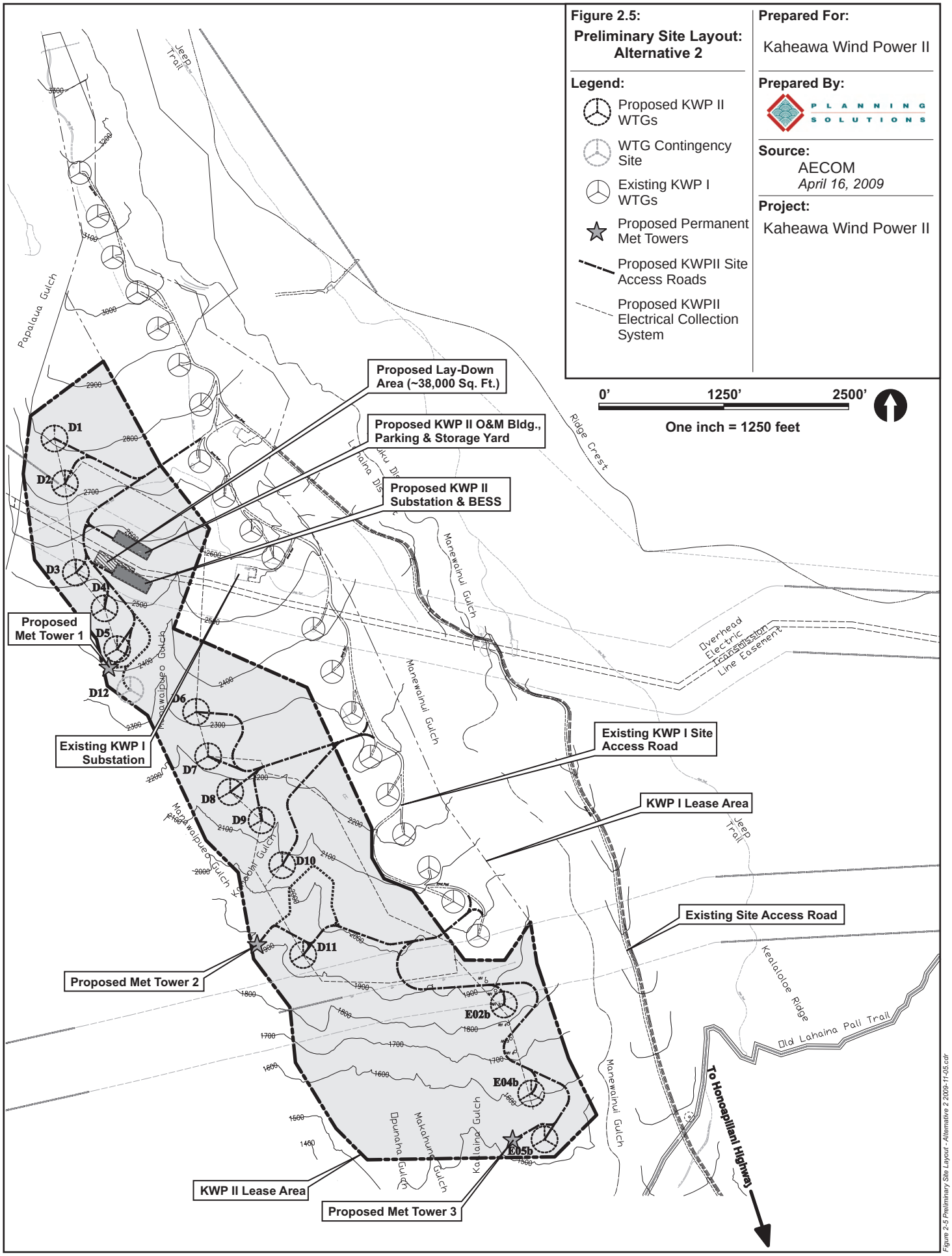


Figure 2-5 Preliminary Site Layout - Alternative 2 2009-11-05.cdr

A. Aerial view of grading for roads and WTG pads.

B. Installation of poured concrete WTG foundation.

C. Partially erected WTGs.

D. Crane used to assemble WTGs. Note rotor on ground.

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

First Wind

Figure 2.6:

KWP I Construction Photos

Kaheawa Wind Power II

Figure 2-6 KWP I Construction Photos 2009-09-11.cdr

2.2.3 WIND TURBINE GENERATORS

The same type of General Electric 1.5 MW wind turbine generators (WTGs) would be used regardless of the alternative that is selected. Figure 2.3 contains photographs of these. Each of the proposed WTGs has four principal elements: 1) a three-bladed rotor which converts the wind's energy into rotational shaft energy; 2) a nacelle that houses a gearbox and a generator; 3) a tower that holds the rotor and drive train above the ground; and 4) electronic equipment at the base of the turbine such as controls, electrical cables, and a transformer.

Rotor. The three-bladed rotor on each WTG has a diameter of approximately 230 feet. When the blade tip is at the top of its arc it extends about 327 feet above the ground. The rotors turn at a rate of between 10 and 21 revolutions per minute depending on wind speed.

Nacelle. The nacelle atop each tower (see Figure 2.7) contains the gear box, low- and high-speed shafts, generator, controller, and brake; it is approximately 12 feet high by 12 feet wide by 27 feet long. The nacelles are mounted on the towers in a manner that enables them to rotate 360 degrees about a vertical axis so that they can always be oriented into the wind. Each WTG is equipped with sensors that monitor wind speed and direction. When the wind speed picks up to within operating range, the sensors cue the WTG to orient itself to face the wind, to switch its rotor from a dormant (i.e., feathered) to an active position, and to commence generating power.

Tower. The conical tubular steel towers supporting each unit will be 212 feet high; they will taper from a diameter of approximately 15 feet at the base to approximately 10 feet at the top. Each tower will contain an internal ladder that allows access to the nacelle and a 450-pound capacity load-lifting system that allows work equipment and parts to be hoisted from the ground to the nacelle. The reinforced concrete foundation supporting each tower is approximately 46 feet square. The exact depth will depend upon the results of geotechnical tests conducted at each of the final tower locations, but will probably on the order of 10 feet below finished grade.

Electronic Equipment. An electronics cabinet inside the base of each tower houses the electric switchgear and related controls. Additionally, a small (approximately 8-foot cube) pad-mounted transformer is located adjacent to the base of each tower to increase the electrical voltage of the energy produced by the generator to 34.5 kilovolts (kV).

WTG Pads & Foundations. A work area will be cleared and graded around the base of each WTG to provide room for delivery and laydown of turbine components, crane access, and foundation construction. This will be done using bulldozers, trucks and a crusher-screener, plus water trucks and cement mixers needed for the concrete foundations. Based on experience gained at KWP I the size and shape of each work area will vary depending on terrain and construction requirements. However, it will generally be on the order of 180' x 200'. A gravel perimeter will be provided around each foundation to facilitate access and maintenance; weed-barrier material will be used beneath the gravel. Disturbed areas outside the gravel perimeter will be scarified and seeded to stabilize the soil.

Equipment Transport and Installation. The WTG components have been delivered to an interim storage site on Maui. The equipment will be transported to the site via the existing KWP I access road. Once at the site, the turbines will be erected by the 300-ton crane that is housed at the KWP I facility.

Figure 2.7 Schematic Drawing of GE 1.5 MW Wind Turbine Nacelle

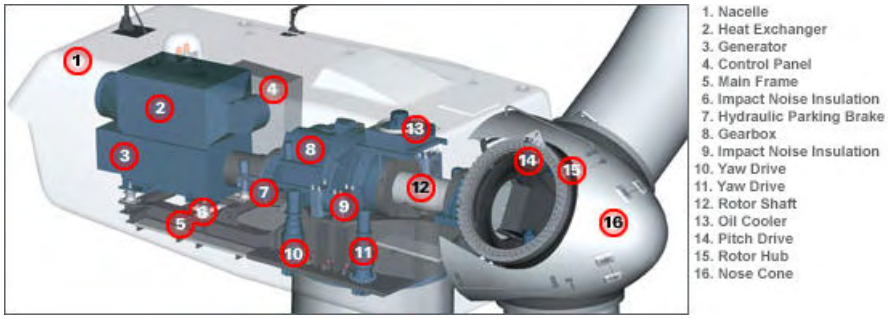


Table 2.3 Characteristics of 1.5 MW Wind Turbine

Power Generation	1.5 MW each
Tower Structure and Height	Tubular; 212 feet
Rotor Diameter	231 feet
Total Height (Tower + ½ Rotor)	328 feet
Rotor Swept Area	50,130 square feet
Rotor Speed	10-21 rpm (variable)
Wind Speed at Which Generator Starts	8 miles per hour
Wind Speed at Which Generator Cuts Out	56 miles per hour
Rated wind speed (unit reaches maximum output)	27 miles per hour
Note: Based on GE Model 1.5sle on 64.7 m tower.	
Source: Kaheawa Wind Power LLC (2004).	

2.2.4 OPERATIONS & MAINTENANCE BUILDING

The prefabricated metal building typically used for First Wind projects would be approximately 70 feet wide and 100 feet long. The operations and maintenance (O&M) building would house the wind farm's supervisory control and data acquisition (SCADA) racks, which monitor the performance of the overall system and the operational status and performance of individual turbines and wind monitoring equipment. The facility will also provide for two large maintenance bays as an indoor work area, shop facilities including an overhead crane to facilitate large equipment repair, and a storage area for spare parts. An outdoor lay down area approximately 150 feet x 250 feet located in the southern portion of the Preferred Alternative site or next to the O&M building for the Alternative 2 site. A site plan for the Preferred Alternative is included as Figure 2.8 and one for Alternative 2 as Figure 2.9.

2.2.5 SITE ACCESS AND INTERNAL ROAD NETWORK

Both the Preferred and Downwind Alternative rely on the existing State-owned access road from Honoapi‘ilani Highway to KWP I. However, they differ substantially with regards to the additional road construction that will be needed. The cleared and graded area for the proposed new internal access roads will be approximately 36 feet wide. Within that there will be a gravel surface approximately 16 feet wide and a 10-foot wide native soil shoulder on either side. The relatively wide right-of-way is needed to accommodate the large crawler crane that is used in erecting and

periodically maintaining the WTGs and other oversized equipment. Individual spur roads will branch off from the main connector roads to each turbine site.

2.2.5.1 Site Access/Road Requirements for Preferred Alternative

In order to access the Preferred Alternative, KWP II will need to obtain an easement or other permission from the State allowing it to use and relocate a portion of the aforementioned existing access road from Honoapi‘ilani Highway to the new substation that would be constructed on the downhill side of MECO’s uppermost transmission corridor. As KWP I already has an easement covering a portion of this route, KWP II would need permission from KWP I as well. KWP II anticipates that all of the WTG pads in this alternative will be accessible from driveways directly off the main access road.[11]

2.2.5.2 Site Access/Road Requirements for Alternative 2

In order to implement this alternative, KWP II LLC will require the same permissions to use the existing access road as is the case for the Preferred Alternative. In addition, it must construct a substantial additional internal road network to connect the new WTGs that KWP II has proposed to the existing KWP I access road and to one another. The presence of two steep gulches cross-cutting the row of proposed WTGs means that excessive earth disturbance would be required to construct a continuous road that connects all 14 turbine sites. To avoid this, the KWP II plan for Alternative 2 shown on Figure 2.5 calls for three spur roads to be constructed to connect the Alternative 2 site with the existing KWP I road.

2.2.6 ELECTRICAL SYSTEM COMPONENTS

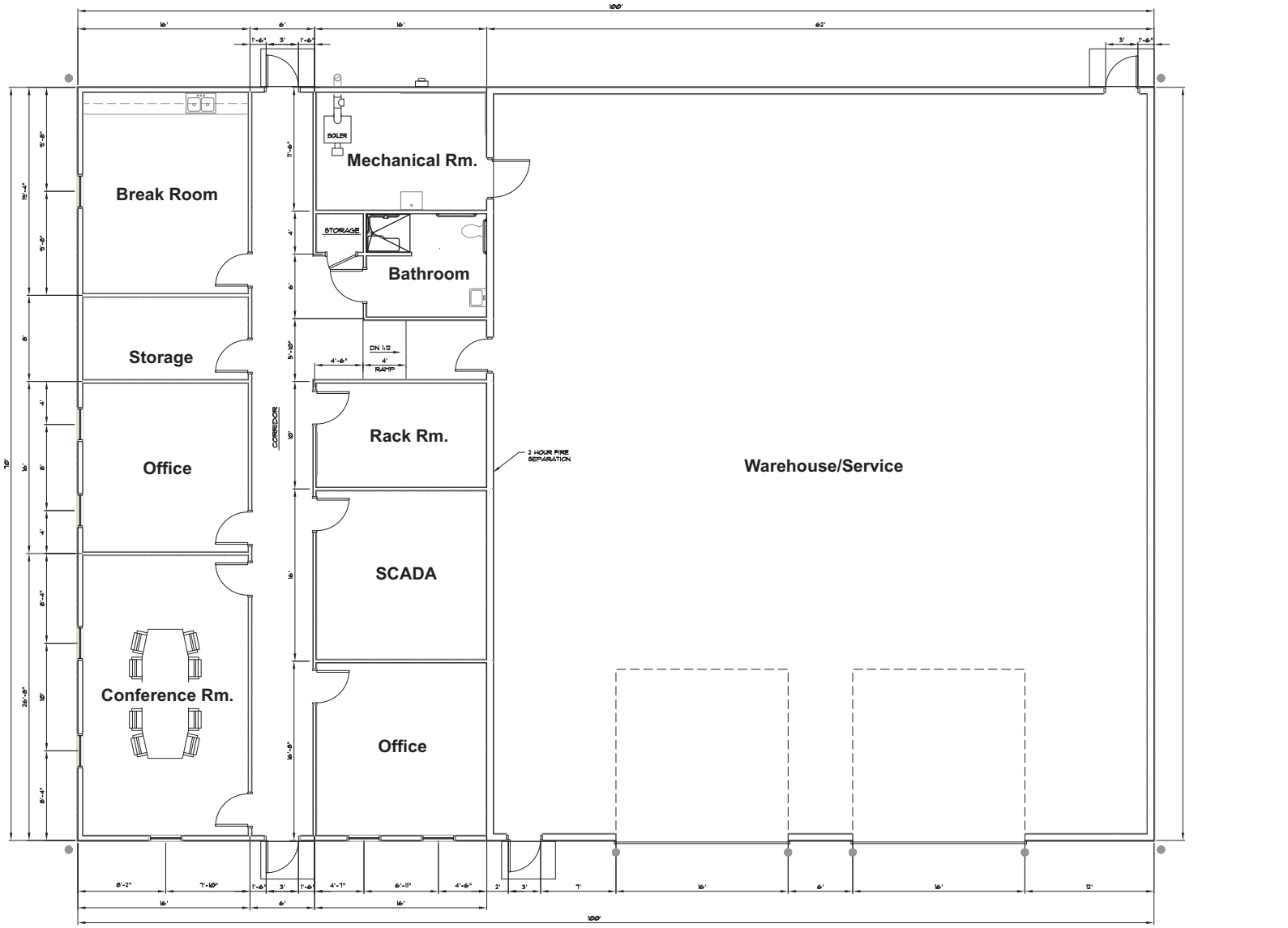
2.2.6.1 Transformers and WTG Interconnections: Both Alternatives

A pad-mounted transformer at the base of each tower will boost the lower-voltage electrical power produced by the nacelle-mounted generator to 34.5 kilovolts (kV). Two collection circuits will be installed. The 34.5 kV power will be carried by underground cable from the transformers to the on-site electrical substation described in Section 2.2.6.2. The cables would be direct-buried in four-foot deep trenches. For the Preferred Alternative, engineers are proposing the use of a short segment of overhead power line along one of two possible alignments. The use of the overhead segment would substantially lessen the amount of trenching required.

Table 2.4 Characteristics of Above-Ground Collector Line

Item	*Value*	
	Lower Crossing	*Upper Crossing*
Height of Poles (in feet above ground)	80-90	60-80
Number of poles	2 (one on each side)	2 (one on each side)
Length of Crossing (in feet)	1,226	1,570
Proposed wire configuration	vertical	vertical
Number of wires per circuit	3	3
Number of circuits	2	2
Space between wires in circuit (in feet)	3 feet	3 feet
Number of static (sky) wires	1	1
Space between static wire top energized wire	3 feet	3 feet
Source: KWP II LLC		

[11] It is possible that access to a few may be from a combined driveway if that appears to be more efficient, but the assumption of individual driveways represents the “worst case” assumption.



Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

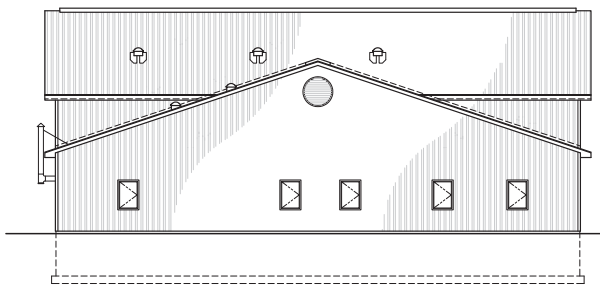
BRSA
B.R. Smith Associates, Inc.
Surveying Engineering

Figure 2.8:

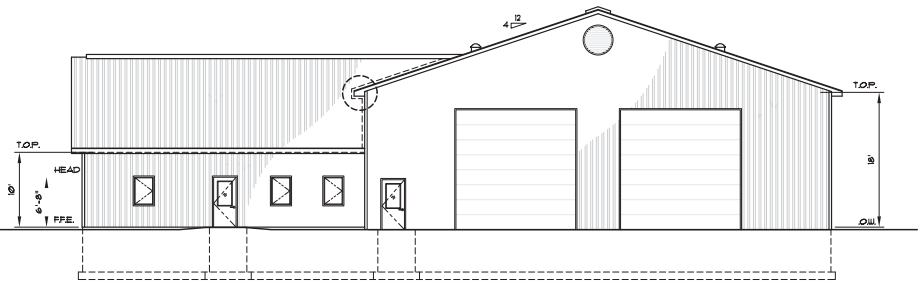
Operations & Maintenance Building Coneptual Floor Plan

Kaheawa Wind Power II

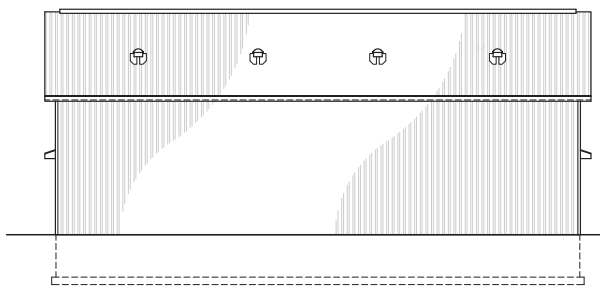
Figure 2-8 Operations & Maintenance Building Conceptual Floor Plan 2009-09-11.cdr



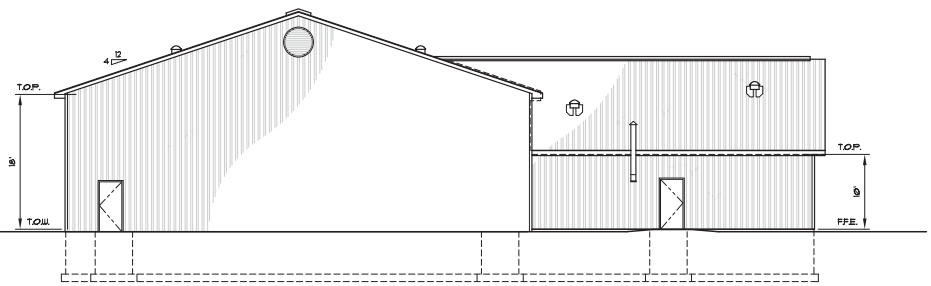
NORTH ELEVATION



WEST ELEVATION



SOUTH ELEVATION



EAST ELEVATION

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

BRSA
B.R. Smith Associates, Inc.
Surveying Engineering

Figure 2.9:

Operations & Maintenance Building Elevation View

Kaheawa Wind Power II

Figure 2-9 Operations & Maintenance Building Elevation View 2009-09-11.cdr

2.2.6.2 Electrical Substation: Both Alternatives

The substation will feed electricity from KWP II's electrical power collection system into MECO's transmission system. The substation will be an open steel switchrack design similar to that constructed for KWP I with associated power circuit breakers and disconnect switches. It will provide for the termination of the two 34.5 kV collection circuits, a 69/34.5 kV main step up power transformer, and a 69 kV interconnection to the MECO electric grid. All substation control, relaying, and primary metering equipment will be housed in a separate control room located in the Energy Storage building located adjacent to the substation. A fiber optic cable will run from the new substation to the communications tower at the existing substation to support off-site communications. The new substation would have a layout similar to that of the existing substation; a preliminary site plan is shown on Figure 2.10 and elevation drawings showing the substation equipment are given on Figure 2.11.

2.2.6.3 Electrical Transmission Lines: Both Alternatives

Three electrical transmission lines presently cross the mountainside in the vicinity of Kaheawa Pastures. They are located in two corridors. The upper corridor, which contains two transmission lines, is at an elevation of approximately 2,300 feet, and electrical power from the KWP I substation is fed into the uppermost of the two lines. The lower corridor, which contains a single electrical line, crosses the pastures about a mile *makai* of the upper two lines at an elevation of about 1,800 feet. The new substation that is part of the KWP II proposal would connect to the lower of the two transmission lines in the upper corridor.

2.2.6.4 Battery Energy Storage System (BESS): Both Alternatives

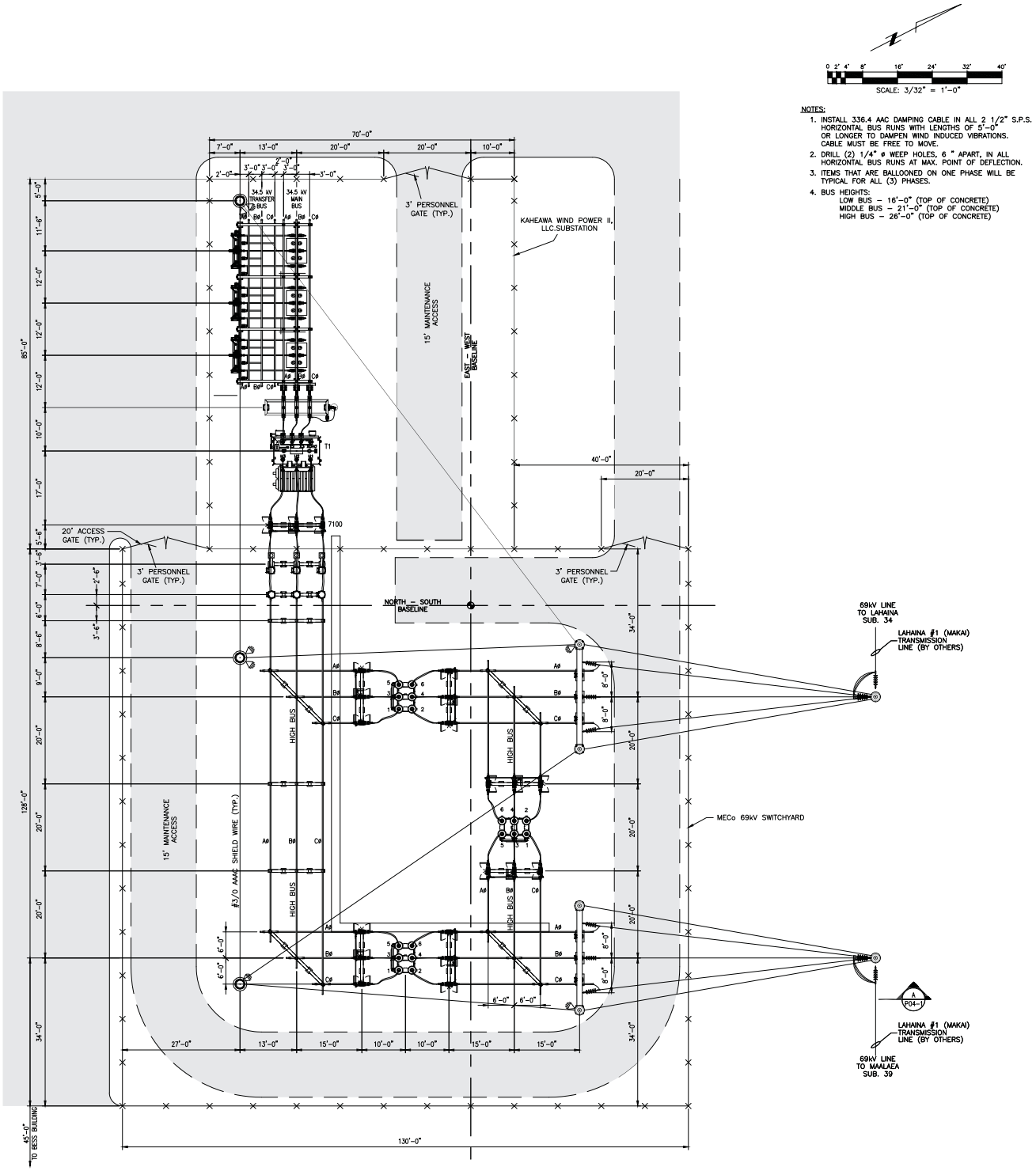
Because of the size and operating characteristics of its system, MECO is requiring KWP II LLC to mitigate the variability of output power. In response to this request and to enhance the overall operation of the wind generating facility, KWP II LLC is proposing to install a commercial-scale BESS immediately adjacent to the KWP II substation. The BESS will utilize dry cell battery technology that has been used in various commercial and military applications (for example, the BESS uses batteries similar to those used in electric vehicles). The material is non-hazardous and there is no potential for it to release harmful substances to the surrounding environment. The BESS will be sized according to the PPA and IRS, which could be approximately 10 MW with 20 MWh of energy storage capability.[12]

The proposed BESS building will be a one-story, concrete block and steel structure with an angled roof totaling approximately 14,750 square feet in area. It will be located adjacent to the proposed substation. The building will house the power cell components and electrical equipment including control and switching panels, DC/AC inverters, and up to eight external pad mounted transformers to connect to the substation. The building will also accommodate the substation relaying, metering, and control equipment for MECO and KWP II, as well as the control equipment for the BESS.

2.2.7 FACILITY MAINTENANCE/OPERATIONS: BOTH ALTERNATIVES

Personnel will generally be present at the facility on a daily basis throughout project operation. They will monitor the condition of the internal roadways and ensure that any needed maintenance is performed promptly, as well as ensuring that the turbines and supporting facilities are operating properly. Site maintenance will include vegetation control within graveled areas to eliminate any foraging attractions of new growth that might put wildlife at risk of vehicle collision. Finally, personnel carrying out the biological and other monitoring mandated by the permits under which the facility is operated will often be in the field at various locations within the leased area.

[12] This sizing means that when fully charged the BESS will be able to deliver a maximum of 20 megawatts of power to the MECO system for a period of up to an hour. It could provide half that amount (10 MW) for twice as long (2 hours) a third that amount for 3 hours, etc.



Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Sources:

Electrical Consultants, Inc.
Dwg. No. KW2-D-P004-1
July 10, 2009

Legend:

EX – EXPANSION CONNECTION

F – FIXED CONNECTION

S – SLIP CONNECTION

– LIGHTS

Figure 2.10:

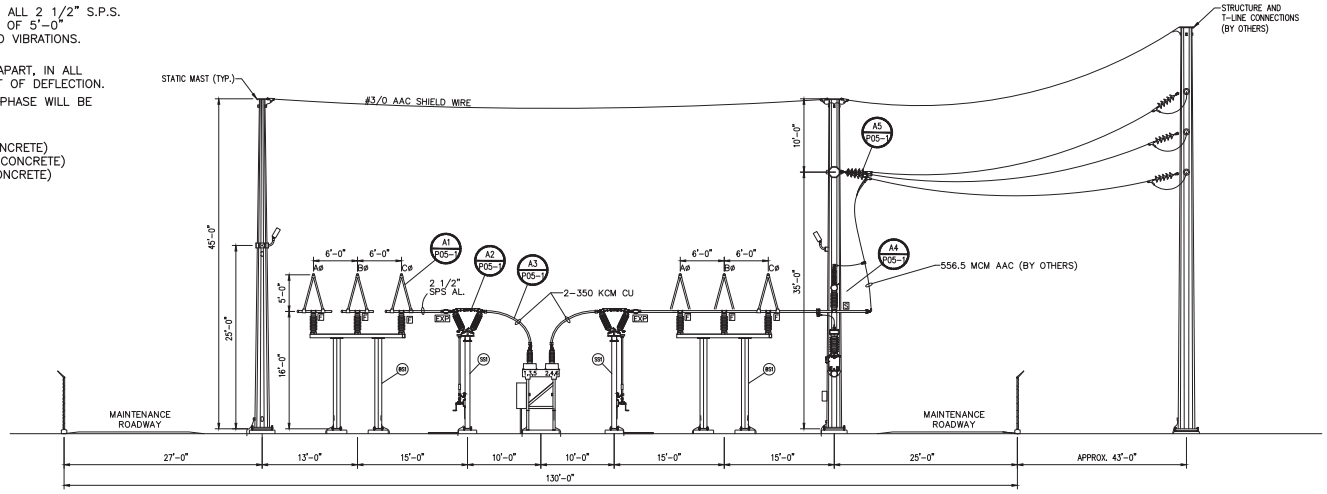
Electrical Substation: Preliminary Plan View

Kaheawa Wind Power II

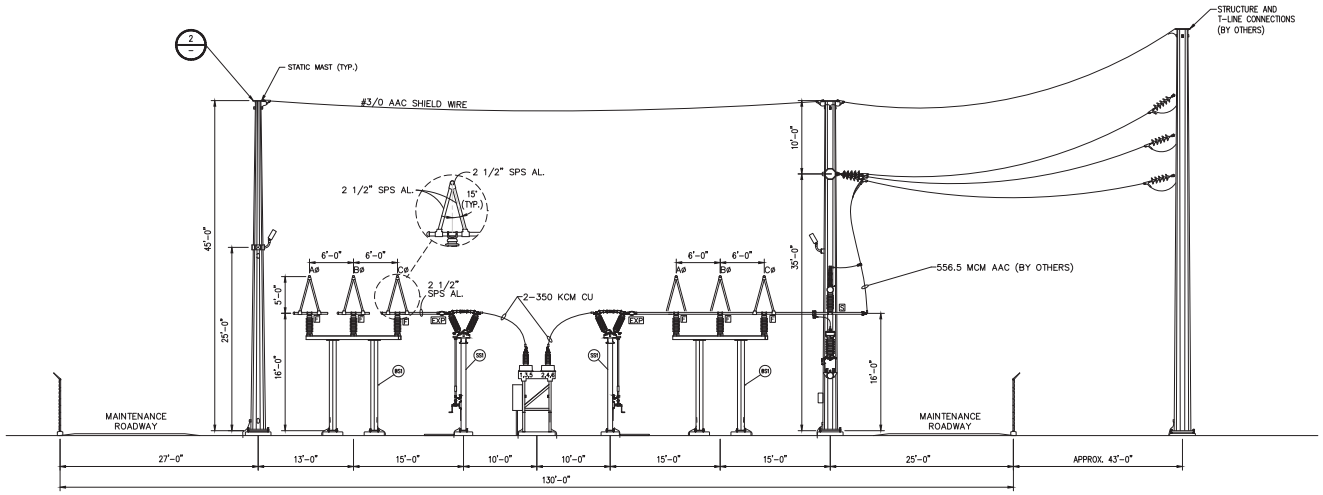
Figure 2-10 Electrical Substation Site Plan 2009-11-02.cdr

NOTES:

1. INSTALL 336.4 AAC DAMPING CABLE IN ALL 2 1/2" S.P.S. HORIZONTAL BUS RUNS WITH LENGTHS OF 5'-0" OR LONGER TO DAMPEN WIND INDUCED VIBRATIONS. CABLE MUST BE FREE TO MOVE.
2. DRILL (2) 1/4" ø WEEP HOLES, 6 " APART, IN ALL HORIZONTAL BUS RUNS AT MAX. POINT OF DEFLECTION.
3. ITEMS THAT ARE BALLOONED ON ONE PHASE WILL BE TYPICAL FOR ALL (3) PHASES.
4. BUS HEIGHTS:
   LOW BUS – 16'-0" (TOP OF CONCRETE)
   MIDDLE BUS – 21'-0" (TOP OF CONCRETE)
   HIGH BUS – 26'-0" (TOP OF CONCRETE)



ELEVATION A P03-1
SCALE: 1/8"=1'-0"



ELEVATION B P03-1
SCALE: 1/8"=1'-0"

0 2' 4' 8' 16' 24' 32'
SCALE: 1/8" = 1'-0"

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

Electrical Consultants, Inc.
Dwg. No. KW2-D-P004-1
July 10, 2009

Legend:

◯ – REFERENCE BILL OF MATERIALS

EX – EXPANSION CONNECTION

F – FIXED CONNECTION

S – SLIP CONNECTION

△ – LIGHTS

Figure 2.11:

Electrical Substation: Preliminary Elevation View

Kaheawa Wind Power II

Figure 2-11 Electrical Substation Elevation Views 2009-10-28.cdr

2.2.8 WATER SUPPLY/WASTEWATER DISPOSAL: BOTH ALTERNATIVES

KWP II has a very low on-site water requirement. Consequently, there will be no direct connection to the municipal water supply. Instead, water will be purchased from an existing off-site supplier and trucked to the site.

KWP II LLC is considering the installation of a 60,000-gallon tank adjacent to the existing O&M Building, which could be filled with non-potable water periodically trucked into the site and installing a septic tank to collect waste from sinks and restrooms. If this does not prove feasible due to permitting or cost considerations, KWP II LLC will use bottled water and portable toilets, as is currently done at the KWP I facility.

Non-potable water for dust control, landscape irrigation, emergency fire-fighting, and other similar purposes will be drawn from either of the 60,000-gallon tanks. This water will be trucked from the storage tank to required locations on the KWP II site.

2.2.9 PROPOSED LAND LEASE

In September 2006 the Board of Land and Natural Resources authorized its Land Division to negotiate a lease with KWP II LLC for the area needed to construct what is now the Alternative 2 (333 acres) site. This negotiation includes rent as a percentage of total revenue generated, conditions for granting access to the site for certain types of visitors, and restoration of the site or replacing the equipment at the end of the lease period. Also, KWP II LLC is in discussion with the Land Division to execute a lease of the area needed to construct what is now the Preferred Alternative (143 acres) site.

2.2.10 PROPOSED POWER PURCHASE AGREEMENT (MECO/KWP II)

KWP II LLC has submitted a Non-utility Generator Application for the proposed project to HECO, MECO's parent company. Currently, KWP II and HECO are conducting a Performance Requirements Study to determine what will be needed to interconnect the proposed project with the Maui grid. When the Performance Requirement Study is complete and the Interconnect Requirements Study has been conducted, KWP II LLC will complete negotiations of a Power Purchase Agreement with HECO for the proposed project. The proposed term for the agreement is 20 years with provisions for an extension to 25 years.

2.2.11 SCHEDULE

Major permitting and construction milestones associated with the proposed project are shown in Table 2.5.

Table 2.5 Preliminary Project Schedule

Milestone	***Estimated Completion Date***
Complete permitting process	Second Quarter 2010
Project Financing Notice to Proceed	June 2010
Commence Construction	Third Quarter 2010
Complete WTG Installation	First Quarter 2011
Energize Substation	Second Quarter 2011
Commence Commercial Operations	Second Quarter 2011
Source: KWP II LLC September 14, (2009).	

2.2.12 ANTICIPATED COSTS OF ALTERNATIVES BEING CONSIDERED

Table 2.6 summarizes KWP II LLC's preliminary estimates of the anticipated costs.

Table 2.6 Estimated Construction Costs

Item	*Order-of- Magnitude Cost (2009 dollar value in millions)*	
	Preferred Alternative	*Alternative2*
Access Road/Site Development	$14	$16
Wind Turbine Equipment	$27	$27
Wind Turbine Installation/Balance of Plant	$10	$10
Transportation and Logistics	$5	$6
Electrical Substation, Collection Lines, and Interconnect	$22	$25
Operation and Maintenance Facility	$1	$1
TOTAL:	$79	$85
Source: KWP II LLC, October 23, 2009.		

2.3 ALTERNATIVES ELIMINATED FROM DETAILED CONSIDERATION

Many action alternatives were evaluated during planning for the KWP II project but eliminated from detailed consideration. Those alternatives, and the reasons for their elimination, are summarized below.

2.3.1 ALTERNATE WTG LOCATIONS AT KAHEAWA PASTURES

As indicated in the EISPN, KWP II LLC initially considered four potential WTG Siting Areas (Upwind, Downwind, Downstring, and Downroad). It eliminated the Upwind Siting Area from further consideration. The area eliminated is located on the eastern side of the existing main access road approximately 2,000 feet to the east (i.e., on the Central Valley side) of the existing KWP I turbines.

KWP II LLC's preliminary analyses indicated that the Upwind Siting Area could accommodate up to 15 WTGs. However, accessing the Upwind area would require construction of a new road across the intervening Manawainui Gulch, which is a sensitive area, and construction requirements would be substantial. A viewshed analysis also confirmed that turbines placed in this siting area would be more visible to surrounding communities than turbines placed in the Downwind and Downstring siting areas. In fact, this siting area is more visible to more people than any of the other locations that were considered. These considerations led KWP II to eliminate the Upwind area from further consideration.

KWP II LLC considered several factors in selecting suitable locations for individual WTGs (i.e., micro-siting). These included the viability of the wind resource, proximity and orientation to the existing KWP I turbines (which can affect the efficiency and output of the facility), access to

transmission, visibility to the Maui community, presence of sensitive resources (e.g., native flora and fauna, cultural features, etc.), and constructability (i.e., site topography, geological features, and extent of road-building required).

2.3.2 GREATER OR LESSER WIND ENERGY GENERATING CAPACITY

The EA/EISPN for the project identified a range of possible generating capacities for KWP II, from 10.5 MW (in accordance with the capacity that MECO's now superseded Integrated Resource Plan 3 identified as being appropriate for development by 2011) to 30 MW. Feedback on the EA/EISPN, analyses of the wind and meteorological data that KWP II LLC has collected, and the fixed costs of the required battery storage facilities have led KWP II LLC to conclude that 21 MW is the appropriate capacity for the facility. The following discussion describes the reasons why KWP II LLC has decided not to consider alternatives that involve greater or lesser generating capacity than the proposed 21 MW facility.

2.3.2.1 Reduced Scale Project (<21 MW)

KWP II LLC believes that reducing the size of the facility below 21 MW would decrease the benefits of further wind power development without providing off-setting environmental benefits. Moreover, lowering the number of wind generators does not produce an equivalent reduction in the cost of the support facilities and permitting. When combined with the high fixed costs of transportation, logistics, mobilization and other factors, the cost per megawatt of capacity increases as the number of turbines decreases. For these reasons, KWP II LLC believes it is financially infeasible to construct and operate a facility with fewer than fourteen 1.5-MW WTGs.

2.3.2.2 Increased Scale Project (>21 MW)

There is sufficient room to construct more than 14 additional WTGs in the area. However, in order to engineer a successful utility integration design (and limit visual effects), KWP II LLC does not believe it would be appropriate or practical to install more than the proposed number of 1.5MW wind generators at the site at this time.

2.3.3 DEVELOP WIND POWER GENERATING FACILITY ELSEWHERE ON MAUI

As discussed in Chapter 3, the wind regime at Kaheawa Pastures is extremely favorable in its consistency and strength. In addition, the site's proximity to KWP I allows KWP II to share infrastructure such as the main access road, some equipment storage and parts, and to a smaller extent, personnel, with the existing wind project, subject to licensing agreements between the parties. Other wind-rich sites on Maui are located in areas that lack adequate transmission capability, are closer to/more visible from populated areas, or have other constraints. KWP II LLC believes that duplicating this infrastructure at another site would likely result in greater costs and environmental impacts than would its proposed facility. Moreover, other sites suitable for wind development on Maui present comparable challenges in terms of topography, visibility, natural resources, flora and fauna without having comparable benefits. Therefore, KWP II LLC has concluded that the proposed site is superior to the alternatives that are available for its project.

2.3.4 DIFFERENT WIND TURBINE SIZE OR DESIGN

KWP I uses GE 1.5 MW wind turbines. These have been proven to be a suitable match for the wind regime at the proposed site. Moreover, while sufficiently large to take advantage of economies of scale and the higher wind speeds that are present at heights above those that can be reached by smaller/lower wind turbine generators, the GE units are considerably shorter and less massive than the larger WTGs that are now being put into service in some areas.[13] KWP II LLC plans to use GE

[13] Examples include General Electric's 2.5 MW series and 3.6 MW machines (which have overall heights reaching up to 500 feet) and the 3.0 MW Vestas V90, whose overall height is about the same as that of the large GE Unit.

1.5 MW turbines as well, which will be nearly identical in appearance, though about 30 feet taller in overall height due to manufacturer's design changes.[14] Using the same type of wind energy generators in KWP II as have been used in KWP I will help ensure visual, operational, and logistical continuity for the facilities at Kaheawa Pastures. This decreases the overall visual impact of the WTGs and streamlines the delivery and exchange of parts.[15] KWP II LLC's economic analyses indicate that the 1.5 MW GE turbines are likely to be the most cost-effective choice for this site. Finally, the GE 1.5 turbines can meet the requirements that MECO is likely to set based on the Interconnect Requirement Study that it is conducting as part of the PPA negotiations.

2.3.5 ALTERNATE ENERGY STORAGE TECHNOLOGIES

Various means have been used for storing wind energy, each of which is best-suited for certain situations (see Table 2.7 for examples). As described above in Section 2.2.6.3, KWP II LLC selected a BESS as the preferred technology for use at KWP II. This technology offers several environmental advantages, such as a small footprint and use of non-toxic materials. Electrical advantages are an instantaneous response time and a reasonably long cell life allowing thousands of charge and discharge.

KWP II LLC considered several alternate storage technologies prior to selecting a BESS for its project. These included pumped water storage, compressed air storage, thermal energy storage, flywheel storage, and superconducting magnetic energy storage.[16] Each of these is described briefly below, along with the reasons why KWP II LLC elected not to pursue it.

Table 2.7 Advantages and Disadvantages of Other Storage Technologies

Storage Technology	*Main Advantages (relative)*	*Disadvantages (relative)*
Pumped Storage	High Capacity, Low Cost	Special Site Requirement
Compressed Air Energy Storage	High Capacity, Low Cost	Special Site Requirement, Needs Gas Fuel
Thermal Storage	Preserves Heating or Cooling Power for Later Application	Best Suited for Heat that Originates in an Enclosed Repository
Flywheels	High Power	Low Energy density
Superconducting Magnetic Energy Storage	High Power	Low Energy Density, High Production Cost
Note: All are non-battery storage technologies.		
Source: Electricity Storage Association - http://www.electricitystorage.org/tech/technologies_comparisons.htm		

- ***Pumped Water Storage***. Pumped water storage (often called "pumped hydro") is probably the best known large-scale technology. This consists of pumping water to a high storage reservoir using power that is available but not immediately needed and then releasing the stored water through turbo-generators to produce electricity when it is most needed (in this case when the wind is not

[14] The GE Model 1.5se turbines that are presently in production are slightly taller than the ones that were utilized at KWP I. The current model, which is proposed for use at KWP II, has a tower height of 212 feet and the same rotor diameter (231 feet), for a total height of 328 feet. In comparison, the total height of the existing GE 1.5se turbines at KWP I is 296 feet.

[15] Because the ownership of KWP II is different from that of KWP I, the exchange/sharing of parts and services will be done on a commercial basis, but the co-location of the two sets of wind generators and support equipment will greatly facilitate this and will reduce overall costs.

[16] Additional information can be found at www.electricitystorage.org/pubs/2004/EPRI-DOE%20Storage%20Costs-ESA.pdf.

blowing). Pumped storage recovers 80 to 90 percent of the energy consumed by the pumps (i.e., the electrical generator that is driven by the water that is released from the reservoir produces 80 to 90 percent as much electricity as is consumed pumping water into the storage reservoir). The chief challenge with pumped storage is that it usually requires two nearby reservoirs at considerably different heights and an adequate water supply. There are few locations on Maui that are well-suited for large-scale water storage of this sort; moreover, it often requires considerable capital expenditure, and this increases the cost of the electricity produced by such systems. Because of this, pumped hydro is most suitable for storage periods of a few hours, or a few days at most if the power output is greatly reduced. The lack of an available fresh water source combined with the steep topography and the fact that the KWP II site is in the State Conservation District precludes the use of pumped storage for this project.[17]

- ***Superconducting Magnetic Energy Storage (SMES)***. SMES systems store energy in the magnetic field created by the flow of direct current in a superconducting coil which has been cooled to a temperature below the point at which it becomes a superconductor. A typical SMES system includes three parts: (i) a superconducting coil, (ii) a power conditioning system, and (iii) a cryogenically cooled refrigerator. Once the superconducting coil is charged, the current will not decay and the magnetic energy can be stored indefinitely. The stored energy can be released back to the network by discharging the coil. SMES wastes less electricity in the energy storage process than other methods of storing energy (less than 5 percent). The advantage of having low losses is offset by the high energy requirements of refrigeration and of the superconducting wire that the technology requires. Because of this, SMES is currently used for short duration energy storage such as needed to improve power quality. In summary, SMES is not suitable for the KWP II project due to the very high costs, the energy requirements of refrigeration, and the limits in the total energy able to be stored.
- ***Compressed Air Storage (CAES)***. A CAES plant stores electrical energy in the form of air pressure, then recovers this energy as an input for future power generation.[18] When applied to wind energy, this technology uses electricity from WTGs to compress air, which is then stored it in airtight underground caverns. While it is a promising technology for some Mainland locations, this technology is not suitable for Maui because of the absence of suitable underground storage conditions.
- ***Thermal Storage***. Several technologies are available that can store energy in a thermal reservoir for later reuse. The thermal reservoir may be maintained at a temperature above (hotter) or below (colder) than that of the ambient environment. The principal application today is the production of ice or chilled water at night which is then used to cool environments during the day. Thermal energy storage technologies are most useful for storing energy that originates as heat in an insulated repository for later use for space heating or for domestic or process hot water heating. They are not well suited for storing electrical energy and consequently are not viable for KWP II.
- ***Flywheel Storage.*** This form of storage uses electricity from the wind energy generator to power an electric motor that accelerates a heavy rotating disc, which acts as a generator on reversal,

[17] In theory, electrical energy from the WTGs could be used in a pump/reservoir system located elsewhere. However, the challenge of obtaining the permits and land/water rights needed for this introduces a high degree of uncertainty that KWP II LLC believes makes it unviable.

[18] Essentially, the CAES cycle is a variation of a standard gas turbine generation cycle. In the typical simple cycle gas fired generation cycle, the turbine is physically connected to an air compressor. Therefore, when gas is combusted in the turbine, approximately two-thirds of the turbine's energy goes back into air compression. With a CAES plant, the compression cycle is separated from the combustion and generation cycle. When the CAES plant regenerates the power, the compressed air is released from the cavern and heated through a recuperator before being mixed with fuel and expanded through a turbine to generate electricity. Because the turbine's output no longer needs to be used to drive an air compressor, the turbine can generate almost three times as much electricity as the same size turbine in a simple cycle configuration, using far less fuel per MWh produced. The stored compressed air takes the place of gas that would otherwise have been burned in the generation cycle and used for compression power.

slowing down the disc and producing electricity. Electricity is stored as the kinetic energy of the rotating disc. Mechanical inertia is the basis of this storage method. The ranges of power and energy storage technically and economically achievable with this technology are quite limited, however, making flywheels unsuitable for general power system application such as KWP II.

None of the storage technologies listed above provide an effective and viable means of storing large amounts of energy produced by wind at the Kaheawa site. Battery storage systems do, however, provide a means of mitigating energy output fluctuations from variable wind resources across desired frequencies. This ability increases the predictability of the energy output to the utility, thus allowing higher as-available penetrations in a small island electrical grid than would otherwise be feasible. Beyond that, other, firm energy sources (such as the existing fossil fuel-fired generating units on the island) are still needed.

2.3.6 DELAYED ACTION/SLOWER IMPLEMENTATION

Because of the substantial benefits that substituting wind energy for fossil fuel use has for the natural environment and for Maui's economy, KWP II LLC has concluded that postponing development of the project is not advantageous. It believes that the sooner that additional wind energy is brought online and replaces fossil fuels, the sooner the economic and environmental benefits described in Chapter 1 can be realized. Consequently, it is not considering a slower development schedule at the present time. Similarly, slowing development tends to increase costs, extends the time during which the site has been disturbed and increases the potential for erosion and other adverse effects on the natural environment.

2.3.7 THIRD KWP INCREMENT (KWP III)

KWP II LLC considered proposing the construction of a third increment of KWP (KWP III) in the vicinity of KWP I and II that could take further advantage of the infrastructure that would already be in place (e.g., transmission lines, road access, substation). KWP II decided against proposing a third increment due to the absence of a large enough market on Maui to justify wind energy development beyond the 21 MW that is now proposed. Based on the available information, KWP II LLC has concluded that with the efficiency of known technologies and the isolated small island grid requirements, it is unlikely that larger amounts of as available wind energy can be integrated into the Maui grid without significant technological improvements.

Should improved technology become available at some time in the future and/or if greater than anticipated load growth should occur on Maui to allow room for additional wind power on the grid, then the option of constructing a third increment (i.e., KWP III) could be revisited.

2.3.8 OTHER RENEWABLE ENERGY SOURCES

The principals of KWP II LLC specialize in wind energy generation and have extensive experience implementing it in a cost-effective and environmentally friendly manner. The wind facility being proposed is not intended to exclude or replace the use of other renewable energy sources; rather it will make a contribution to a diversified renewable energy portfolio on Maui. The Integrated Resource Plan (IRP) that MECO submitted to the PUC on April 30, 2007, includes 10.5 MW of wind capacity in its Preferred Plan, and the governor has expressed strong support for the development of wind energy. Hence, KWP II LLC did not evaluate other forms of renewable energy in depth.

2.4 NO ACTION ALTERNATIVE

In addition to these two "action alternatives," this EIS evaluates the "No Action" alternative in compliance with HAR, §11-200-17(f)(1) (see Chapter 5.0). That alternative assumes that neither KWP II nor other developers will install additional wind generating capacity at Kaheawa Pastures for the foreseeable future. This would not satisfy the objectives listed in Section 1.3.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

3.0 OVERVIEW OF THE EXISTING ENVIRONMENT

This chapter discusses the environmental, cultural, and social characteristics of the areas that would be affected by the action described above. In most instances, the area affected by the project is limited to areas on and immediately around the alternative sites. However, the description broadens to a wider geographical scope where applicable. The discussion is organized by topic (e.g., topography, hydrology, noise, etc.). The information is intended as a means of orienting readers to the project area and to describe the general kinds of resources that will be examined in the impact analysis in Chapter 4.[19] More detailed information on existing conditions needed to understand and evaluate potential impacts is provided in that Chapter.

3.1 TOPOGRAPHY, GEOLOGY AND SOILS

3.1.1 PHYSIOGRAPHY AND TOPOGRAPHY

3.1.1.1 Preferred Alternative

The WTGs in the Preferred Alternative would be constructed on the lower part of a broad interfluve between Manawainui Gulch on the west and Malalowaiaʻole Gulch on the east. Kealaloloa Ridge, another broad interfluve lies immediately northeast of Malalowaiaole Gulch and separates the proposed facilities from the isthmus of Maui to the east. The proposed baseyard (substation, BESS, and support facilities) would be adjacent to the upper electrical transmission corridor within the KWP I wind farm. The gulches are steep and rocky. Several small puʻu are present in the area, including Puʻu Lūʻau, which is near the uppermost of the two existing MECO transmission line corridors at an elevation of about 2,300 feet above mean sea level (msl).

The ground slope along the length (i.e., the mauka-makai axis) of the area where the WTGs would be constructed varies, but averages about 14 percent. The cross-slopes within this area are also variable, but typically are no more than 2 to 3 percent.

3.1.1.2 Alternative 2

The dominant topographic features in the Alternative 2 area are Kaheawa Pasture; the upper portion of Manawainui Gulch and Kealaloloa; Pāpalaua Gulch which is west of Kaheawa Pastures; and several *puʻu* (peaks or outcrops). The *puʻu* include Puʻu Lūʻau, which is near the existing MECO transmission lines at an elevation of about 2,300 feet, and Pōhakuloa, which is at about 1,600 feet elevation at the lower end of the project area. The WTGs and other facilities in this alternative are located on a narrow band of land running *mauka-makai* between Manawainui Gulch and Pāpalaua Gulch, and on the ridge between Manawainui Gulch and Malalowaiaole Gulch where the current access road lies. The ground slopes in these areas are similar to those in the area that would be used for the Preferred Alternative.

3.1.2 GEOLOGY

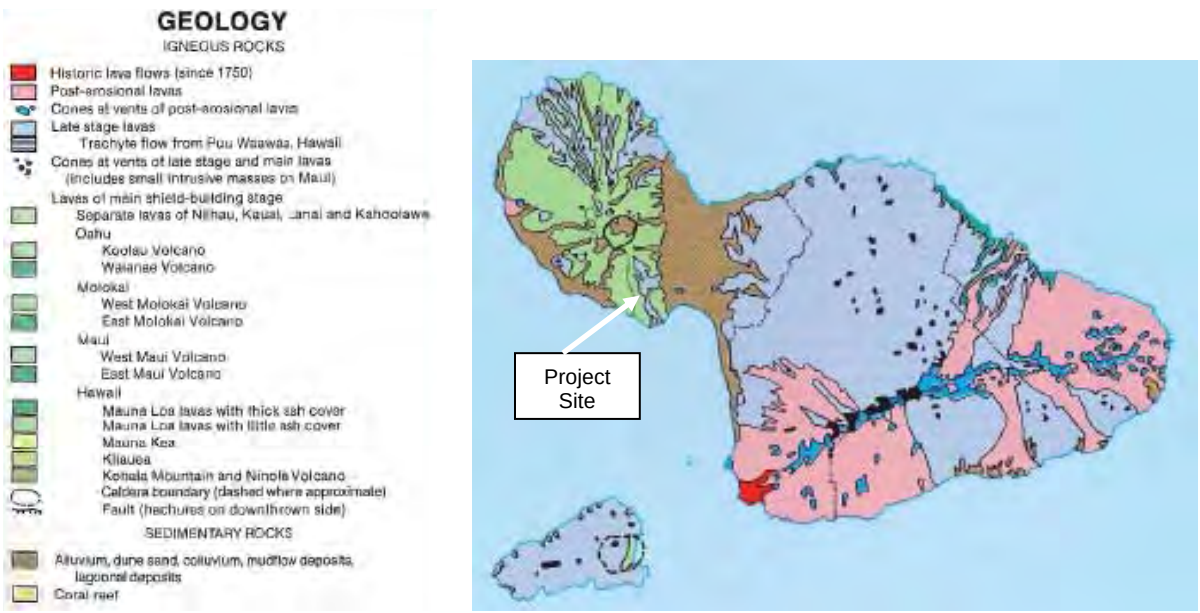
The extinct West Maui volcano where the proposed project is located evolved through shield (1.6 to 2.0 million years old), post-shield (1.5-1.2 million years old), and rejuvenated stages. While each of the flows was relatively thin, the accumulation during each stage was thousands of feet thick. Nearly a half-million years passed between the post-shield and rejuvenated phases with no evidence of volcanic activity. The rejuvenated stage is represented by only a handful of vents and flows. All the eruptions in the rejuvenated phase were from small cinder cones that grew briefly and then died. Lava flows were extruded from each, but the area covered by lava was generally only a few acres. West Maui's rejuvenated-stage eruptions ended about 385,000 years ago. The oldest of the small

[19] Existing conditions for the Preferred Alternative baseyard area, which lies within the KWP I leased area, are essentially the same as those in Alternative 2.

cones is Kīlea, which lies a short distance inland from Olowalu on the southwest side of West Maui. The youngest cone, Puʻuhele lies 2.5 km (1.6 mi) north of Māʻalaea along the road to Wailuku. No lava flows issued outward from Puʻuhele cone, and it has been quarried so extensively that the mound of the cinder cone is gone. The great age and limited extent of lava from these late-phase eruptions indicate that even if the volcano is not extinct, it poses little danger on the site of the proposed wind farm.

Figure 3.1 shows the generalized geology of the island. The present Island of Maui is part of "Maui Nui", which consisted of six or seven coalesced volcanoes, including Haleakalā, West Maui, Kahoʻolawe, Lānaʻi, East Molokaʻi, West Molokaʻi, and Penguin Bank, which is believed to have been separate from West Molokaʻi.[20] At its largest, Maui Nui probably had a maximum size of about 6,200 square miles, some 2,150 square miles larger than present-day Hawaiʻi Island. About 300,000 to 400,000 years ago, Maui Nui, which grew from west to east, subsided to form two islands, one consisting of Penguin Bank, Molokaʻi, and Lānaʻi, and the other consisting of Maui and Kahoʻolawe. Kahoʻolawe then separated from Maui, and finally Lānaʻi separated from Molokaʻi, both within the last 100,000 to 200,000 years. Penguin Bank probably became submerged within the last several hundred thousand years. With continued subsidence at the present-day rates, Haleakalā and West Maui will become separate islands in about 15,000 years.

Figure 3.1 Geological Setting



Source: Atlas of Hawaiʻi, Second Edition (1983).

3.1.3 SOILS

The primary soil types on Maui belong to the Lahaina Volcanic Series, the Honolua Volcanic Series, and the Wailuku Basaltic Series. Kaheawa Pastures is mostly underlain by deep, well-drained volcanic soils, transitioning into the steep, rocky gulches to the east, south, and west of the project site. Soils in the area of the Preferred Alternative where the WTGs would be constructed are exclusively characterized as Rocklands (rRK) by the National Resource Conservation Service (Foote et al, 1972). This substrate consists of thin soils formed from gray trachyte lavas of the Honolua

[20] Based on information from Volcano Watch by the U.S. Geological Survey / Hawaiian Volcano Observatory --- September 8, 1995; September 15, 1995; September 22, 1995; and September 29, 1995. http://users.bendnet.com/bjensen/volcano/eastpacific/hawaii-hawaii.html

Series which overlay the foundational lavas of the West Maui volcano. These lavas weather to platy gray blocks that extend across the entire ridge. The proposed baseyard for the Preferred Alternative and the area on which all of the Alternative 2 facilities would be constructed is mostly underlain by deep, well-drained volcanic soils that transition into the steep, rocky gulches to the east, south, and west of the project area. Table 3.1 lists the characteristics of the major soil types found at the Preferred Alternative and Alternative 2 sites.

Table 3.1 Characteristics of Soil Types within the Project Area

Soil Type	Slope %	Permeability	Runoff	Erosion Hazard	Land Uses	Soil Type Present?	
						Preferred Alt.	Alternative 2
Nāʻiwa silty clay loam	3-20	Moderately Rapid	Medium	Moderate to Severe	Pasture, woodland, and wildlife habitat	No	Yes
Oli silt loam	3-10	Rapid	Medium	Moderate	Pasture and wildlife habitat	No	Yes
Rock land	-	-	-	-	Pasture, wildlife habitat, water supply, urban development	Yes	Yes

Source: Foote *et al.* 1972 (U.S. Soil Conservation Service).

3.2 CLIMATE

The climate of the Hawaiian Islands is characterized by a two-season year, mild and uniform temperatures everywhere (except at high elevations), marked geographic differences in rainfall, high relative humidity, extensive cloud formations (except on the driest coasts and at high elevations), and dominant trade-wind flow (especially at elevations below a few thousand feet). Maui itself has a wide range of climatic conditions and weather patterns that are influenced by several different factors in the physical environment. Among the most important of these are elevation, position on the windward or leeward side (relative to the prevailing northeast trade winds) of the island, and local terrain features (such as valleys and ridges).

3.2.1 TEMPERATURE

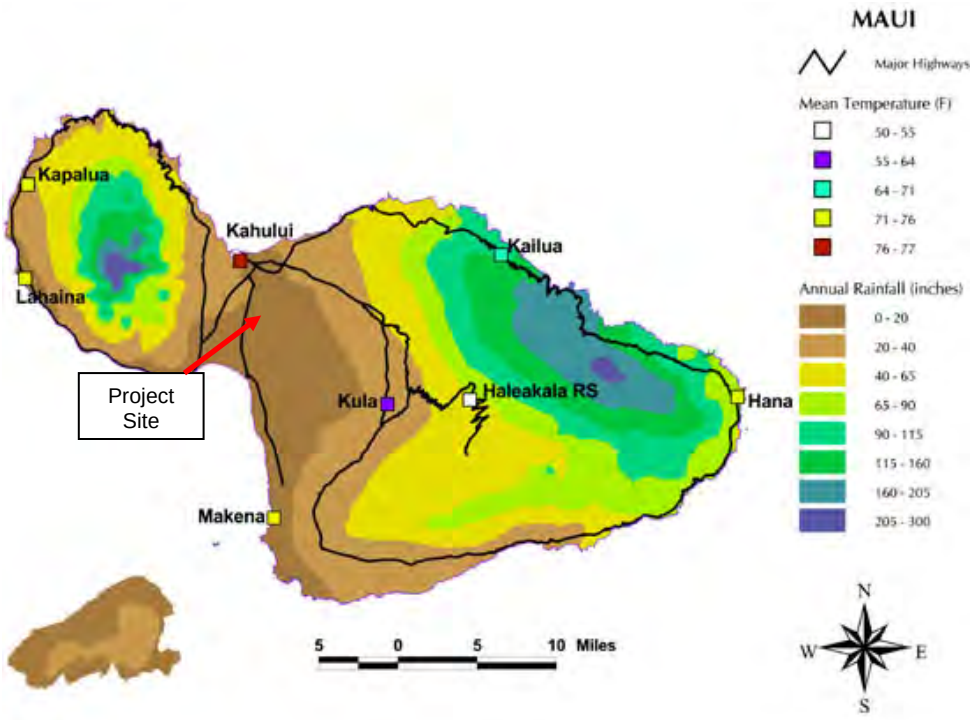
Due to the tempering influence of the surrounding Pacific Ocean and their low-latitude location, the Hawaiian Islands experience extremely small diurnal and seasonal variations in ambient temperature. At Kahului Airport, the average low temperature in the coldest month is 63.4˚ Fahrenheit (F) (January). Average high temperature in the warmest month is 86.3˚F (July). These temperature variations are quite modest compared to those that occur at inland continental locations. Additional temperature data from Kahului Airport are summarized in Table 3.2. Figure 3.2 illustrates temperature and rainfall averages on Maui.

Table 3.2 Average Monthly Temperatures, Kahului Airport (1954-2000)

Month	*Normal Ambient Temperature, ºFahrenheit*		
	Monthly Average	*Monthly Average Maximum*	*Monthly Average Minimum*
January	71.7	80.0	63.4
February	71.7	80.0	63.3
March	72.7	81.0	64.4
April	74.0	82.0	66.0
May	75.5	83.7	67.2
June	77.3	85.5	69.2
July	78.5	86.3	70.7
August	79.2	87.1	71.2
September	78.8	87.4	70.1
October	77.8	86.2	69.3
November	75.7	83.6	67.8
December	73.1	81.0	65.2

Source: Hawai'i State Climate Office (2008).

Figure 3.2 Mean Temperatures and Annual Rainfall on Maui



Source: Spatial Climate Analysis Service, Oregon State University (http://www.medb.org/communityprofile/geographic.cfm)

3.2.2 RAINFALL

As everywhere in the state, average annual rainfall on Maui varies greatly from place to place, ranging from about 20 inches at the coast to up to 400 inches in the higher elevations. Near the alternative project sites, it ranges from less than 15 inches per year at the Honoapiʻilani Highway/site access road intersection to slightly over 40 inches per year at the uppermost of the existing WTGs. Most of the rainfall occurs during winter months (80+ percent from November through April).

Rainfall variability is far greater during the winter, when occasional storms contribute appreciably to rainfall totals, than during summer, when trade-wind showers provide most of the rain. Major storms occur most frequently between October and March, including "Kona" storms, so named because they often generate winds coming from the Kona or southerly direction. During these months, there may be as many as six or seven major storm events in a year. Such storms bring heavy rains and are sometimes accompanied by strong local winds. The storms may be associated with the passage of a cold front – the leading edge of a mass of relatively cool air that is moving from west to east or from northwest to southeast. While rare storm events can produce relatively high rainfall amounts (e.g., the 24-hour rainfall with a 50-year recurrence interval is about 10 inches, and the 1-hour rainfall with the same recurrence interval is approximately 3 inches), even these are modest compared to those experienced in parts of the island that are wetter than Kaheawa Pastures.

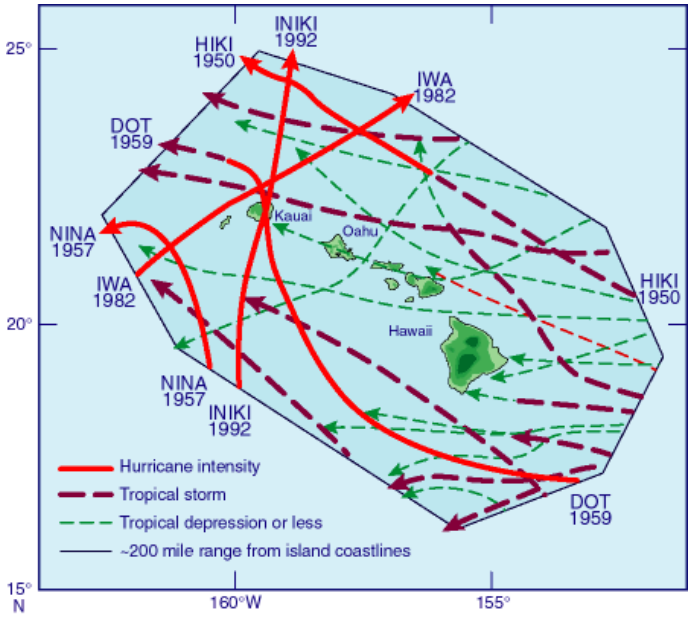
3.2.3 WIND PATTERNS

Prevailing surface winds in the project area are the northeasterly trade winds, which occur over 70 percent of the time; however, during "Kona" storm conditions the prevailing winds change to a south/southwesterly direction. Wind patterns vary on a daily basis, with trade winds generally being stronger in the afternoon. When the trade winds are weak or absent, a land-sea breeze pattern sometimes develops. When this occurs, 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 topography of Maui and the West Maui Mountains is largely responsible for the heightened wind velocity and power at Kaheawa Pastures. The prevailing northeasterly trade winds tend to be split by Haleakalā, and the northern stream whips over the southwest flank of the West Maui Mountains while attempting to regain uniform flow, making that location the best wind resource on the island. The deep gulches and ravines that exist in the area can create additional acceleration of the wind speeds in the downslope direction, thereby increasing wind velocity on the ridges immediately above these gulches. Figure 3.3 and Figure 3.4 illustrate wind speed and power patterns in Maui County, respectively. The designers of KWP II have learned a great deal more about the specifics of wind on the proposed site, but consider the met tower data and/or forecasting data they have collected to be confidential and proprietary; hence, it cannot be included here.

3.2.4 HURRICANES & TROPICAL STORMS

True hurricanes are very rare in Hawai‘i, as indicated by the fact that only four have affected the islands during the past 65 years. Tropical storms are more frequent. These are similar to hurricanes but with more modest winds, below 74 mph. Because weak tropical storms resemble some Kona storms in the winds and rains they produce, and because early records do not distinguish clearly between them, it has been difficult to estimate the average frequency of tropical storms. A tropical storm will pass sufficiently close to Hawai‘i every year or two to affect the weather in some part of the Islands. Unlike cold front and Kona storms, hurricanes and tropical storms are not limited to the winter season. They are most likely to occur during the last half of the year, from July through December.



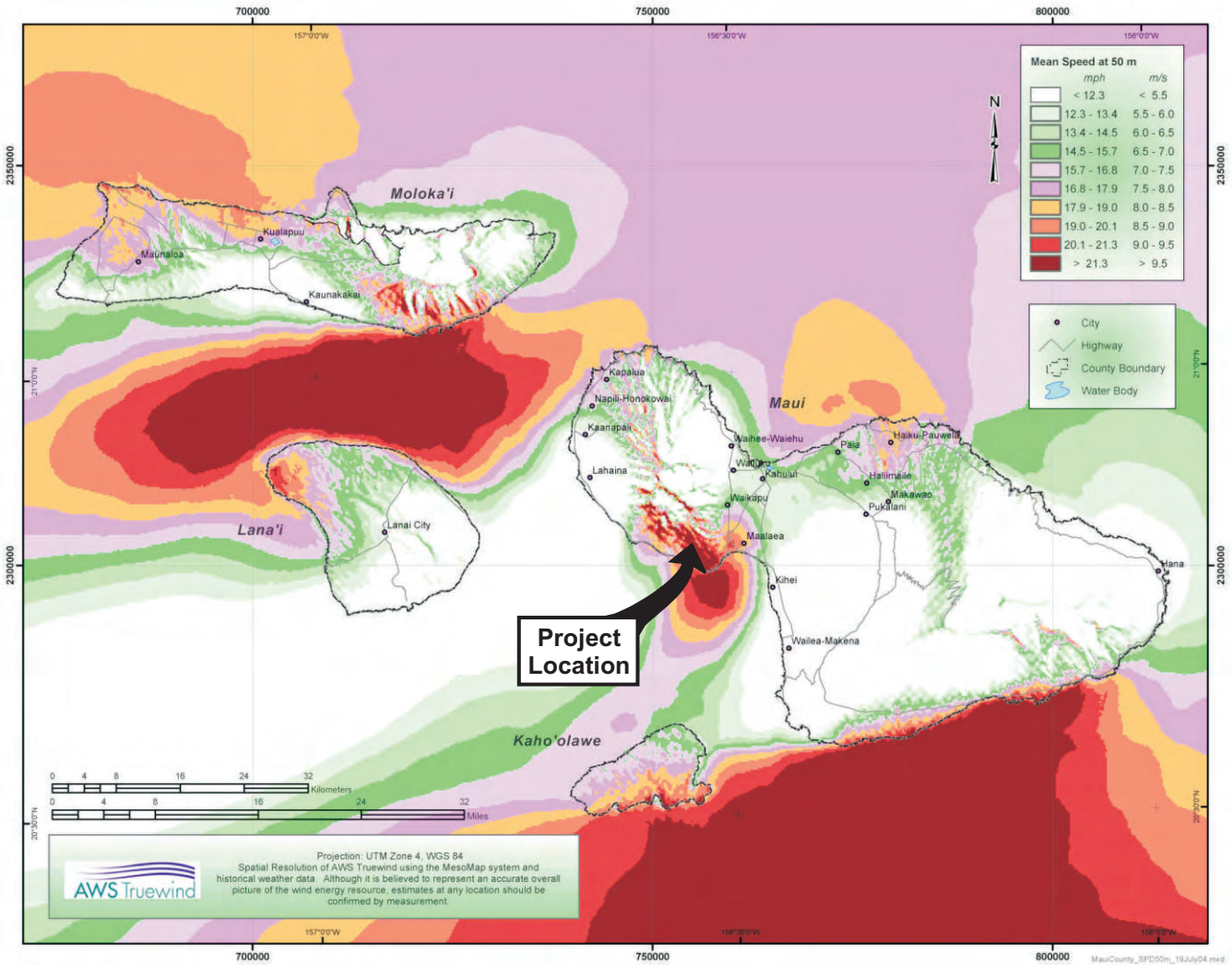
Source: www.soest.hawaii.edu/MET/Faculty/businger/poster/hurricane/Fig2_tracks.gif

3.3 AIR QUALITY

3.3.1 AIR QUALITY STANDARDS

The U.S. Environmental Protection Agency (EPA) has set national ambient air quality standards (NAAQS) for ozone, nitrogen dioxide, carbon monoxide, sulfur dioxide, 2.5-micron and 10-micron particulate matter ($PM_{2.5}$ and PM_{10}), and airborne lead. These ambient air quality standards establish the maximum concentrations of pollution considered acceptable, with an adequate margin of safety, to protect the public health and welfare. The State of Hawai‘i Department of Health (DOH) has also adopted ambient air quality standards for some pollutants. In some cases, these are more stringent than the Federal standards. At present, the State has set standards for five of the six criteria pollutants (excluding $PM_{2.5}$) in addition to hydrogen sulfide (DOH 2005).

Both State and national air quality standards consist of two parts: (i) an allowable concentration of a pollutant and (ii) an averaging time over which the concentration is measured. The allowable concentrations are based on the results of studies of the effects of the pollutants on human health, crops, and vegetation, and, in some cases, damage to paint and other materials. The averaging times are based on whether the damage caused by the pollutant is more likely to occur during exposure to a high concentration for a short time (one hour, for instance), or to a lower average concentration over a longer period (e.g., 8 hours, 24 hours, or a year). For some pollutants there is more than one air quality standard, reflecting both its short-term and long-term effects. Table 3.3 presents the State and national ambient air quality standards for selected pollutants.



Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

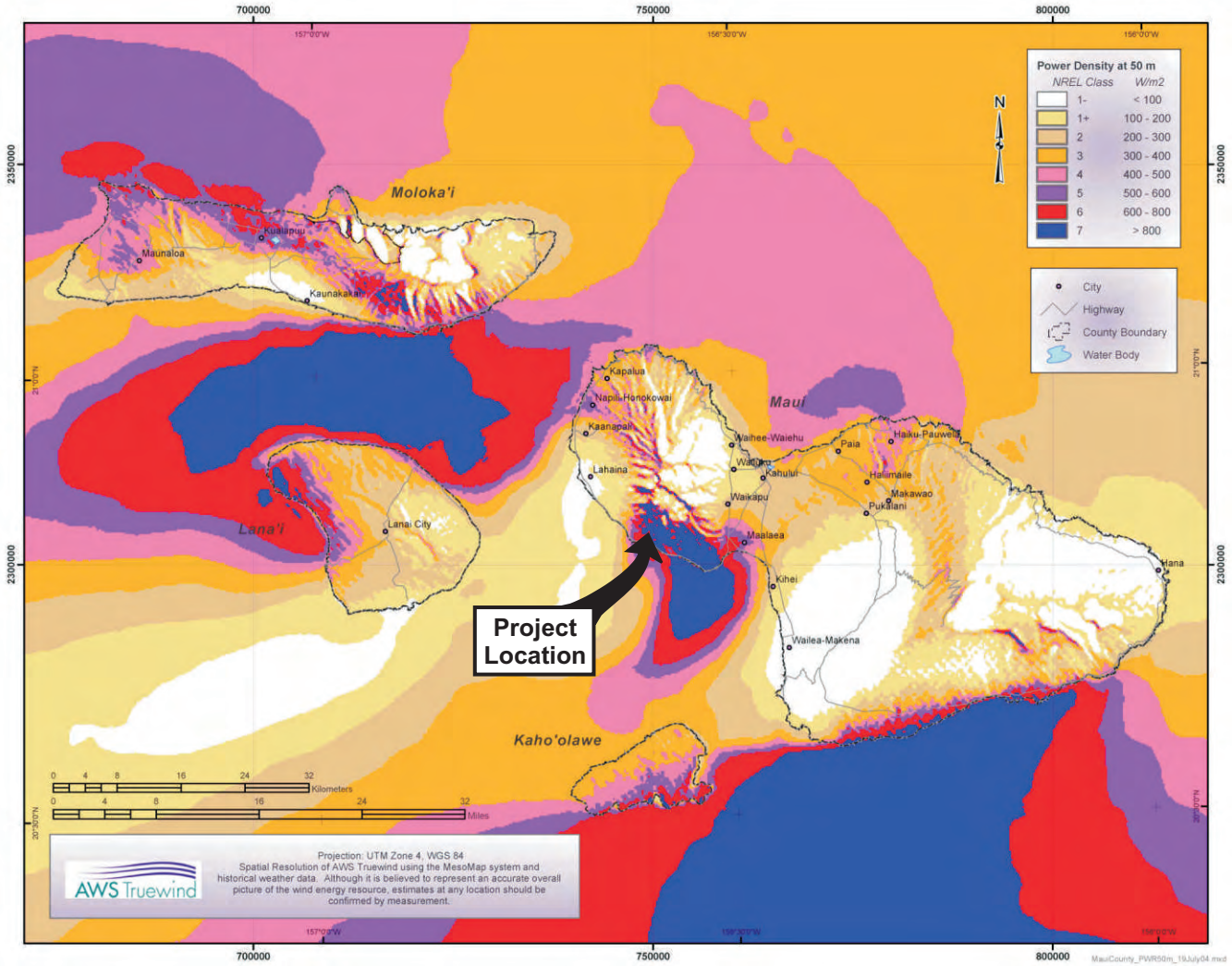
Hawaiian Electric Co., Inc.

Figure 3.3:

Wind Speed Patterns for Maui County

Kaheawa Wind Power II

Figure 3-3 Wind Speed 2008-09-23.cdr



Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

Hawaiian Electric Co., Inc.

Figure 3.4:

Wind Power Patterns for Maui County

Kaheawa Wind Power II

Figure 3-4 Wind Power 2008-09-23.cdr

3.3.2 EXISTING AIR QUALITY

The State DOH maintains monitoring stations throughout the State in order to measure ambient air concentrations of the six criteria pollutants regulated by the NAAQS. The monitoring station nearest to the KWP II site is at Kīhei, Maui. This station monitors $PM_{2.5}$ and PM_{10} only. During 2005, the only exceedance of 24-hour PM_{10} standards occurred in July; DOH attributed this occurrence to agricultural tilling and flagged it as an exceptional event (DOH 2005). In general, the State of Hawai‘i was in attainment for all NAAQS during 2005.

There are few sources of air pollutants near the project site. The most significant is the dust that naturally arises when strong winds sweep across the open fields or exposed slopes during dry weather. Other sources of airborne contaminants on or near the project site include vehicle exhaust, intermittent fugitive dust and “Maui snow” from agricultural cultivation, dust from construction activities, and smoke from wildfires. Emissions from MECO’s power plants also affect air quality, but they are sufficiently far away that they do not have a strong effect on ambient concentrations of the pollutants. Particulate and other emissions from such activities are required to meet Federal and State air quality standards.

Table 3.3 State and National Ambient Air Quality Standards

Pollutant/Averaging Period	*Standard, $\mu g/m^3$*		
	State Standard	*Federal Primary Standard [1]*	*Federal Secondary Standard [2]*
Nitrogen Dioxide (NO_2)	70	100	100
Sulfur Dioxide (SO_2)	1300	---	1300
24-hour	365	365	---
Annual	80	80	---
Carbon Monoxide (CO)	10,000	40,000	40,000
8-hour	5,000	10,000	10,000
2.5-micron Particulate Matter ($PM_{2.5}$)	---	65	65
Annual	---	15	15
10-micron Particulate Matter (PM_{10})	150	150	150
Annual	50	50	50
Ozone	---	235	235
8-hour	157	157	157
Hydrogen Sulfide (H_2S)	35	---	---
Lead	1.5	1.5	1.5

[1] Designated to prevent against adverse effects on public health.
[2] Designated to prevent against adverse effects on public welfare, including effects on comfort, visibility, vegetation, animals, aesthetic values, and soiling and deterioration of materials.

Source: State of Hawai‘i Department of Health (2005)

3.4 HYDROLOGY AND WATER RESOURCES

The land on which KWP II would be developed consists of rocky ridges in the Preferred Alternative site and a grassy ridge in the Alternative 2 site. Neither area contains wetlands or other aquatic habitat (Hobdy 2004a, 2004b, 2006 and 2009). No perennial streams flow through the areas. Storm runoff from the WTG sites in the Preferred Alternative is in a southeasterly direction toward Malalowaiaole Gulch. Storm runoff from the WTG sites in Alternative 2 is overland in a generally southerly direction, with most of the runoff eventually reaching the ocean through several small dry gulches as shown in Figure 1.2.

The State of Hawai‘i Commission on Water Resource Management (CWRM, October 27, 2004) has determined that Manawainui Gulch does not have sufficient water to support instream uses and is therefore not considered a stream. Consequently it is not subject to CWRM regulation. Similarly, the U.S. Army Corps of Engineers (USACE), concluded that the KWP I project site (including the access road along which the proposed WTGs are located) is located entirely within an upland area and does not contain or convey waters of the United States subject to USACE jurisdiction (Young, November 8, 2004).

Both the alternative sites are located over the Ukumehame Sector of the Lahaina Aquifer (Aquifer Code 60206 as designated by the State of Hawai‘i Water Use Commission). The estimated depth to the basal groundwater ranges from approximately 1,500 to 2,950 feet below the surface (depending on the location on the site) and the overall groundwater flow is likely in a southerly direction. Perched areas of groundwater may also underlie the site (VEC 2005). Both sites being considered are located *mauka* of the Underground Injection Control (UIC) line. The UIC line is the designated boundary that divides protected inland areas situated over drinking water sources from seaward areas located over non-potable water sources.

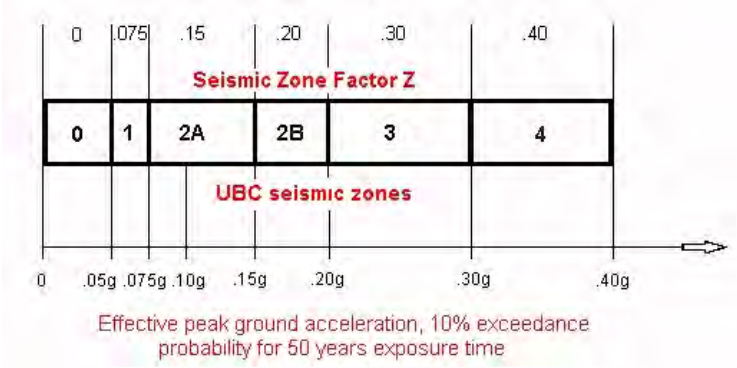
3.5 NATURAL HAZARDS

3.5.1 FLOODING & TSUNAMI

The proposed KWP II site is entirely within Flood Zone X, an area that is determined to have less than 0.2 percent annual risk (once in 500 years) of flood inundation. There are no 100-year flood zones identified on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) at or near the mouths of either of the gulches bordering the site. The Civil Defense Tsunami Evacuation Maps indicate the subject property is not within the Tsunami Inundation Zone.

3.5.2 SEISMIC HAZARDS

Seismic hazards are those related to ground shaking; they include landslides, ground cracks, rock falls, and tsunami. Scientists and engineers have devised a system of classifying seismic hazards on the basis of the expected strength of ground shaking and the probability of the shaking actually occurring within a specified time. The results are incorporated into the Uniform Building Code (UBC) seismic provisions, which establish minimum design criteria for structures to address the potential for damages due to seismic disturbances. These establish six seismic zones, ranging from “0” (where there is considered to be no chance of severe ground shaking) to “4” (10 percent chance of severe shaking in a 50-year interval). The shaking is quantified in terms of g-force (a unit of force equal to the force exerted by the earth’s gravity) as indicated in the following diagram:



The entire island of Maui is in Seismic Zone 2B, in which a force of 0.15g to 0.20 g is expected to occur once every 50 years (USGS 1997). This designation was the governing seismic code for KWP I, and is within the design envelope of the GE 1.5gse wind turbines utilized on that project and proposed to be used at KWP II.

3.5.3 FIRE HAZARDS

With the cessation of cattle-grazing in the West Maui Mountains, a number of grass and weed species have proliferated, creating a heightened fire hazard. A large fire swept across the mountain in 1999 consuming vegetation on more than 2,500 acres including most of the project area. In September 2006 (after the KWP I facility commenced operation), another extensive brush fire affected a large portion of the West Maui Mountains from the coastal highway to the existing facility, including a large portion of the KWP II area. The existing KWP I facility was not the cause of the fire. The wind farm equipment was protected from damage by multiple firebreaks constructed by KWP I staff and by extensive watering, and the roadways constructed for the KWP I project were instrumental in providing firefighting crews access to the fire line.

On-site fire-fighting resources at the existing KWP I facility include fire extinguishers in the O&M building, at the substation, and in all project vehicles, as well as shovels and backpack pumps in the O&M building and maintenance vehicles. The existing facility also maintains graveled, vegetation-free buffers around the O&M building, the substation, and the WTG foundation pads. The KWP II site is approximately 10 miles from the Wailuku Fire Station and approximately 12 miles from the Kīhei Station (measured from access roadway entrance at the Honoapiʻilani Highway).

3.6 TERRESTRIAL FLORA

According to Hobdy (2006, 2009), both areas being considered are believed to have been entirely covered with native vegetation in pre-contact times. The vegetation is thought to have been of low stature, with dry grass and shrublands below and mesic to wet windblown forests above. He reports that native Hawaiians made some uses of forest resources present at higher elevations here and had a cross-island trail cresting the ridge at 1,600 feet elevation. This trail was upgraded during the mid-1800s and used as a horse trail to Lahaina. It was reopened in recent years and is the present Lahaina Pali Trail.

Cattle ranching in the area began in the late 1800s and continued for over 100 years. During this time the grazing animals consumed most of the native vegetation, which was gradually replaced by hardy weed species. During the 1950s MECO installed high voltage transmission lines and maintenance roads through this area. Increased traffic brought more disturbances and weeds. Fires became more frequent, further eliminating remnant native vegetation (Hobdy 2006, 2009).

3.6.1 PREFERRED ALTERNATIVE: EXISTING CONDITIONS

In August 2009, Hobdy surveyed the flora of the area that would be encompassed by the Preferred Alternative on Kealaloloa Ridge. He characterized the project area as containing a wide variety of low shrubs, grasses and some small trees in the wetter gullies. The most common species is buffelgrass (*Cenchrus ciliaris*) which proliferated after the fires in 1999. Other common species are Natal redtop (*Melinis repens*), ‘ilima (*Sida fallax*), ‘uhaloa (*Waltheria indica*), lesser snapdragon (*Antirrhinum orontium*) and Jamaican vervain (*Stachytarpheta jamaicensis*). Of the 62 plant species that Hobdy identified, 15 are endemic or indigenous to the Hawaiian Islands. None of the native plants are federally listed as threatened or endangered (Hobdy, 2009). The remaining 47 plant species were non-native trees, shrubs, and grasses. Table 3.4 lists all the species encountered during the survey. A complete copy of the 2009 report is included in Appendix A.

3.6.2 ALTERNATIVE 2: EXISTING CONDITIONS

Hobdy (2006) conducted a botanical survey of the Alternative 2 area in October 2006, noting that the portion of the project area that burned had only bare, blackened ground with a few charred stumps. He described the vegetation within unburned portions of the project area as a diverse array of grasses and low shrubs with a scattering of small trees. The most abundant species was molasses grass (*Melinis minutiflora*), which began taking over following the 1999 fire. Also common are broomsedge (*Andropogon virginicus*), Natal redtop (*Melinis repens*), hairy horseweed (*Conyza bonariensis*), kilau (*Pteridium aquilinum var. decompositum*), fire weed (*Senecio madagascariensis*), narrow-leaved plantain (*Plantago lanceolata*) and ’ūlei (*Osteomeles anthyllidifolia*). He recorded a total of 57 plant species during the course of the survey; these are listed in Table 3.4. Approximately one-third of the species detected were endemic or indigenous. The remaining 39 species are non-native plants. A copy of the full 2006 report is included in Appendix A.

Table 3.4 Plant Species Observed at the Sites Under Consideration (2006 & 2009)

Scientific Name	***Common Name***	***Status***	***Presence/Abundance***		
			Preferred Alternative 2009	***Alternative 2***	
				2006	***2009***
FERNS					
DENNSTAEDTIACEAE (Bracken Family)					
Pteridium aquilinum (L.) Kuhn. *var. decompositum* (Gaudich.) R.M. Tryon	kilau	endemic		common	common
NEPHROLEPIDACEAE (Sword Fern Family)					
Nephrolepis brownii (Desc.) Hovencamp & Miyam.	Asian sword fern	non-native	rare		
PTERIDACEAE (Brake Fern Family)					
Doryopteris decipiens (Hook.) J.Sm.	Kumuniu	endemic	rare		
Pityrogramma austroamericana Domin.	Gold fern	non-native	rare	absent	rare
MONOCOTS					
CYPERACEAE (Sedge Family)					
Carex wahuensis C.A. Mey. subsp. *wahuensis*	----------	endemic		rare	uncommon
Cyperus phleoides Nees ex Kunth subsp. Phleoides.		endemic	rare		
POACEAE (Grass Family)					
Andropogon virginicus L.	broomsedge	non-native	rare	common	uncommon
Axonopus fissifolius (Raddi) Kuhlm.	narrow-leaved carpetgrass	non-native		rare	absent
Bothriochloa barbinodis (Lag.) Herter	Fuzzy top	non-native		absent	rare
Bothriochloa pertusa (L.) A. Camus	pitted beardgrass	non-native		absent	common
Cenchrus ciliaris (Retz.) Koeler	Buffelgrass	non-native	abundant	absent	common
Cynodon dactylon (L.) Pers.	Bermuda grass	non-native	rare	uncommon	Rare
Digitaria ciliaris (Retz.) Koeler	Henry's crabgrass	non-native		rare	Rare
Digitaria insularis (L.) Mez ex Ekman	Sourgrass	non-native		absent	Rare
Eragrostis deflexa Hitchc.	Kalamalō	Endemic	rare		
Heteropogon contortus (L.) P.Beauv. ex Roem.&Schult.	Pili grass	indigenous	uncommon	rare	Rare
Hyparrhenia rufa (Nees.) Stapf	Thatching grass	non-native		absent	Rare
Melinis minutiflora P. Beauv.	Molasses grass	non-native	rare	abundant	Abundant
Melinis repens (Willd.) Zizka	Natal redtop	non-native	common	common	Common
Panicum maximum Jacq.	Guinea grass	non-native	rare	rare	Rare
Paspalum conjugatum Bergius	Hilo grass	non-native		rare	Rare
Paspalum dilatatum Poir.	Dallis grass	non-native		rare	Rare
Pennisetum clandestinum Chiov.	Kikuyu grass	non-native		uncommon	Uncommon
Rhytidosperma pilosum (R.Br.) Connor &Edgar	hairy oatgrass	non-native		rare	Rare
Setaria parviflora (Poir.) Kerguelen	Yellow foxtail	non-native		absent	Rare
Setaria verticillata (L.) P. Beauv.	Bristly foxtail	non-native		absent	Rare
Sporobolus africanus (Poir.) Robyns & Tournay	smutgrass	non-native	rare	rare	Uncommon
Stenotaphrum secundatum (Walter) Kuntze	St.Augustine grass	non-native		rare	Absent
Trisetum inaequale Whitney	----------	endemic		absent	Rare

DICOTS					
AMARANTHACEAE (Amaranth Family)					
Amaranthus spinosus L.	spiny amaranth	non-native	rare		
Amaranthus viridis L.	slender amaranth	non-native	rare		
Atriplex semibaccata R. Br.	Australian saltbush	non-native	rare		
Chenopodium murale L.	'Āheahea	non-native	rare		
Chenopodium oahuense (Meyen) Aellen	'Āheahea	endemic	rare		
ANACARDIACEAE (Mango Family)					
Schinus terebinthifolius Raddi	Christmas Berry	non-native		rare	uncommon
APOCYNACEAE (Dogbane Family)					
Calotropis procera (Aiton) W.T. Aiton	Small crown flower	non-native	rare		
Stapelia gigantea N.E. Brown	Zulu giant	non-native		absent	rare
ASTERACEAE (Sunflower Family)					
Acanthospermum australe (Loefl.) Kuntze	Spiny bur	non-native		absent	rare
Ageratina adenophora (Spreng.) R.King & H.Robinson	Maui pamakani	non-native		absent	rare
Bidens cynapiifolia	--------	non-native		absent	rare
Bidens mauiensis (A. Gray) Sherff	koʻokoʻolau	endemic		absent	rare
Bidens micrantha Gaud.	koʻokoʻolau	endemic		rare	absent
Bidens micrantha Gaud. Subsp. *Micrantha*	koʻokoʻolau	endemic		absent	uncommon
Bidens pilosa L.	Spanish needle	non-native		absent	rare
Conyza bonariensis L. Cronq.	hairy horseweed	non-native	uncommon	common	uncommon
Conyza canadensis (L.) Cronq.	horseweed	non-native		absent	rare
Conyza canadensis (L.) Cronq. *var. pusilla* (Nutt.) Cronq.	little horseweed	non-native		rare	absent
Emilia fosbergii Nicolson	Red pualele	non-native	uncommon	absent	rare
Erigeron karvinskianus DC.	daisy fleabane	non-native		rare	uncommon
Galinsoga parviflora Cav.	---------	non-native		absent	rare
Heterotheca grandiflora Nutt.	telegraph weed	non-native		uncommon	rare
Hypochoeris radicata L.	gosmore	non-native		rare	rare
Lactuca sativa L.	Prickly lettuce	non-native	rare		
Lipochaeta lobata (Gaud.) DC. var. lobata	Nehe	endemic	rare		
Melanthera lavarum (Gaud.) Wagner &Rob	Nehe	endemic	uncommon	rare	rare
Pluchea carolinensis (Jacq.) G. Don.	sourbush	non-native		rare	absent
Senecio madagascariensis Poir.	fireweed	non-native	rare	common	common
Sonchus oleraceus L.	Pualele	non-native	rare	absent	uncommon
Tridax procumbens L.	Coat buttons	non-native	uncommon	absent	rare
Xanthium strumarium L.	kikania	non-native	rare		
Zinnia peruviana (L.) L.	Zinnia	non-native	rare	absent	rare
BRASSICACEAE (Mustard Family)					
Sisymbrium altissimum L.	tumble mustard	non-native	uncommon		
Sisymbrium officinale (L.) Scop.	Hedge Mustard	non-native		absent	rare

CACTACEAE (Cactus Family)					
Opuntia ficus-indica (L.) Mill.	Panini	non-native	rare	rare	Rare
CASUARINACEAE (She-oak Family)					
Casuarina equisetifolia L.	common ironwood	non-native		uncommon	Common
Casuarina glauca Siebold ex Spreng.	longleaf ironwood	non-native		rare	Rare
CONVOLVULACEAE (Morning Glory Family)					
Ipomoea indica (J. Burm.) Merr.	koali awahia	indigenous	rare	rare	Uncommon
Ipomoea tuboides Degener & Ooststr.	Hawaiian moon flower	endemic		absent	Rare
ERICACEAE (Heath Family)					
Leptecophylla tameiameiae (Cham. & Schlect.) C.M. Weiller	Pukiawe	indigenous		uncommon	Uncommon
EUPHORBIACEAE (Spurge Family)					
Chamaesyce celastroides (Boiss.) Croizat&Degener *var. amplectens* (Sherff) Degener&I.Degener	‘akoko	endemic		rare	Rare
Chamaesyce hirta (L.) Millsp.	hairy spurge	non-native	rare		
FABACEAE (Pea Family)					
Acacia farnesiana (L.) Willd.	Klu	non-native	rare	uncommon	Uncommon
Chamaecrista nictitans (L.) Moench	partridge pea	non-native	uncommon	uncommon	Common
Crotalaria incana L.	fuzzy rattlepod	non-native	uncommon		
Crotalaria pallida Aiton	Smooth rattlepod	non-native		absent	Rare
Crotalaria retusa L.	----------	non-native		absent	Rare
Desmanthus pernambucanus (L.) Thellung	Slender mimosa	non-native	uncommon	absent	Uncommon
Desmanthus incanum DC.	Kaimi clover	non-native	rare	absent	Rare
Desmodium sandwicense E. Mey.	Spanish clover	non-native		rare	Rare
Desmodium tortuosum (Sw.) DC.	Florida beggarweed	non-native	rare		
Indigofera suffruticosa Mill.	iniko	non-native	uncommon	uncommon	Common
Leucaena leucocephala (Lam.) de Wit	koa haole	non-native	uncommon	uncommon	Uncommon
Macroptilium lathyroides (L.) Urb	Wild bean	non-native	uncommon	absent	Rare
Pithecellobium dulce (Roxb.) Benth.	'opiuma	non-native	rare		
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe	non-native	uncommon	rare	Rare
GENTIANACEAE (Gentian Family)					
Centaurium erythraea Raf.	bitter herb	non-native	rare	rare	Absent
GOODENIACEAE (Goodenia Family)					
Scaevola gaudichaudii Hook. & Arnott	orange naupaka	endemic		rare	Absent
LAMIACEAE (Mint Family)					
Leonotis nepetifolia (L.) R. Br.	lion's ear	non-native	rare		
Salvia coccinea B. Juss. ex Murray	scarlet sage	non-native		rare	Rare
MALVACEAE (Mallow Family)					
Abutilon grandifolium (Willd.) Sw.	Hairy abutilon	non-native		absent	Rare
Abutilon incanum (Link) Sweet	hoary abutilon	non-native	rare		
Malva parviflora L.	Cheese weed	non-native		absent	Rare
Malvastrum coromandelianum (L.) Garcke	False mallow	non-native		absent	Rare

Sida fallax Walp.	‘ilima	indigenous	common	uncommon	common
Waltheria indica L.	‘uhaloa	indigenous	common	uncommon	common
MENISPERMACEAE (Moonseed Family)					
Cocculus orbiculatus (L.) DC.	huehue	indigenous		rare	uncommon
MYOPORACEAE (Myoporum Family)					
Myoporum sandwicense A. Gray	naio	endemic	rare	rare	rare
MYRTACEAE (Myrtle Family)					
Metrosideros polymorpha Gaud. *var. incana* (H. Lev.) St. John	‘ohi‘a	endemic		rare	rare
Psidium guajava L.	guava	non-native		rare	rare
OXALIDACEAE (Wood Sorrel Family)					
Oxalis corniculata L.	‘ihi	Polynesian		absent	rare
PAPAVERACEAE (Poppy Family)					
Argemone glauca (Nutt. ex Prain) Pope	puakala	endemic	rare		
PLANTAGINACEAE (Plantain Family)					
Antirrhinum orontium L.	lesser snapdragon	non-native	common		
Plantago lanceolata L.	narrow-leaved plantain	non-native	uncommon	common	common
POLYGALACEAE (Milkwort Family)					
Polygala paniculata L.	----------	non-native		rare	uncommon
PORTULACACEAE (Purslane Family)					
Portulaca oleracea L.	Pigweed	non-native	rare	absent	rare
Portulaca pilosa L.		non-native	rare		
PRIMULACEAE (Primrose Family)					
Anagallis arvensis L.	scarlet pimpernel	non-native		rare	rare
PROTEACEAE (Protea Family)					
Grevillea robusta A. Cunn. ex R.Br.	silk oak	non-native	rare	rare	rare
ROSACEAE (Rose Family)					
Osteomeles anthyllidifolia (Sm.) Lindl.	‘ulei	indigenous	uncommon	common	common
SANTALACEAE (Sandalwood Family)					
Santalum ellipticum Gaud.	‘iliahi alo‘e	endemic		rare	uncommon
SAPINDACEAE (Soapberry Family)					
Dodonaea viscosa Jacq.	‘a‘ali‘i	indigenous	uncommon	uncommon	uncommon
SOLANACEAE (Nightshade Family)					
Solanum lycopersicum L.	Cherry tomato	non-native	rare	absent	rare
THYMELAEACEAE (‘Akia Family)					
Wikstroemia oahuensis (A.Gray) Rock.	‘akia	endemic	rare	rare	uncommon
VERBENACEAE (Verbena Family)					
Lantana camara L.	lantana	non-native	uncommon	uncommon	rare
Stachytarpheta jamaicensis (L.) Vahl	Jamaica vervain	non-native	common	absent	uncommon
Verbena littoralis Kunth.	‘owi	non-native		rare	absent
Source: Hobdy, October 2006, January 2009, August 2009					

In January 2009, Hobdy conducted a second survey of the Alternative 2 project area to document re-growth following the 2006 wildfire. He detected a total of 86 plant species, 20 of which are endemic or indigenous (see Table 3.4). All of the endemic and indigenous plants detected were present in either similar or higher numbers than observed in 2006, with the sole exception of orange naupaka (*Scaevola gaudichaudii*), which was detected in low numbers in 2006 but was absent in 2009. As with the 2006 survey, none of the species detected in 2009 are classified as threatened or endangered or are candidates for such status. A copy of the full report is included in Appendix A.

3.7 AVIAN AND TERRESTRIAL FAUNA

The mixed grassland/shrubland vegetation on both site alternatives is habitat for several mammals as well as for endemic, indigenous, and migratory birds. The mammals include mice (*Mus musculus*), rats (*Rattus* sp.), mongooses (*Herpestes auropunctatus*), feral cats (*Felis silvestris*), Axis deer (*Cervus axis*), and feral dogs (*Canis lupus*). No federally listed species of snails were found in a recent molluscan survey of the area (Severns 2009) (see Section 3.7.2.4).

As discussed below, the bird species are more varied. They include many that are not protected, as well as some that are protected by Federal and/or State Endangered Species laws and regulations or that are covered by the Migratory Bird Treaty Act (MBTA).

3.7.1 MBTA PROTECTED AND NON-PROTECTED SPECIES

Several ornithological surveys were conducted at Kaheawa when development of a wind farm at Kaheawa Pastures was first being considered (Nishibayashi 1997, 1998). The purpose of those surveys was to identify the avian species present and to assess the potential for wind power development to impact them negatively. The non-ESA protected bird species observed during one or more of these surveys are listed in Table 3.5. One, the Hawaiian short-eared owl or pueo, is protected on the island of O‘ahu by the State of Hawai‘i under its endangered species legislation, but it is not considered endangered or threatened on Maui. The Hawaiian short-eared owl is protected under the MBTA. Other native species protected by the MBTA include the Pacific golden-plover (*Pluvialis fulva*) and white-tailed tropic bird (*Phaethon lepturus dorotheae*).

Table 3.5 MBTA Protected and Non-Protected Avian Species Identified in the Project Area

Common Name	*Scientific Name*	*Status*
Black Francolin	*Francolinus francolinus*	None
Barn Owl	*Tyto alba*	MBTA
Eurasian Skylark	*Alauda arvensis*	MBTA
Common Myna	*Acridotheres tristis*	None
Gray Francolin	*Francolinus pondicerianus*	None
House Finch	*Carpodacus mexicanus*	MBTA
Hawaiian Short-eared Owl (Pu‘eo)	*Asio flammeus sandwichensis*	MBTA, HI Species of Concern (informal)
Northern Cardinal	*Cardiinalis cardinalis*	MBTA
Nutmeg Manikin	*Lonchura punctulata*	None
Pacific Golden Plover (Kolea)	*Pluvialis fulva*	MBTA
Ring-Necked Pheasant	*Phasianus colchicus*	None
Spotted Dove	*Streptopelia chinensis*	None
White-tailed Tropic Bird	*Phaethon lepturus dorotheae*	MBTA
Zebra Dove (or Barred Ground Dove)	*Geopelia striata*	None

Source: Compiled by Planning Solutions, Inc.

The native white-tailed tropicbird (*Phaethon lepturus*), is sometimes seen in the area but usually remains associated with the deep gulches adjacent to the sites. This species is known to nest in steep valley faces and canyon walls which are common features in nearby Ukumehame, Manawainui, and Malalowaiaole Gulches. Finally, one migratory species, the Pacific golden-plover (*Pluvialis fulva*), is present from late August to May.

3.7.2 ESA PROTECTED SPECIES

Surveys conducted in support of the development of KWP I made it clear that at least two, and probably three threatened and endangered bird species were present in the area, and extensive surveys were conducted to establish baseline numbers for these species. They include the endangered Hawaiian Petrel (*Pterodroma sandwichensis*), the threatened Newell's Shearwater (*Puffinus auricularis newelli*), and the endangered nēnē (*Branta sandvicensis*). One listed mammal was also suspected, and later confirmed in the area - the endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) (Cooper & Day 1999, 2004a, 2009).

Once it was determined that the KWP I facilities had the potential to affect these listed species, its owner prepared, and is now implementing, a Habitat Conservation Plan (HCP) for the project. The HCP serves as the basis for the incidental take permit (ITP) from the U.S. Fish and Wildlife Service and the incidental take license (ITL) from the State of Hawaiʻi Department of Land and Natural Resources under which the existing WTGs are operating.[21] The following sections provide additional information about the four listed species that are present.

3.7.2.1 Hawaiian Petrel & Newell's Shearwater

3.7.2.1.1 Biology

Hawaiian Petrel. The endangered Hawaiian Petrel was once abundant on all main Hawaiian islands except Niʻihau (Mitchell et al. 2005). The population was most recently estimated to be approximately 20,000, with 4,000 to 5,000 breeding pairs (Mitchell *et al*. 2005). Today, Hawaiian petrels continue to breed in high-elevation colonies on Maui, Hawaiʻi, Kauaʻi and Lānaʻi (Richardson and Woodside 1954, Simons and Hodges 1998, Telfer et al. 1987, DOFAW unpublished data 2006, 2007). Radar studies conducted in 2002 also suggest that breeding may occur on Molokaʻi (Day and Cooper 2002). Breeding is no longer thought to occur on Oʻahu (Harrison 1990).

Survey work at a recently re-discovered Hawaiian petrel colony on Lanaʻi, that had been previously thought to be extirpated, indicates that thousands of birds are present, rather than hundreds of birds as first surmised, and that the size of the breeding colony approaches that at Haleakalā, Maui, where as many as 1,000 pairs have been thought to nest annually (Mitchell *et al*. 2005, Tetra Tech EC, Inc., June 2008). Radar counts of petrels on the perimeter of Maui and recent colony detections by KWP researchers suggest that the Maui population may be much higher than the 1,000 pairs previously estimated but did not attempt to give an exact estimate (Cooper and Day 2003).

Hawaiian Petrels are nocturnal and subsist primarily on squid, fish, and crustaceans that predatory fish and other factors bring near the sea surface. Unlike shearwaters, Hawaiian Petrels are not known to dive or swim below the surface (Pitman 1986). Foraging may take place thousands of miles from their home islands during both breeding and non-breeding seasons (Spear et al. 1995). In fact, recent studies conducted using satellites and transmitters attached to breeding Hawaiian Petrels have shown that they can range across more than 6,200 miles during two-week foraging expeditions (Adams 2008).

[21] The term "incidental take" refers to harm that is caused to a threatened or endangered species that is incidental to an otherwise lawful activity. Thus, for example, it is possible to obtain a permit that allows one to accidentally harm a member of the species while one is driving a tractor or automobile as part of one's work but it is not possible to obtain a permit that would allow one to hunt a listed species for food.

Adult members of the species are active in their nesting colonies for about eight months each year. The birds are long-lived (ca. 30 years) and return to the same nesting burrows each year between March and April. Present-day Hawaiian petrel colonies are typically located at elevations above 2,500 meters (8,200 ft). The types of habitats used for nesting are very diverse and range from xeric habitats with little or no vegetation, such as at Haleakalā National Park on Maui, to wet forests dominated by ʻōhiʻa with uluhe understory as those found on Kauaʻi (Mitchell et al. 2005). Females lay only 1 egg per year, which is incubated alternately by both parents for approximately 55 days. Eggs hatch in June or July, after which both adults spend their time flying to sea to feed themselves and to collect food which they provide for the nestling. The fledged young depart for sea in October and November. Adult birds do not breed until age six and may not breed every year, but pre-breeding and non-breeding birds nevertheless return to the colony each year to socialize.

Newell's Shearwater. The Newell's Shearwater is an endemic Hawaiian sub-species of the nominate species, the Townsend's shearwater (*Puffinus a. auricularis*) of the eastern Pacific. The Newell's Shearwater is considered "Highly Imperiled" in the Regional Seabird Conservation Plan (USFWS 2005b) and the North American Waterbird Conservation Plan (Kushlan et al. 2002). Species identified as "Highly Imperiled" have suffered significant population declines and have either low populations or experience some other high risk factor. The most recent population estimate of Newell's Shearwater was approximately 84,000 birds, with a possible range of 57,000 to 115,000 birds (Ainley et al. 1997). Radar studies on Kauaʻi showed a 63 percent decrease in detections of shearwaters between 1993 and 2001 (Day et al. 2003a). Declines in Newell's Shearwater populations are attributed to loss of nesting habitat, predation by introduced mammals (mongoose, feral cats, rats, and feral pigs) at nesting sites, and fallout of juvenile birds associated with disorientation from urban lighting (Ainley et al. 1997, Mitchell et al. 2005, Hays and Conant 2007).

Newell's Shearwaters nest on several of the main Hawaiian Islands, with the largest numbers occurring on Kauaʻi (Telfer et al. 1987, Day and Cooper 1995, Ainley et al. 1995, 1997b, Day et al. 2003b). These birds also nest on Hawaiʻi (Reynolds and Richotte 1997, Reynolds et al. 1997, Day et al. 2003a) and almost certainly nest on Molokaʻi (Pratt 1988, Day and Cooper 2002). Recent radar studies suggest the species may also nest on Oʻahu (Day and Cooper 2008). On Maui, radar studies and visual and auditory surveys conducted over the past decade suggest that one or more small breeding colonies of Newell's Shearwaters are present in the West Maui Mountains ~9 miles north of the KWP I and II project areas in the upper portions of Kahakuloa Valley (G. Spencer, pers. comm.). Newell's Shearwaters typically nest on steep slopes that are vegetated by uluhe fern (*Dicranopteris linearis*) undergrowth and scattered ʻōhia trees (*Metrosideros polymorpha*). The birds nest in short burrows excavated into crumbly volcanic rock and ground, usually under dense vegetation and at the base of trees.

A single egg is laid in the burrow and one adult bird remains on the egg while the second adult goes to sea to feed. Once the chick has hatched and is large enough to withstand the cool temperatures of the mountains, both parents will go to sea to provide the growing chick with a continuous supply of food. Newell's Shearwaters arrive at and leave their burrows during darkness and birds are seldom seen near land during daylight hours. During the day adults remain either in their burrows or at sea some distance from land.

First breeding occurs at approximately six years of age, after which breeding pairs produce one egg per year. A high rate of non-breeding is found among experienced adults that occupy breeding colonies during the summer breeding season, similar to some other seabird species (Ainley et al. 2001). No specific data exist on longevity for this species, but other shearwaters may reach 30 years of age or more (see for example Bradley et al. 1989, del Hoyo et al. 1992). The Newell's Shearwater breeding season begins in April, when birds return to prospect for nest sites. A pre-laying exodus follows in late April and possibly May; egg-laying begins in the first two weeks of June and likely continues through the early part of July. The average incubation period is thought to be approximately 51 days (Telfer 1986). The fledging period is approximately 90 days, and most

fledging takes place in October and November, with a few birds still fledging into December (SOS Data).

3.7.2.1.2 Seabird Occurrence in the Project Area

ABR Inc. conducted radar and night-visual observations over the existing wind farm and Alternative 2 project areas in summer 1999, and the Summer and Fall of both 2004 and 2008 (Cooper and Day 2004a and 2004b, Sanzenbacher and Cooper 2009). An additional study of the Preferred Alternative site was conducted in Summer 2009 (Cooper and Day 2009), and Fall 2009 (Cooper and Sanzenbacher in prep). The goal of the latter surveys was to obtain estimates of seabird movement rates during evening inland and pre-dawn seaward flight periods over the areas being considered for the KWP II project, and to observe any changes in flight behavior, such as alterations in flight trajectory, that might be evident as seabirds approached and passed through the area.

Movement rates and other observations on seabird occurrence in the Preferred Alternative and the Alternative 2 sites are summarized below:

Preferred Site: ABR, Inc. conducted radar and night-visual observations in July and October 2009 to document passage rates of seabirds over the Preferred Alternative site during the nesting season. Based on the results of the July survey, ABR, Inc. estimated that 6.3 Hawaiian petrel/night passed through the approximately 1.9 miles (3 km) circular airspace they surveyed for the entire Spring/Summer season. The passage rate over the Preferred Alternative site in October 2009 (i.e., during the Fall fledging season) was estimated at 4.12 birds/night. As noted by Simons (1985), visitation rates by adults to feed their chicks decline as much as 80 percent in the last quarter of the nesting period.

Spring/Summer and Fall passage rates of seabirds (Hawaiian petrels and Newell's shearwaters combined) at the Preferred Site are within the range of variability of passage rates observed upslope at KWP I during surveys that have been conducted over the last ten years. Moreover, they are generally lower than the mean rate Cooper and Day (2003) measured for West Maui (8.7 ± 3.9 targets/hr) and for East Maui (52.8 ±16.6 targets/hr). These seabird passage rates are only 2.5 percent (i.e., one-fortieth) the mean passage rate (131 ± 35 targets/hour) that Day and Cooper (2001) measured on Kaua'i (KWP II Draft HCP, 2009).

Alternative 2 Site:

- Combined results of the 1999 and 2004 surveys by ABR Inc, resulted in an estimated passage rate of 160 Hawaiian petrels and 105 Newell's shearwaters per year over the KWP I and Alternative 2 sites (Cooper and Day 2004a and 2004b). This is a little less than half the 348 Hawaiian petrels/ 193 Newell's shearwaters that Sanzenbacher and Cooper (2009) estimated based from the 2008 survey, at (Sanzenbacher and Cooper 2009). The 2006 survey by KWP biologists did not differentiate between Hawaiian petrels and Newell's shearwaters. The passage rate of all seabirds in the Summer of 2006 was twice that reported by Cooper and Day (2004a, 2004b) from the 1999 and 2004 data. However, the Fall passage rate of targets in 2006 was only 17 percent of the Fall passage rates measured in 2004.
- Only the results of the 2008 survey were used to characterize movement rates of seabirds over the Alternative 2 area.
- Hawaiian petrel and Newell's shearwater targets combined represent less than 6.5 percent of the lowest mean movement rate recorded at any of the 18 sites sampled on Kaua'i during the summers of 1993 to 2001 (Day and Cooper 2001).

The cumulative research conducted in the project area confirms that movement rates of Newell's Shearwaters and Hawaiian Petrels in the Kaheawa Pastures area are relatively low compared to other areas of Maui (Day and Cooper 1995, 2001, 2003). In the most recent and extensive survey, Sanzenbacher & Cooper (2009) estimate that ~348 Hawaiian Petrels and ~193 Newell's Shearwaters

pass over the radar sampling area annually. They used data on flights at nearby Ukumehame contained in Cooper and Day (2003) to estimate the proportions of targets that were Hawaiian Petrels (60 percent) and those that were Newell's Shearwaters (40 percent).

3.7.2.2 Nēnē (Hawaiian Goose)

3.7.2.2.1 Nēnē Biology

The nēnē is adapted to a terrestrial and largely non-migratory lifestyle in the Hawaiian Islands with negligible dependence on freshwater habitat. Compared to the related Canada goose (*Branta canadensis*), nēnē wings are reduced by about 16 percent in size and their flight capability is comparatively weak. Nonetheless, nēnē are capable of both inter-island and high altitude flight (Miller 1937; Banko et al. 1999). Nēnē occupy various habitat types ranging from beach strand, shrubland, and grassland to lava rock, and elevations ranging from coastal lowlands to alpine areas (Banko 1988; Banko et al. 1999). The geese eat plant material, and the composition of their diet depends largely on the vegetative composition of their surroundings. They appear to be opportunistic in their choice of food plant as long as they meet nutritional demands (Banko et al. 1999; Woog and Black 2001).

The nēnē has an extended breeding season with eggs reported from all months except May, June, and July, although the majority of birds in the wild nest during the rainy (winter) season between October and March (Banko et al. 1999, Kear and Berger 1980). Nēnē nest on the ground in a shallow scrape in the dense shade of a shrub or other vegetation. A clutch typically contains three to five eggs, and incubation lasts for 29 to 31 days. The female incubates the eggs, with the male standing guard nearby, often from an elevated location. Once hatched, the young remain in the nest for 1 to 2 days (Banko et al. 1999). Fledging of captive birds occurs at 10 to 12 weeks, but may occur later in the wild. During molt, adults are flightless for a period of 4 to 6 weeks. Molt occurs after hatching, such that the adults generally regain their flight feathers at about the same time as their offspring. When flightless, goslings and adults are extremely vulnerable to predators such as dogs, cats, and mongoose. From June to September, family groups join others in post-breeding aggregations (flocks), often far from nesting areas.

Currently, there are wild populations nēnē on Hawai‘i, Maui and Kaua‘i composed of an estimated 421, 444, and 829 individuals, respectively (USFWS 2004a). After nearly becoming extinct in the 1940s and 1950s, this species' population slowly has been rebuilt through captive-breeding programs. As a result of such programs, the nēnē has been re-introduced onto four of the main Hawaiian islands (Kaua‘i, Maui, Moloka‘i, and Hawai‘i). The primary release site on Maui is located at Haleakalā National Park on East Maui, where 511 nēnē ere released between 1962 and 2003.

Since 1995, the majority of Maui releases have been from a release pen in the Hana‘ula in the region of West Maui in an effort to establish a second population on Maui on this part of the island (F. Duvall, Maui DOFAW, pers. comm.). This pen is located near the upper end of the Kaheawa Pastures project site. Since 1994, 104 nēnē have been released at Hana‘ula, compared with 18 at Haleakalā (USFWS 2004a). KWP I is currently working with Maui DOFAW and USFWS to establish a new nēnē release pen on land owned by Haleakalā Ranch in East Maui. If approved nēnē will be released from this pen (total release numbers to be determined) for a period of 10 to 20 years in fulfillment of the KWP I HCP mitigation program for nēnē.

Little is known about the exact distribution and movements of the birds released at the Hana‘ula release pen near the project site, although they have been recorded as far west as Lahaina and as far east as Haleakalā National Park, indicating that at least some birds from this release site move extensively around the island (J. Medeiros, Maui DOFAW, pers. comm.).

3.7.2.2.2 Nēnē Occurrence in the Project Area

The Hana‘ula release pen is located near the upper end of the existing KWP I project area approximately 1,800 feet from the nearest existing WTGs. A number of nēnē from the Hana‘ula release site have remained as residents within or near the KWP I project area; in 1998, four goslings

were successfully fledged from the first nest reported in the area since reintroduction began (DOFAW 2000). Nēnē presence and nesting behavior has been regularly monitored in the project area prior to and after commencing operation of KWP I.

Biologists monitoring nēnē in the vicinity of the existing wind farm have found that many nēnē transiting the site fly in an east-west direction. This is essentially perpendicular to the proposed north-south turbine layouts and not surprising given the location of the Hanaʻula nēnē release pen to the west and other favorable habitat to the east of Kaheawa Pastures. Nēnē were observed transiting near the existing wind farm during 17 (one-third) of the 53 surveys conducted between June 2006 and June 2007.

Nesting has been observed in the vicinity of the existing KWP I turbines since the facility commenced operation. One successful nest was discovered in 2007 about 330 feet to the west of WTG-15 while another pair was observed using a nearby nest site in 2008. Spencer (2008, personal communication) reported that most nesting activity is observed well to the west and southwest of the KWP I area. No nesting has been observed near the area on which WTGs would be developed for the Preferred Alternative. While nesting has not been observed in the area where the Alternative 2 WTGs are sited, its greater proximity to the existing (KWP I) WTGs, where nēnē nesting has been observed, suggests that the probability of some nesting occurring there may be greater.

Nēnē commonly use both areas that are under consideration for the WTGs for shelter and for browsing. However, fewer nēnē are seen near the Preferred Alternative area in comparison to the Alternative 2 site (Spencer personal communication). The nēnē population in this region is monitored closely under the existing HCP and survey effort is now well coordinated between DOFAW and KWP I biologists.

Data that KWP I biologists have collected during the incidental surveys conducted as part of a wildlife education and observation program (WEOP) (December 2006 – June 2009), have provided information about nēnē distribution and behavior in the area. Monitoring of nēnē during the construction period of KWP I (January to June 2006) also documented nēnē use of the Preferred Alternative and Alternative 2 areas. Both these data sets combined provide over 800 observations (n = 820 individuals) on nēnē distribution and span over three and a half years. Results show that nēnē are seen almost twice as frequently (n = 532 individuals) at the higher elevations where the KWP I and adjacent Alternative 2 sites are located than they are in the Preferred Alternative area (n = 288). Most of the observations of nēnē at the Preferred Alternative area are at the upper elevations near the Pali Trail Junction (Mile Marker 1.75) and the MECO tower (Mile Marker 2.25). At the KWP I area, nēnē are most frequently observed between turbines 7 and 12.

3.7.2.3 Hawaiian Hoary Bat

3.7.2.3.1 Hoary Bat Biology

The Hawaiian Hoary Bat is the only extant native terrestrial mammal from the Hawaiian archipelago (USFWS 1998). Little is known about its biology, distribution, or habitat use in the Hawaiian Islands, beyond the fact that it is an insectivorous bat that roosts solitarily in tree foliage. This subspecies has been recorded between sea level and approximately 9,050 feet in elevation on Maui, with most records occurring at approximately 2,060 feet (USFWS 1998). The Hawaiian Hoary Bat has been recorded on Kauaʻi, Oʻahu, Molokaʻi, Maui, Lānaʻi, and Hawaiʻi and is thought to be present in low numbers on Maui. Population estimates for the state of Hawaiʻi in the recent past have ranged from hundreds to a few thousand bats (Menard 2001). However, monitoring currently underway on the Island of Hawaiʻi suggests that the population could be as high as a hundred thousand bats on that island alone (Bonaccorso personal communication, February 5, 2009).

Hawaiian Hoary Bats roost in native and non-native vegetation from 3 to 30 feet above ground level. They have been observed roosting in ʻōhiʻa, hala (*Pandanus tectorius*), coconut palms (*Cocos nucifera*), kukui (*Aleurites moluccana*), kiawe (*Proscopis pallida*), avocado (*Persea americana*),

mango (*Mangifera indica*), shower trees (*Cassia javanica*), pūkiawe (*Styphelia tameiameiae*), and fern clumps; they are also suspected to roost in eucalyptus (Eucalyptus spp.) and Sugi pine (*Cryptomeria japonica*) stands. The species is rarely observed using lava tubes, cracks in rocks, or man-made structures for roosting. While roosting during the day, Hawaiian Hoary Bats are solitary, although mothers and pups roost together (USFWS 1998).

It is thought that breeding occurs primarily between April and August. Breeding has only been documented on the islands of Hawai‘i and Kaua‘i (Baldwin 1950, Kepler and Scott 1990, Menard 2001). It is not known whether bats observed on other islands breed locally or only visit these islands during non-breeding periods. Seasonal changes in the abundance of Hawaiian Hoary Bat at different elevations indicate that altitudinal migrations occur on the island of Hawai‘i. During the breeding period, Hawaiian Hoary Bat occurrences increase in the lowlands and decrease at high elevation habitats. Hawaiian Hoary Bat occurrences are especially low from June until August in high elevation areas. In the winter, especially during the post-lactation period in October, bat occurrences increase in high elevation areas and in the central highlands, possibly receiving bats from the lowlands (Menard 2001).

Hawaiian Hoary Bats feed on a variety of native and non-native night-flying insects, including moths, beetles, crickets, mosquitoes, and termites (Whitaker and Tomich 1983). They appear to prefer moths ranging between 0.60 and 0.89 inches in size (Bellwood and Fullard 1984, Fullard 2001). Prey is located using echolocation. Water courses and edges (e.g., coastlines and forest/pasture boundaries) appear to be important foraging areas. In addition, the species is attracted to insects that congregate near lights (USFWS 1998, Mitchell et al. 2005). They begin foraging either just before or after sunset depending on the time of year (USFWS 1998, Mitchell et al. 2005).

3.7.2.3.2 Hoary Bat Occurrence on Maui and in the Project Area

On Maui, this bat is believed to occur primarily in moist, forested areas, although little is known about its exact distribution and habitat use on the island, especially in the West Maui Mountains. No Hawaiian Hoary Bats were recorded in the area of the existing or proposed wind turbines during nighttime visual studies using night vision equipment conducted in Summer 1999 (Day and Cooper 1999) or Fall 2004 (Cooper and Day 2004a). While Hawaiian Hoary Bats occur from sea level to elevations far higher than the KWP II site (Menard 2001; Fraser et al. 2007), they are not expected to breed or roost in the project area due to the lack of trees in the grassland-dominated landscape. Instead, while bats (including volent juveniles) are likely to be present, it would be for foraging only.

Since the HCP for KWP I was approved and the existing facilities began operation in the Summer of 2006, KWP I has carried out regular bat monitoring in accordance with the provisions of its HCP. Over the past year, KWP II monitored at the Preferred Alternative and Alternative 2 sites as well. The results of these observations, which are summarized below, confirm that the number of foraging bats is low.

Visual Surveys for Flying Bats. No Hawaiian hoary bats were recorded during nighttime visual studies using night vision equipment conducted in Summer 1999 (Day and Cooper 1999) or Fall 2004 (Cooper and Day 2004a). In accordance with the provisions of the KWP I HCP, KWP biologists carried out regular crepuscular and nocturnal IR-enhanced visual surveys aimed at recording bat presence and activity at Kaheawa Pastures from June 2006 through June 2007. During this period, biologists performed 32 surveys totaling nearly 116 hours of observation effort in and around the KWP I site and adjacent countryside. Significant portions of the site were surveyed during winter and spring seasons and under a range of weather and survey conditions. Though there often appeared to be abundant aerial insect prey and favorable wind conditions for flight, no positive observations of Hawaiian Hoary Bats were made during either survey period (KWP, LLC. 2007a & b, 2008a).

Ground Searches for Downed Bats. KWP I biologists also look for bats as part of their year-round ground searches aimed at documenting all downed (i.e., injured or dead) covered species in the project area. On October 3, 2008, a single dead bat was found near WTG 8. Injuries to the bat

suggested it had died of physical trauma, presumably having been hit by a blade or collided with the tower. This is the only observed bat fatality associated with the KWP I project as of November 5, 2009.

Acoustic Monitoring of Bat Activity. Since August 2008, four to eight Anabat detectors (Titley Electronics, NSW, Australia) have been deployed at various locations in the project area (KWP I LLC 2008, 2009). These detectors record ultrasonic sounds, which are then analyzed using Analook® computer software to determine whether echolocation calls made by bats were recorded. Bat call sequences were detected only from April through November; no calls were recorded between December and March (see Table 3.6).

Nineteen confirmed bat passes were recorded by the four detectors over the sampling period (see "qualifying bat passes" in Table 3.6). This equates to a detection rate of 0.010 pass per detector per night (19 bat passes in 1,997 detector-nights). This is less than one-fiftieth (2 percent) of the detection rates measured during a study being conducted by the USGS at Hakalau National Wildlife Refuge on the Island of Hawai‘i (0.66 calls/detector/night) (Bonaccorso, unpub. 2008).

3.7.2.4 Other Wildlife

Severns (2009a, 2009b) estimates that over 1,300 species and subspecies of endemic land snails have been recorded in Hawai‘i representing 7 widespread Indo-Pacific families. The preferred habitat of snail species identified by Severns (2009a) that could still occur or may once have occurred in the area or vicinity of Kaheawa Pastures are a moist environment beneath rocks and talus in gulches at lower elevations; in the leaf litter beneath trees and shrubs; in mosses growing on trees and rocks; and beneath thick understory such as uluhe fern at mid-elevations. He concludes that native Hawaiians appear to have had very little effect on the land snail fauna but found that the ranching, large-scale agriculture, and other commerce that began immediately following the arrival of the first Europeans has had a major effect on this component of Hawaiian fauna. He reports that perhaps 90 percent of the known Hawaiian snail fauna is now extinct or is in imminent danger of extinction.

His 2009 surveys of the project area were aimed at determining if any species of native Hawaiian snails (particularly those listed as threatened, endangered, or of substantial conservation concern) are present and, if so, to identify them and to try to determine their habitat. The survey methodology entailed searching tree leaves, bark, grasses, and rock talus for living and dead snails and screening soil, mosses and leaf litter samples for living and dead snails to 1 mm in diameter. In addition, Severns also searched exposed ground in gulches and road cuts for fresh and dead shells. Together, these are the habitats where he felt the snails were most likely to be found. He did not find any federally listed species of snails at either of the two areas being considered for the proposed project.

***Preferred Alternative Site*:** Severns (September 2009) found two native species of snails in this area. The Succinid *Succinea mauiensis* is present throughout this area within undisturbed rock outcroppings where it attaches to the moist undersides of closely-packed rocks or in the root mat of grasses beneath the rocks. It was not found beneath the loose surface rocks which litter the pasture but have no root mat. This species is known to have a wide range in dry habitat on East and West Maui. The *S. mauiensis* present in the survey area were uncommon in the pasture compared to the upper edges of the gulches. In addition to the Succinid, Severns discovered an undescribed species of Vertiginidae of the genus Nesopupa in similar habitat; it was seen in only one location along the upper edge of Malalowaia‘ole Gulch, in an area not scheduled to be developed.

Table 3.6 Results of Acoustical Bat Monitoring

Summary of Bat Detector Survey Data - West Maui Mountains, Fall 2008 to Summer 2009						
Detector	***Location***	***Survey Dates****	***Detector Operating-Nights*****	***Number of Call Sequence Files***	***Qualifying Bat Passes******	***Detection Rate (passes/detector-night)***
Unit F	Alt. 2	Aug 8 – Nov 14	81	3	2	0.025
Unit H	KWP I	Aug 8 – Nov 14	99	7	3	0.030
Unit I	KWP I	Aug 8 – Nov 14	99	4	2	0.020
Unit J	Alt. 2	Aug 8 – Nov 14	99	1	0	0
Unit G	KWP I	Nov 12 - Apr 8	147	0	0	0
Unit H	KWP I	Nov 12 – Apr 15	154	0	0	0
Unit I	KWP I	Nov 12 – Apr 15	154	0	0	0
Unit J	KWP I	Nov 12 – Jan 1 Mar 4 – Apr 5	88	0	0	0
Unit G	KWP I	Apr 28 – Jun 30	75	0	0	0
Unit H	KWP I	Apr 17 – Jun 30	86	1	1	0.012
Unit I	Alt. 2	Apr 17 – Jun 30	86	0	0	0
Unit J	KWP I	Apr 28 – Jun 30	75	0	0	0
Unit K	KWP I	Jun 2 – Jun 30	28	0	0	0
Unit L	Preferred	Jun 2 – Jun 30	28	0	0	0
Unit M	Preferred	Jun 2 – Jun 30	28	0	0	0
Unit N	Alt. 2	Jun 2 – Jun 30	28	0	0	0
Unit G	KWP I	Jun 30 – Sept 23	85	0	0	0
Unit H	KWP I	Jun 30 – Sept 23	85	7	7	0.082
Unit I	Alt. 2	Jun 30 – Sept 4	66	0	0	0
Unit J	KWP I	Jun 30 – Sept 23	85	1	1	0.012
Unit K	KWP I	Jun 30 – Sept 23	85	0	0	0
Unit L	Preferred	Jun 30 – Sept 23	85	3	3	0.035
Unit M	Preferred	Jun 30 – Sept 23	85	0	0	0
Unit N	Alt. 2	Jun 30 – Sept 23	66	0	0	0
		Subtotal KWP I	1,345	20	14	0.156
		Subtotal Preferred Alternative	226	3	3	0.035
		Subtotal Alternative 2	426	4	2	0.025
		Overall Total	1,997	27	19	0.010

* Bat detector surveys are ongoing. Results here reflect all data recorded and analyzed through September 23, 2009.

**A detector night is equivalent to one detector operating for one night.

*** "Qualifying Bat Passes" represent recorded call sequence files that conform to data quality standards (such as number of call pulses and signal strength) commonly used to report detector data. As such, those call sequence files that do not conform to those standards are not included in the calculation of Detection Rates. Detection rates using "passes" provides a data set more comparable with other studies.

Source: Spencer (2009 pers. comm.)

Alternative 2 Site: Severns (January 2009) found no evidence of snails, fossil or extant, native or introduced during his survey of the Alternative 2 site. Moreover, he concluded that the habitat was unsuitable for native snails. As part of his investigation, Severns also searched the collection data for records of subspecies specimens that may have been recorded by early collectors, but found none.[22] The absence of collecting data and specimens from Kaheawa Pastures when data are available for such a nearby location suggests that Kaheawa Pastures was unproductive for snail hunters from at least the early 19th century.

3.8 EXISTING SOUND LEVELS

3.8.1 APPLICABLE SOUND LIMITS

Hawai‘i Administrative Rules §11-46, “Community Noise Control” establishes maximum permissible sound levels (see Table 3.7) and provides for the prevention, control, and abatement of noise pollution in the State from stationary noise sources and from equipment related to agricultural, construction, and industrial activities. The standards are also intended to protect public health and welfare, and to prevent the significant degradation of the environment and quality of life. Note that the limits are applicable at the property line rather than at some pre-determined distance from the sound source.

Because the KWP II site is in the State Conservation District, the Class A limits are applicable. HAR §11-46-7 grants the Director of the Department of Health the authority to issue permits to operate a noise source which emits sound in excess of the maximum permissible levels specified in Table 3.7 if it is in the public interest and subject to any reasonable conditions. Those conditions can include requirements to employ the best available noise control technology.

Table 3.7 Maximum Permissible Sound Levels in dBA

Zoning Districts	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
Class A	55	45
Class B	60	50
Class C	70	70

Table Notes:

(1) Class A zoning districts include all areas equivalent to lands zoned residential, conservation, preservation, public space, open space, or similar type.

(2) Class B zoning districts include all areas equivalent to lands zoned for multi-family dwellings, apartment, business, commercial, hotel, resort, or similar type.

(3) Class C zoning districts include all areas equivalent to lands zoned agriculture, country, industrial, or similar type.

(4) The maximum permissible sound levels apply to any excessive noise source emanating within the specified zoning district, and at any point at or beyond (past) the property line of the premises. Noise levels may exceed the limit up to 10% of the time within any 20-minute period. Higher noise levels are allowed only by permit or variance issued under sections 11-46-7 and 11-46-8.

(5) For mixed zoning districts, the primary land use designation is used to determine the applicable zoning district class and the maximum permissible sound level.

(6) The maximum permissible sound level for impulsive noise is 10 dBA (as measured by the “Fast” meter response) above the maximum permissible sound levels shown.

Source: Hawaii Administrative Rules §11-46, “Community Noise Control”

[22] The nearest location for which there is data for the collection of a snail species is along the ridge overlooking Ukumehame Valley on the trail leading to the reservoirs at Hana‘ula, at a higher elevation, but parallel to the Kaheawa Pastures. There *Partulina fusoidea* was collected and still exists today.

3.8.2 EXISTING SOUND LEVELS

3.8.2.1 Preferred Alternative

Ambient sound measurements were conducted in the Preferred Alternative area in the vicinity of the Lahaina-Pali Trail. As shown in Table 3.8, the ambient sound environment along the hiking trail is dynamic and depends significantly on environmental noises, primarily wind and rain. When wind blows through the landscape, sound from the rustling grass and vegetation dominates the ambient noise environment. During periods of low wind, noise levels drop off significantly.

Secondary sound sources include wind turbine sound, interference due to wind noise, occasional aircraft flyovers, crickets, birds, hikers, and occasional vehicular noise from the access road. There are no dwellings or other noise sensitive buildings near the site.

Table 3.8 Sound Measurement Results at Lahaina-Pali Trail at the Preferred Site

		Daily Avg. Sound Level	*Daily Avg. Sound Level*	*Daily Avg. Day-Night Level*
ID	***Measurement Location***	***Leq (Day)[1]***	***Leq (Night)[2]***	***Ldn[3]***
L1	N20 47.727 W156 32.397	39 – 45 dBA	35 – 46 dBA	42 - 52 dBA
L2	N20 47.783 W156 32.328	37 – 42 dBA	34 – 46 dBA	41 – 53 dBA
L3	N20 47.909 W156 32.348	38 – 53 dBA	37 – 48 dBA	46 - 56 dBA
L4	N20 48.050 W156 32.202	40 – 51 dBA	36 – 43 dBA	45 - 52 dBA

1. Leq(day) is an average of the hourly equivalent sound levels during the daytime hours only (between 7:00 am and 10:00 pm) within a 24-hour measurement period. The range represents the quietest and noisiest day measured within the 7 day measurement period.
2. Leq(night) is an average of the hourly equivalent sound levels during the nighttime hours only (between 10:00 pm and 7:00 am) within a 24-hour measurement period. The range represents the quietest and noisiest night measured within the 7 day measurement period.
3. The Ldn represents the lowest and highest calculated average day-night level from the 7 day measurement period.

Source: Adams, D.L. & Associates, March 27, 2009, Table 2.

3.8.2.2 Alternative 2

There are several ambient sound sources in the Alternative 2 project area.[23] These include the turbines at the existing KWP I facility, vehicles traveling along the facility access road, rain, wind blowing through low brush and grass, crickets, birds, and mammals. The wind turbines do not operate at wind speeds below three meters per second (6.7 mph). Thus, during periods of light or calm winds at hub height, sound level emissions from the wind farm are virtually non-existent. Table 3.9 presents the results of sound measurements made at the base of one of the KWP I turbines in September 2006 during a period of low wind speed. It is not meant to represent sound levels under a full range of operating conditions.

[23]Undesirable sound is generally referred to as noise; however, the terms sound and noise are commonly used interchangeably. The effects of sound depend on its frequency (or pitch), decibel level, and duration, particularly in relationship to changes in existing sound levels.

Table 3.9 Baseline Sound Levels in dBA at the Base of an Existing WTG at KWP I Site

Station Description	*Baseline Sound Levels in dBA*[1]		
Existing KWP I Site at the Base of a Turbine	***Leq***[2]	***MaxP***[3]	***MaxL***[4]
	47.5	99.8	69.1

[1] A person's ability to hear a sound depends greatly on its frequency. People hear sounds best when the predominant sound energy is between 1,000 and 6,000 Hz. To measure sound on a scale that reflects the way people perceive it, more weight must be given to the frequencies that people hear more easily. The U.S. EPA recommends the A-weighting scale for environmental noise.

[2] Equivalent Sound Level (Leq). This variable is the root-mean square (RMS) average of the time-varying sound energy measured during the 10-minute measurement interval. Leq correlates reasonably well with the effects of noise on people, even for wide variations in environmental sound levels and time patterns.

[3] Maximum Peak Level (MaxP). This is the instantaneous maximum sound level measured.

[4] Maximum Sound Level (MaxL). This is the maximum sound level (1-second integrated value) recorded.

Source: Planning Solutions, Inc. Sound levels recorded over a ten-minute period on September 6, 2006 set to integrate data every second using the A-weighting scheme.

3.9 ARCHAEOLOGICAL, HISTORIC, AND CULTURAL RESOURCES

3.9.1 PRE-HISTORIC AND HISTORIC LAND USES IN THE PROJECT AREA

3.9.1.1 Ukumehame Ahupuaʻa

The project area is located at the upper reaches of the traditional land area of Ukumehame, the easternmost *ahupuaʻa* in the district of Lahaina. The *ahupuaʻa* includes Ukumehame valley, a steep mountainous area, and several inter-valley tablelands (Rechtman *et al*., October 2009). Archaeological evidence compiled in reports that are reproduced in Appendix B shows that taro was formerly cultivated in irrigated fields on the lowland plains and gulch bottom.

Because there was no reliable source of water, traditional wetland taro cultivation was not possible on the ridges or upland tablelands, such as the present-day Kaheawa Pastures area. However, the tablelands may have been a resource area for the collection of native birds and an access route to the higher elevations of the West Maui Mountains (Tomonari-Tuggle 1998). 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. In general, the tablelands and ridges were relatively inhospitable for intensive settlement or agriculture because of their steep and rugged terrain, lack of water sources, and limited access to the ocean. Similarly, although coastal trails once ringed much of Maui, no coastal trail was present fronting the KWP II project area because of the rough terrain, so "from Olowalu [to the west of the current project area] travelers were ferried by canoe to Māʻalaea [to the east of the current project area], thence to Mākena" (Handy et al. 1991).

By the 1850s, portions of Ukumehame *ahupuaʻa* were being leased for various enterprises, primarily cattle ranching (Tomonari-Tuggle 1998). In 1886, the western half of Ukumehame *ahupuaʻa* was listed as being leased to Olowalu Plantation Company, for sugarcane cultivation and sugar production, and the eastern half (including the KWP II project area) was listed as leased to John Richardson and Kahahawai for cattle ranching (Clark & Rechtman 2006). The same authors report that cattle ranching continued in the area until the mid-1990s, while lower portions of the wetter, western half of Ukumehame *ahupuaʻa* continued to be used for sugarcane cultivation.

3.9.1.2 Kaheawa Pastures

Clark and Rechtman (2006) synthesized information from archival resources and archaeological studies conducted in the project area in preparing their summary of prehistoric and historic uses of the

entire Kaheawa Pastures area (extending from above the proposed KWP II site down to the coast). They concluded that pre-contact use of the project area centered on coastal habitation and the exploitation of marine resources.

Devereux et al. (1999) described a network of trails that may once have connected the coastal habitation area with inland resource areas. If a pre-contact *mauka/makai* trail route traversed Kaheawa Pastures, then it likely accessed inland resource areas, and may have connected to trails leading to other areas of West Maui. At some point in the mid-1940s the McGregor Point jeep road was bulldozed through the Kaheawa Pastures area, allowing vehicular access to the *mauka* land. This may account for the fact that Clark and Rechtman did not observe evidence of a pre-contact trail during their 2006 survey. Once constructed, the *mauka-makai* road was maintained by ranchers, MECO (for construction and maintenance of the transmission lines that it installed in the 1970s), and the State DLNR, with newer bulldozer routes approximating the older ones. Portions of the road were subsequently improved as part of the construction of KWP I. Athens (2002) reported that trails likely ran to Site 5232, an inland *heiau* located on Pu‘u Luau, in late pre-contact times. He conjectured that isolated marine shell fragments and an adze fragment observed in the area may have been dropped along such a trail route leading to or from the *heiau*.

Historic-period sites in the vicinity of Kaheawa Pastures far outnumber those dated to the pre-contact period. The majority of these were relatively close to the old Honoapi‘ilani Highway alignment. The date (1908) embedded in concrete stairs on the ridge to the west of Malalowaiaole Gulch (Site 5654) indicates that the area was being used in the early part of the 20th century. Other features (e.g., a terraced roadbed, a possible privy, and a hoist location) were also located in the area. All of these sites may relate to cattle ranching, which was ongoing in the area from the late 1850s to the early 1990s (Tomonari-Tuggle 1998). The only historic period site recorded close to the existing wind farm facilities is a concrete watering trough constructed in 1943 (Site 5402).

In addition to these sites the Lahaina Pali trail crosses the lower Kaheawa Pastures area, *makai* of the existing and proposed WTGs. This historic-period trail was constructed around 1841 for horse travel between Wailuku and Lahaina. The trail fell into disuse approximately 50 years later with the construction of a carriage road (Site 4696) along the coast (Tomonari-Tuggle and Tuggle 1991). The old trail brought numerous Historic travelers across the lower slopes of the West Maui Mountains, and it continues to bring modern day visitors to the area as part of the Na Ala Hele Statewide Trail and Access System.

3.9.2 ARCHAEOLOGICAL AND HISTORIC FEATURES: PREFERRED ALTERNATIVE

Rechtman *et al*. (October 2009) conducted an archaeological inventory survey of approximately 175-acres of land on and around the Preferred Alternative site, and the statements made in this section are based upon their findings. The survey objective was to create a complete inventory of all archaeological sites and features within the Preferred Alternative area and to provide preliminary evaluations of significance for any recorded sites. Information from that report supplemented data contained in reports of several previous archaeological surveys conducted in the same general area. These included an archaeological survey report (Tomonari-Tuggle and Tuggle 1991) and a cultural resource management plan (Tomonari-Tuggle 1995) that were prepared for the Lahaina Pali Trail, a portion of which crosses through the Preferred Alternative area. An inventory survey was conducted for MECO transmission lines that mark the mauka terminus of the Preferred Alternative, and in inventory survey for the 333 acres for the Alternative 2 site described below.

The archaeological inventory survey of the Preferred Alternative site identified several features in the project area, including the Lahaina Pali Trail (and a possible remnant section of its Mā‘alaea branch trail), the previously recorded Site 5648, along with a concrete water trough (Site 6665). The Lahaina Pali Trail and the Mā‘alaea branch of this trail were constructed in 1841 and remained in use until 1891. It is reasonable to assume that during earlier times other trails accessed this area; however the physical evidence of such trails is no longer observable on the surface. At site 5648, twenty new

features were documented bringing the total number of features at this site to thirty. The features are indicative of temporary habitation and may represent recurrent use shelters associated with trail routes. The use of these features probably dates to both pre-contact and historic times. The most intensive habitation may have been from 1841 to 1891 when the Lahaina Pali Trail and its Mā‘alaea branch were in use. Site 6665 is a concrete water trough that was built on December 14, 1943. This water trough is part of a water system developed by Honoula Ranch in Ukumehame in the 1940s. This system provided water for cattle in the once extensive, but arid pastures of this upland area. Cattle ranching continued in the Preferred Alternative area until the 1990s.

Rechtman *et al*. (October 2009:68) concluded that the Lahaina Pali Trail and the Mā‘alaea branch trail are significant under HAR §13-284-6, Criterion D for the information yielded relative to middle and late nineteenth century transportation patterns and evolving modes of transportation, and recommended that it be preserved. The main trail branch is already governed by a management plan (Tomonari-Tuggle 1995) and it will not be directly impacted by the proposed project. The newly discovered remnant portion of the Mā‘alaea branch trail does not currently provide a link to the main branch of the Lahaina Pali Trail or to Mā‘alaea. Rechtman *et al*. (October 2009:68) recommended that a preservation plan for this site be prepared and submitted to State Historic Preservation Division for review and approval.

Site 5648 is considered significant under Criterion D, for the information it has yielded and the potential information it is likely to yield if future work is conducted. The locations of the proposed wind generating towers and the associated infrastructure are being designed to avoid all of the features of this site. Rechtman *et al*. (October 2009:68) concluded that while it is possible that data recovery might enhance our knowledge relative to the age and specific function of the various features of Site 5648, such mitigation work is not necessary given the current proposed Preferred Alternative project layout. They further recommended that if in the future it becomes necessary to impact one or more of the site’s features, DLNR-SHPD be contacted to address possible mitigation of impacts through data recovery.

Site 6665 is considered significant under Criterion D for the information it has yielded or is likely to yield upon further investigation, relative to mid-twentieth century cattle ranching practices in the area. However, judging that it is neither exceptional nor likely to yield further important information, Rechtman *et al*. (October 2009:68) recommended no further work for this site.

3.9.3 ARCHAEOLOGICAL AND HISTORIC FEATURES: ALTERNATIVE 2

Nine archaeological studies were conducted for the KWP I project. These studies included a reconnaissance survey of 27 wind turbine locations (Tomonari-Tuggle 1998), a study of an upland *heiau* site (Site 5232; Athens 2002) and a preservation plan for that *heiau* (Tomonari-Tuggle and Rasmussen 2005), a supplemental survey of the KWP I wind turbine pad alignments (Magnuson 2003), a supplemental survey for the proposed KWP I access road (Athens 2004), a reconnaissance survey of the southern portion of an alternative road route (Rasmussen 2005a), supplemental reconnaissance surveys within the SMA zone for the proposed KWP I staging area (Rasmussen 2005b and 2005c), and an inventory survey of the entire proposed KWP I development area (Clark and Rechtman 2005). Three of these studies included portions of the KWP II project area (Athens 2002; Magnuson 2003; Tomonari-Tuggle and Rasmussen 2005). In addition to these studies, an archaeological survey report (Tomonari-Tuggle and Tuggle 1991) and a cultural resource management plan (Tomonari-Tuggle 1995) were prepared for the Lahaina Pali trail, a portion of which crosses *makai* of the KWP II project area, and an inventory survey was conducted for the MECO transmission lines that cross the current project area (Hammatt et al. 1996; Robins et al. 1994).

In 2006, Rechtman Consulting conducted an archaeological inventory survey of the Alternative 2 site (Clark and Rechtman 2006, see 0 for full report). The survey team relocated SIHP Site 50-50-09-

5232, an upland *heiau* previously recorded by Athens (2002). The survey also recorded five new sites. These included a windbreak shelter (SIHP Site 50-50-09-6218), three cairns (SIHP Sites 50-50-09-6219, 50-50-09-6220, and 50-50-09-6221), and a historic ranching area containing the remains of a concrete trough and two recently burned wooden structures (possible troughs; SIHP Site 50-50-09-6222). The study noted two segments of an old metal waterline associated with Site 6222 crossing the project area from north to south. In addition to the recorded archaeological sites, they found a single, isolated piece of branch coral on the ground surface to the west of Site 6218 and the old metal waterline.

With the exception of the previously identified *heiau*, all of the newly recorded archaeological sites are within the southern portion of the KWP II project area *makai* of the existing KWP I facility. The *heiau* (Site 5232) is located along the southwestern flank of Pu‘u Luau near the western boundary of the existing wind farm. The Lahaina Pali Trail crosses the hillside several hundred feet south of the proposed KWP II project area. Each of these features is described in Table 3.11, and their locations are depicted on Figure 3.5.

3.9.4 CULTURAL USES AND RESOURCES: KAHEAWA AREA

Wilson and Rechtman (2009) prepared a Cultural Impact Assessment (CIA) for KWP II in accordance with the provisions Chapter 343 HRS, Act 50, approved by the Governor on April 26, 2000, and the Office of Environmental Quality Control (OEQC) Guidelines for Assessing Cultural Impact (see 0). While the physical study area is limited to the portion of Ukumehame Ahupua‘a that encompasses Honua‘ula Ridge, the CIA considered resources in the entire ahupua‘a (including its coastal and off-shore resources) and the site’s relationship to neighboring lands within the larger region.

The archival-historical research and oral-historical interviews that were conducted as part of the CIA were performed in a manner consistent with federal and state laws and guidelines for such studies. The primary objective of the oral-historical component of this study was to identify the existing knowledge about former land use, traditions, practices, and cultural sites. Some of the information is derived from the archaeological studies that have been conducted in the area and the neighboring Kaheawa Wind Power I area (Athens 2002, 2004; Clark and Rechtman 2005, 2006; Rasmussen 2005a, 2005b, 2005c, Rechtman et al. 2009). Other information is from additional archival research conducted and additional oral-historical work completed specifically for the CIA. New interviewees included, but were not limited to, Kupuna Paolo Kamakehau Fujihiro, Kumu Hokulani Holt, Kupuna Walter Kanamu, Kupuna Ed Lindsey, and Glen Kamalani Mclean. All of the interview participants (past and present) have shared their personal knowledge of the land and practices of this portion of West Maui. The most pertinent aspects of it are summarized in the discussion of potential effects and mitigation measures that is presented in Section 4.9.2 of this report.

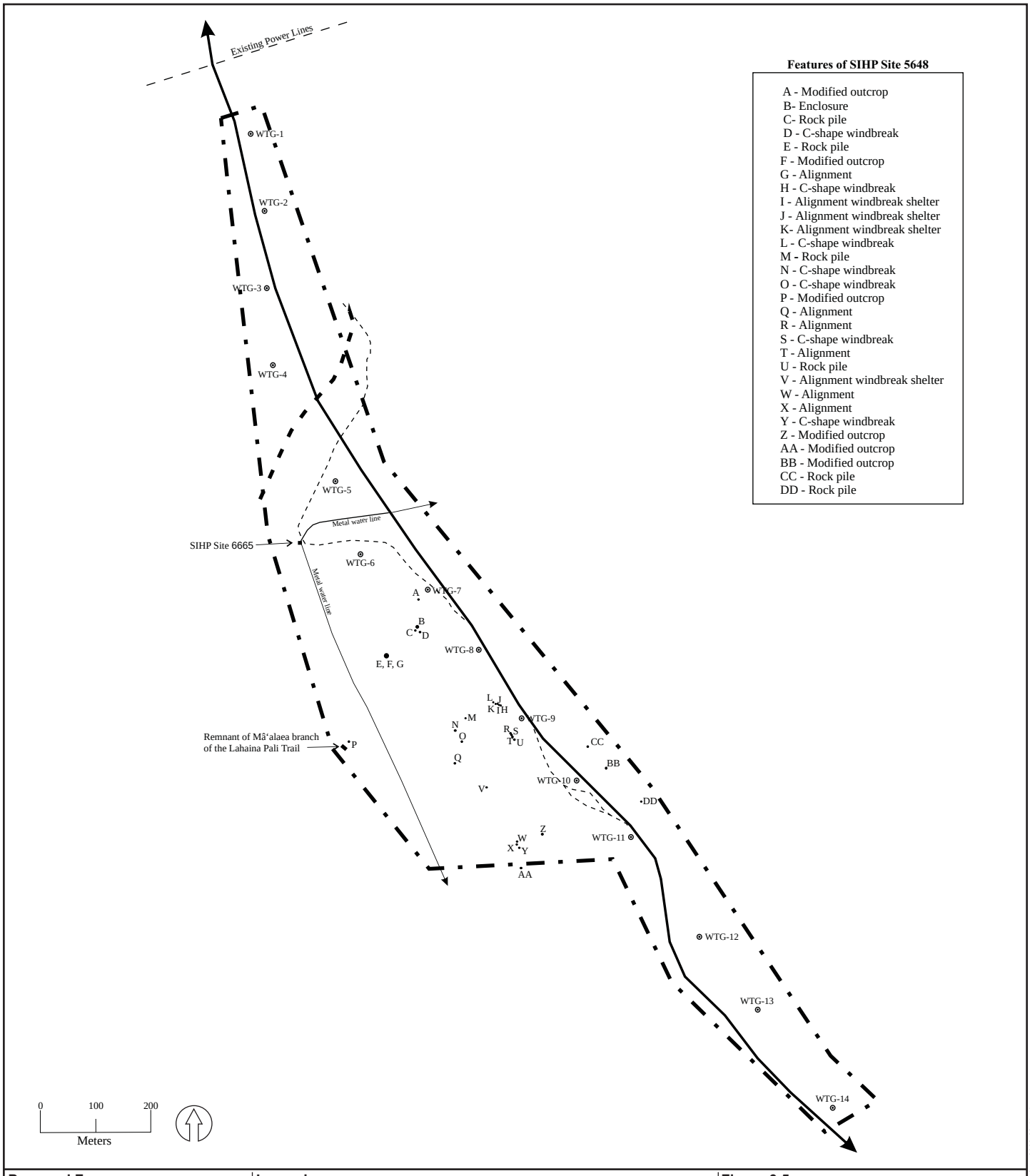
Table 3.10 Archaeological Sites Identified in the Preferred Alternative Project Area

SIHP Site No.	*Time Period*	*Description*
Lahaina Pali Trail	Historic	The Lahaina Pali Trail is a 4.5-mile long section of a Historic-period trail that once connected the towns of Lahaina and Wailuku. The trail is currently part of the Na Ala Hele Statewide Trail and Access System. It was constructed in 1841 for horse traffic, but fell into disuse approximately 50 years later when a carriage road was constructed along the coast to Lahaina (Rasmussen 2005a:5). This trail has been extensively studied and documented (Tomonari-Tuggle 1991 and 1995). No state site number has been issued for the trail itself, specific features along the way were assigned numbers individually. On an 1885 Hawaiian Government Survey Map a branch of the Lahaina Pali Trail is shown to diverge from the main trail between Manawainui and Manawaiaole gulches and continue on to Mā‘alaea. What may be a section of this branch was recorded during the inventory survey of the Preferred Alternative site.
SIHP 50-50-09-5648	Precontact/Historic	Site 5648 was first reported by Rasmussen and included ten rock formations (2005:7) with the caveat that, “it is possible unrecorded features are present at Site 5648 since high grass limited ground visibility” (*ibid*.) This supposition was correct; the present study located twenty new features, for a total at the site of thirty now recorded. Collectively these features represent temporary or short-term recurrent habitation associated with the use of upland trails. The historic expressions of these trails are still visible, but earlier Precontact ones are not. Overall Site 5648 retains integrity of location, design, and setting, and it is significant for the information it has provided relative to past use of the Preferred Alternative area.
SIHP 50-50-09-6665	Historic	Site 6665 is a concrete water trough located in the upper portion of the study area, west of the existing access road. The trough measures 3.05 m long by 1.7 m wide and stands 0.60-0.80 m above ground surface, with an interior height of 0.48-0.74 m from the base to the top of the trough. Several inscriptions are present in the concrete along the top surface of the trough, including in two places the date “DEC. 14/43” which is presumably the date it was constructed. Site 6665 is part of a water system constructed by Honoula Ranch in Ukumehame in the 1940s. This system provided drinking water for cattle in the once extensive but arid pastures of this upland area.
Source: Rechtman et al. (2009).		

Table 3.11 Archaeological Sites Identified in the Alternative 2 Project Area

SIHP Site No.	*Time Period*	*Description*
50-50-09-6218	Unknown (probably historic)	A crude windbreak shelter constructed of cobbles and small boulders. May have been a rest area constructed by the ranch hands working on a metal waterline that was laid nearby in the 1940s. No indication of time or duration of use, although it would have taken very little effort to construct.
50-50-09-6219	Unknown	A cairn consisting of two boulders stacked one on top of the other on top of a natural bedrock boulder. Small stones exist beneath the two stacked boulders to balance them. The boulders are fairly large and would have required two people to lift. The cairn could have been erected at any time, perhaps to marks the route of a former trail, although no such route is apparent on the site.
50-50-09-6220	Unknown (probably modern)	A cairn constructed of three small cobbles stacked on top of a large bedrock boulder. This cairn could have been erected at any time, but it is likely that it was constructed during recent times, as the cobbles are rather precariously balanced and would fall over easily if disturbed. It is possible that the cairn marks the route of a former trail, although no such route is apparent.
50-50-09-6221	Unknown	A cairn constructed of approximately fifteen medium-sized cobbles that are loosely stacked/piled on and against two small bedrock boulders. It could have been erected at any time. Again, it is possible that the cairn marks the route of a former trail, although no such route was observed.
50-50-09-6222	Historic	A concrete water trough (Feature A) and the remnants of two recently burned wooden structures (Feature B), possibly troughs. The features are connected by an old metal waterline. An inscription in the concrete of Feature A reveals that construction of the concrete portion of the trough was completed on December 17, 1943. This water system was likely part of Honoʻula Ranch, which was operating in Ukumehame in the 1940s.
50-50-09-5232	Pre-contact	An upland *heiau* (religious site or temple) approximately 400 feet to the west of the KWP I facility at an elevation of about 2,250 feet MSL. The *heiau* is thought to date from the late prehistoric period, between 1660 and 1760. Excavation inside the notched enclosure revealed a dense deposit of charcoal associated with use of the *heiau* (Athens 2002). Several pieces of branch coral were recovered from the charcoal deposit, further confirming the religious nature of the site (branch coral was commonly brought to *heiau* as offerings). No food or tool remains were found during the extensive survey of the site (Athens 2002). The *heiau* is thought to be connected with Manawaipueo Gulch and is thereby associated with owls (puʻeo). The *heiau* does not appear to have a recorded traditional or common name (Tomonari-Tuggle and Rasmussen 2005). Clark and Rechtman (2006) also noted that the southwestern corner of the *heiau* is oriented toward the tallest point on the Island of Kahoʻolawe, suggesting that it perhaps functioned as a navigation *heiau* (Kahoʻolawe is associated w/ navigation).
50-50-09-2946 and 50-50-09-2950	Historic	The Lahaina Pali Trail (Site Nos. 50-50-09-2946 and 50-50-09-2950) runs east-west across the Kaheawa area, approximately 3,000 feet down slope of the southernmost existing KWP I turbine. 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 20th century following construction of a carriage road along the base of the *pali*" (Tomonari-Tuggle, 1991, as cited in Tomonari-Tuggle and Rasmussen, 2005). Tomonari-Tuggle (1991) further states that "The terrain crossed by the Lahaina Pali Trail is relatively inhospitable for settlement or agriculture. Surface water is virtually nonexistent 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." Old Lahaina Pali Trail was selected as Maui's Demonstration Trail for the Na Ala Hele Trails and Access Program.

Source: Clark and Rechtman (2006).



Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

Rechtman Consulting, LLC
October, 2009

Legend:

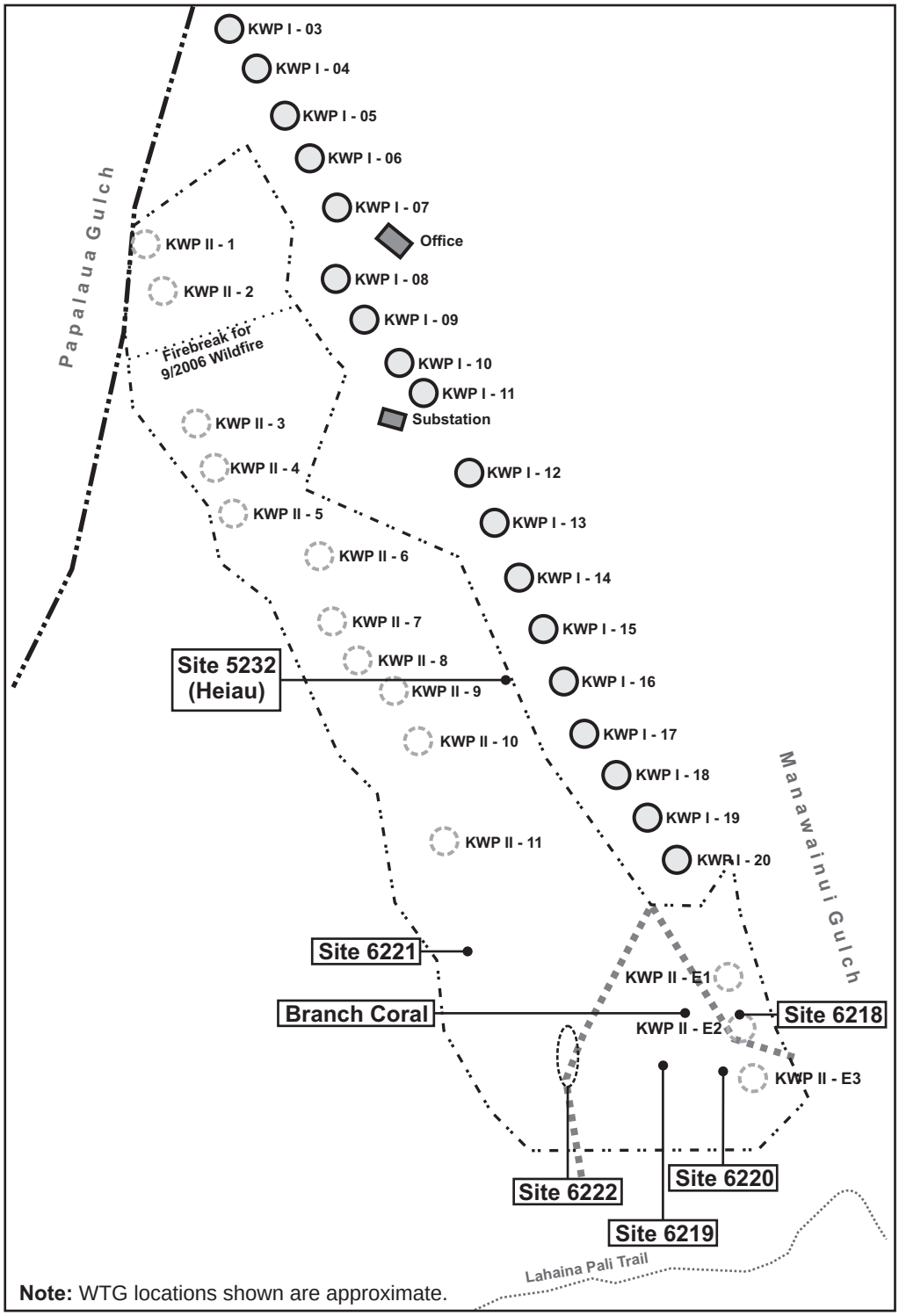
- Existing access road
- Old 4WD road
- Lahaina Pali Trail
- Study area boundary
- Proposed wind tower location
- Features of SIHP Site 5648

Figure 3.5:

Archaeological Sites in the Preferred Alternative Area

Kaheawa Wind Power II

Figure 3-5 Archaeological Sites in the Preferred Alternative Area 2009-09-11.cdr



Note: WTG locations shown are approximate.

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

Rechtman Consulting, LLC (2006)

Legend:

Old Waterline

Extent of Survey

Parcel Boundary

0 250 500
Meters

Figure 3.6:

Archaeological Sites in the Alternative 2 Area

Kaheawa Wind Power II

Figure 3.6 Archaeological Sites in the Alternative 2 Area 2009-09-11.cdr

3.10 EXISTING LAND USE/SOCIOECONOMIC & CULTURAL ENVIRONMENT

3.10.1 LAND USE

3.10.1.1 Existing Land Use Controls

Both the Preferred Alternative and Alternative 2 sites are in the General subzone of the State Conservation District (see Figure 3.7) as established and regulated by Chapter 205, HRS. Lands within the Conservation District are typically utilized for protecting watershed areas, preserving scenic and historic resources, and providing forest, park and beach reserves [subsection 205-2(e) HRS]. Both sites are owned by the State of Hawai‘i. As with other Conservation District lands, the parcel containing the project site is not subject to any County of Maui zoning or community plan designations or restrictions. Neither alternative involves development within the Special Management Area.[24]

3.10.1.2 Existing Land Use

In addition to the KWP I wind farm facilities, a few low-intensity uses are present near the area that is being considered for the proposed KWP II wind farm.

- The area *mauka* and west of the proposed Alternative 2 site is used by the State for the release of native nēnē as part of an ongoing wildlife preservation program.
- The Lahaina Pali Trail traverses the hillside at an elevation of approximately 1,500 feet. Under the Preferred Alternative layout, the trail passes through the upper portion of the project area between proposed WTG #4 and #5. Under the Alternative 2 layout, the lowest of the WTG sites would be approximately 900 feet from the trail.
- Two MECO transmission line easements cross Kaheawa Pastures in a southwesterly direction from Mā‘alaea. The first easement (with 2 power lines) crosses the KWP I and Alternative 2 areas at an elevation of approximately 2,300 feet; the second easement (with 1 power line) crosses about 1,900 feet at the uppermost portion of the Preferred Alternative site.

There are no planned land uses identified in the Maui County General Plan or the West Maui Community Plan for the project area.

3.10.2 POPULATION AND HOUSING

No one lives on the parcel on which facilities would be developed or on immediately adjoining parcels. The nearest settlements are Olowalu, which is over three to five miles to the southwest, and Mā‘alaea, which is approximately 1.5 to 2 miles to the east. Mā‘alaea’s population in 2000 was approximately 450; far fewer people lived in Olowalu.[25]

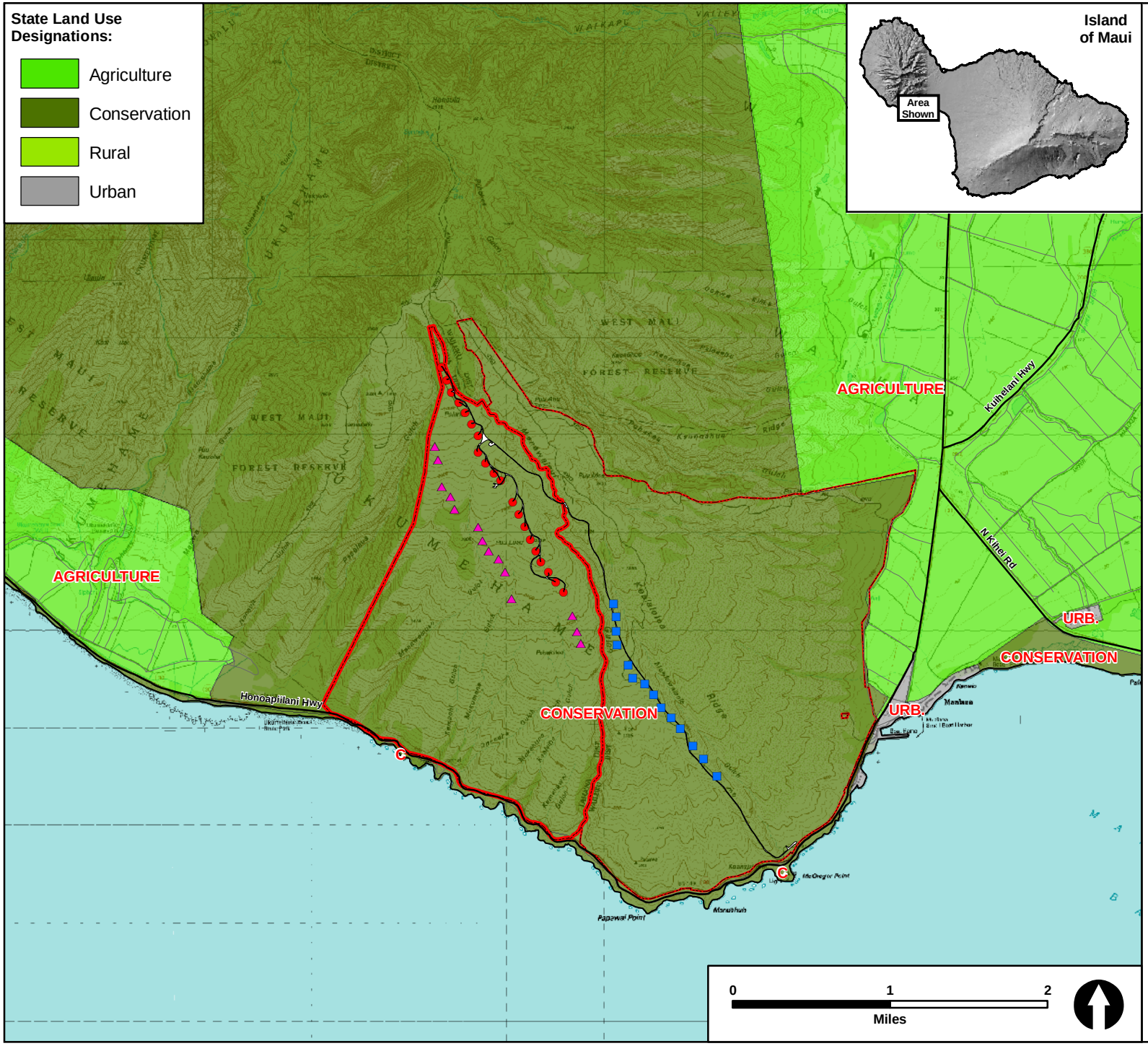
The County of Maui Planning Department *Socio-Economic Forecast: The Economic Projections for the Maui County General Plan 2030* (County of Maui Planning Department 2006: 11) projects Maui island’s de facto population (i.e., the average number of residents and visitor present) will increase from 175,147 in 2005 to 254,448 in 2030, a gain of about 45 percent. Local development potentials include time-share development, the development of large master-planned communities, and the

[24] A small portion of the existing access road (near Honoapi‘ilani Highway) lies within the County Special Management Area (SMA), and the County of Maui issued an SMA permit for that when it was improved as part of the KWP I project. No work within the SMA is required for the proposed KWP II project.

[25] U.S. Census Bureau, Census 2000 Redistricting Data Summary File, Matrices PL1 and PL2.

development of Hawaiian Homelands lands. Proposals include the development of sizeable new residential communities at Olowalu and Mā‘alaea.[26]

[26] The plan for Olowalu calls for realigning the highway inland and the development of 565 Single Family Lots, 785 Multi-Family / Apartments, 150 “Live/Work” Units, and 25,000 sq. ft. of commercial business space in the town centers for such things as a surf shop, doctor, café, restaurant, dentist, book store, market, video store, hardware store, drug store, bakery, and bar (http://www.olowalutown.net/index.cfm?fuseaction=ig.page&PageID=167).



Legend:

- Existing KWP I Turbines
- Highways
- Roadways
- TMK Boundaries

Proposed KWP II Sites:

- Preferred Alternative
- Alternative 2

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Sources:

-UPC Wind Management, LLC
-State of Hawai'i GIS
-SSFM, Inc.

Figure 3.7:

State Land Use Map

Kaheawa Wind Power II

Figure 3-7 Land Use Map 2009-09-11.mxd

3.10.3 ECONOMY

Maui County Planning Department's 2006 Socio-economic Forecast (which was prepared before the current economic downturn) made the following general predictions about the economy of Maui County to the year 2030:

- Wage and salary jobs are expected to increase by about 1.7 percent annually;
- Per capita real income (i.e., using inflation-adjusted dollars) will increase very little;
- Visitor counts will increase by about 1.5 percent annually;
- With high occupancy rates, construction of new units is expected to resume, and the supply of visitor units will likely grow at 1 percent or more annually; and
- The rates of growth in resident population, housing, and jobs are higher than the rate of growth for visitors. This means the Maui economy has diversified and is less driven by tourism than in the past.

West Maui is considered one of Maui's major centers for the visitor industry. In 2007, nearly 2.5 million persons visited Maui and spent approximately $3.4 billion. This represents a little more than a quarter of the statewide visitor expenditures of $12.57 billion during 2007 (DBEDT 2007 Table 13).

While Maui is very dependent on the visitor industry, the island's agricultural industry, principally sugar and pineapple, provides an important contribution to the economy. In 2007, Maui County had 32,400 acres of cane fields and generated a $37.8 million sugar crop. Flower and nursery products sales amounted to $12.7 million, and vegetable sales totaled $6.2 million (DBEDT *2008 Data Book*, Table 19.08).

3.11 SCENIC AND AESTHETIC RESOURCES

Both of the areas that are being considered for the proposed project are situated near the existing KWP I wind farm. The WTG sites in the Preferred Alternative are on the lower slope of Ukumehame, above McGregor Point (though not visible from that location). The ridge and table lands on that are under consideration for the new facilities afford sweeping panoramas of Haleakalā and Mā‘alaea Bay to the east, of Kaho‘olawe and Molokini Islands to the south, and of the West Maui Mountains to the west. Both siting areas are visible from portions of the Lahaina Pali Trail, which passes through the Preferred Site and below the Alternative 2 site and the nearest existing KWP I turbine. As is true of the existing wind farm, the sites now being considered are most visible from aircraft on approach to Kahului airport. They differ in the exact areas from which they can be seen (with the Preferred Alternative being more visible from most publically accessible viewpoints), and this is important to their effect on scenic and aesthetic resources, which is discussed in Section 4.11. For the most part, intervening terrain and vegetation blocks views of much of the land on which Alternative 2 would be built from Honoapi‘ilani Highway and other public views of the area. With the exception of these aircraft and the Lahaina Pali Trail, all public vantage points which offer views of the Alternative 2 site are several miles distant.

3.12 HAZARDOUS MATERIALS

Vuich Environmental Consultants, Inc (VEC 2005) conducted a Phase I Environmental Site Assessment of the KWP I project site. VEC concluded that no "recognized environmental conditions"[27] are present on the site or in the surrounding area. The proximity of both sites under

[27] Recognized environmental conditions, as defined by ASTM Standard E1527-00, are the presence or likely presence of any hazardous substance or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property, or into the ground, ground water, or surface water of the property.

consideration for KWP II and the similarity of past uses suggest that conditions there are similar, but a Phase I Environmental Site Assessment will be conducted prior to construction to confirm this fact.

The Phase I environmental report for KWP I identified a few "products of concern relating to any future development project or land-clearing activity." These consisted of earthen material (silt), paints, oils, antifreezes, and other fluids from automobile or on-site machinery, or leaks from on-site stocked items. All of these were present in small quantities and were determined not to constrain use of the area.

Operation of the existing KWP I facility requires storage of small quantities of several materials that require special handling and storage. These include mineral oil, hydraulic oil, waste oil, and cleaner/degreaser. These materials are presently stored in three container areas on the site: (1) the existing O&M building, (2) the 20 wind turbine sites; and (3) the existing substation. Table 3.12 lists the locations, quantities, and containment types in place for each of the on-site oil storage locations at KWP I. A Spill Prevention, Countermeasure, and Control (SPCC) Plan is in place for the facility and is updated every five years.

A follow-up Phase I assessment of the KWP I facility was conducted by Malama Environmental in August 2007, after that facility commenced operation. The report noted that regulated wastes and petroleum products are effectively managed on-site, and that secondary containment of petroleum-based wastes and effective spill management have been implemented in the daily operations of the facility. Further, it noted that petroleum-based wastes and all other regulated wastes generated on-site are being properly managed and disposed of by certified waste contractors (Malama Environmental 2007).

Table 3.12 Oil Storage and Containment at KWP I

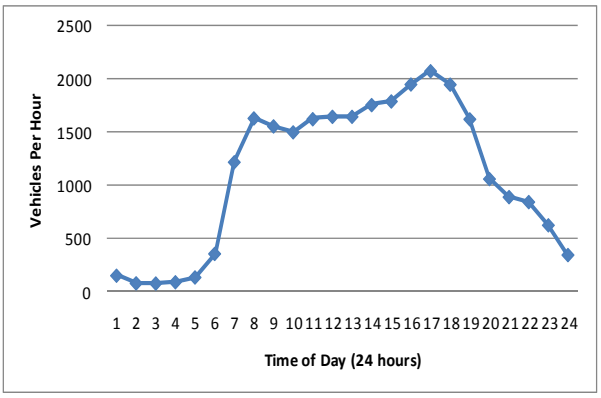
Location	Container ID	No. of Units	Unit Capacity (gallons)	Total Capacity (gallons)	Product Stored	Containment Type
Substation	Substation Transformer	1	3,465	3,465	Mineral Oil	Concrete Pit
Substation	Grounding Transformer – UPC side	1	30	30	Mineral Oil	Aerial Platform – 6 inches of ¾ inch washed gravel
Substation	Distribution Transformer	1	522	522	Mineral Oil	Pad-mounted and surrounded by – 6 inches of ¾ inch washed gravel
WTGs	Step-up Transformers	20	522	10,440	Mineral Oil	Pad-mounted
WTGs	Gear Boxes	20	64	1,280	Hydraulic and Lubricating Oils	Catch-basin and wind turbine structure
O&M Building	Mineral Oil	1	55	55	Extra Mineral Oil	Spill retentive skid
Source: Kaheawa Wind Power Project Spill Prevention, Control, and Countermeasure Plan (July 2007)						

3.13 PUBLIC INFRASTRUCTURE AND SERVICES

3.13.1 TRANSPORTATION FACILITIES

Roadways. The access road to the existing wind farm facilities serves both of the site alternatives under consideration. It begins at Honoapiʻilani Highway, one of Maui's major coastal roadways. The State-owned highway is heavily traveled by tourists and commuters, especially during daylight hours. It connects with other major highways and provides ready access to the harbor facilities at Kahului where the equipment and other construction materials needed for the proposed project would be landed.

The State Department of Transportation conducts regular traffic counts on Honoapiʻilani Highway near McGregor's Point (Site ID B740030000611) just a short distance to the west of the Kaheawa Pastures access road Honoapiʻilani Highway access road intersection. The 24-hour volume on August 24th and 25th, 2007 was 24,973 and 25,559, respectively. With one exception, the volume exceeded 1,500 vehicles per hour every hour between 7:00 a.m. and 6:00 pm. The highest volume occurs between 4:00 p.m. and 5:00 p.m., when an average of over 2,100 vehicles per hour were recorded on the two days.



Harbors. Kahului Harbor is the only harbor on Maui suitable for unloading heavy equipment and construction materials needed for the proposed project. Most construction materials would arrive at the Kahului Harbor and be off-loaded before being trucked to the site.

Airports. The Preferred Alternative and Alternative 2 sites are located approximately 10 miles from the Kapalua Airport and about 8 miles from Kahului International Airport. Because of the height of the proposed wind turbines, KWP II is required to submit a Notice of Intent to the Federal Aviation Administration (FAA) for construction of the proposed facility. The FAA reviewed the KWP I turbines on the land adjacent to the project site and determined that, with proper lighting, they would not constitute a hazard to air navigation.

3.13.2 UTILITIES & PUBLIC SERVICES

Electrical service to the area is provided by MECO. As described in Section 3.10.1.2, two MECO transmission line easements containing three 69kV transmission circuits cross the area in a southwesterly direction from Māʻalaea. The existing KWP I facility obtains the electrical power it needs for operational loads from the uppermost of the three circuits via step-down transformers located at the existing KWP I substation. Likewise, power generated by the KWP I facility is fed into the MECO grid via the same circuit. In accordance with MECO's request, power from the proposed KWP II project would be fed into the second circuit within this same corridor (the lowermost line in the upper transmission corridor).[28]

The nearest hospital to the proposed KWP II site is the Maui Memorial Hospital in Wailuku. In case of emergencies, paramedic/ambulance services are available from the Wailuku and Kīhei areas. The Maui Police Headquarters is located on Mahalani Street in Wailuku. The main Maui fire station is in Kahului on Dairy Road; additional fire stations are located in Wailuku, Kīhei and Lahaina.

[28] MECO requested the use of a different transmission circuit so as to provide greater redundancy and security to its system.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

4.0 POTENTIAL IMPACTS & MITIGATION MEASURES

This Chapter describes the probable adverse and beneficial effects of the alternatives described in Section 2.2. The discussion is organized by type of potential impact (e.g., air quality, water quality, visual, etc.). The discussion within each topical area begins with a description of the components of the project that have the potential to impact the particular aspect of the environment being discussed. Because they typically involve substantially different types of impacts, the analysis also distinguishes between activities that are needed to construct the facilities and those associated with its operation. Where applicable, the discussion draws from experience and data gained during construction and operation of the existing KWP I facility. Good design practice integrates features intended to avoid or minimize potential environmental effects into the fundamental design of the project as project design features (PDFs). Impacts that remain after implementation of the PDFs are then addressed with mitigation measures.

The chapter is divided into the major subsections listed below, each corresponding to one aspect of the environment:

- Section 4.1 – Geology, Topography, and Soils;
- Section 4.2 – Air Flow and Climate;
- Section 4.3 – Air Quality;
- Section 4.4 – Hydrology and Water Resources;
- Section 4.5 – Natural Hazards;
- Section 4.6 – Terrestrial Flora;
- Section 4.7 – Terrestrial and Avian Fauna;
- Section 4.8 – Noise;
- Section 4.9 – Archaeological, Historic, and Cultural Resources;
- Section 4.10 – Land Use and Socio-Economic Effects;
- Section 4.11 – Scenic and Aesthetic Resources;
- Section 4.12 – Hazardous Materials;
- Section 4.13 – Public Infrastructure and Services.

4.1 GEOLOGY, TOPOGRAPHY, AND SOILS

4.1.1 INTRODUCTION

As discussed in Section 3.1.1, there are no known unique or unusual geologic resources or conditions at the proposed KWP II site.[29] Grading similar to that done for the KWP I project will be required for the turbine pads, internal access roads, substation, and control building associated with the proposed KWP II facility. However, because the proposed project can take advantage of the existing access road from Honoapiʻilani Highway rather than having to construct an entirely new road network, the earthwork is more limited than that required for KWP I. The project would not alter any of the major topographic features named in Section 3.1.1.

A detailed analysis was conducted to determine the extent and significance of the project's potential effects on topography and soils. The results of this assessment are described below. Section 4.1.2 characterizes the extent of ground disturbance that would result from construction of the proposed

[29] Seismicity (i.e., the potential for earthquakes) is discussed in Section 4.5.2 as part of a broader review of the natural hazards to which development in the area is exposed.

facilities. Section 4.1.3 discusses the agricultural characteristics of the disturbed soil and the extent to which agricultural productivity would be lost if the KWP II project is constructed.

4.1.2 EXTENT OF GROUND DISTURBANCE

Both the Preferred Alternative and Alternative 2 will require modifications to the existing road network on the hillside; Alternative 2 will require substantial extension of the roads as well. In addition, they will require grading of the 14 WTG pads, 1 to 2 met tower pads, and the sites for the substation, BESS, and O&M building. Construction work will be done using graders, multiple cranes, dump trucks, concrete mix trucks, front end loaders, bulldozers, excavators, and heavy haul trucks. The facilities will be constructed and the WTGs and other equipment installed in a linear fashion, beginning with the construction baseyard and construction lay-down area, followed by the access roads and WTG pads. After these are in place, the WTGs will be erected. Construction of the baseyard will occur at the same time as the other work is being undertaken and will be timed to end at the same time.

Although site civil design is still at an early stage, the preliminary engineering estimates (see Table 4.1) indicate that the Preferred Alternative will involve the disturbance of approximately 43 acres of land while Alternative 2 would disturb approximately 60 acres of land.[30] The principal difference between the two alternatives with respect to disturbed area is the access road extension needed for Alternative 2. Differences between the Preferred Alternative site and the Alternative 2 site also contribute to a marked difference in the volume of material that must be moved, and that can be seen in Table 4.1 as well.

In summary, both alternatives are planned for moderately steep land and will require a substantial amount of grading. This will increase the potential for erosion. Because the Preferred Alternative site is rockier, less soil is likely to be eroded from it than from the Alternative 2 site, where the soils are deeper. In either case, the Best Management Practices (BMPs) outlined below will be employed to prevent construction and operation of the facilities from causing undue erosion. Sections 4.3.1 and 4.4.3 below describe the best management practices that KWP II LLC will implement to prevent and minimize soil erosion during construction and operation of the proposed facility.

4.1.3 EFFECT ON AGRICULTURAL PRODUCTIVITY

As mentioned in Chapter 3, all of the WTG pads in the Preferred Alternative are underlain by rock land. Alternative 2 involves some development on Rock Land, but the majority would be on Nāʻiwa silty clay loam and Oli silt loam. According to the *Soil Survey of the State of Hawaiʻi* (Foote *et al.* 1972), these soil types are generally not suited to mechanized production of common field crops without special management; hence their agricultural usefulness is limited to pasture and wildlife habitat.[31] None of the land in the project area is identified as “Prime” or “Unique” on the Agricultural Lands of Importance to the State of Hawaiʻi (ALISH) map.

While none of the land in alternative project areas is suitable for crop production, portions of the Alternative 2 site have been used in the past for pasture. The developed portion of either of the leased areas will no longer be suitable for pasturage, but the presence of the wind farm will not preclude grazing on the remainder, which comprises the great majority of the leased area.

[30] Estimates are from calculations by AECOM Water dated January 29, 2009.

[31] Rock land is suited for urban development (such as the warehouse that is planned for KWP II), so long as the foundations are designed with the relatively high shrink-swell potential in mind.

Table 4.1 Comparison of Earth Movement Quantities

Component	*Preferred Alternative*				*Alternative 2*			
	Basis	*Area (ac.)*	*Cut (cy)*	*Fill (cy(*	*Basis*	*Area (ac.)*	*Cut (cy)*	*Fill (cy(*
Wind Turbine Generator (WTG)	1.5H:1V cut and 2H:1V embankment	21.2	137,026	188,651	1.5H:1V cut and 2H:1V embankment	21.2	137,026	188,651
Site Road	Access and Spur Road – 36' width, uncrowned mono-cross-slope; 1.5H:1V cut & 2H:1V embankment	16.4	12,542	10,182	16 foot-width with two 10' shoulders; uncrowned mono-cross-slope; 2H:1V cut/embankment slopes	29.6	186,122	246,635
Permanent Meteorological Towers	40 foot pad diameter	0.2	272	491	100 foot pad diameter	1.5	0	0
Baseyard	150 feet x 250 feet	1.5	6,775	9,536	200 feet x375 feet	3	13,554	19,072
Temporary Lay Down Area	150'x250'; 1.5H:1V cut & 2H:1V embankment; grading tied to WTG #12	2	40,194	807	150'x250'; 1.5H:1V cut & 2H:1V embankment; grading tied to WTG #12	2	40,194	807
Buried Collector System	3 foot-wide trench; 4 foot depth; finish grade = existing grade	2	0	0	3 foot-wide trench; 4 foot depth; finish grade = existing grade	2	0	0
	Total	***43***	***196,809***	***209,667***	***Total***	***60***	***376,896***	***455,165***

Notes: Baseyard includes the switchyard/substation, BESS, O&M Building, and parking and storage yard. Buried collector system is given a zero value because the material is immediately replaced in the trench.

Source: Preferred Alternative - SSFM September 28, 2009; Alternative 2 - AECOM April 21, 2009 for Alternative 2

4.2 IMPACTS ON WEATHER AND CLIMATE

WTGs of the type and number that are proposed do not have the potential to affect temperature, rainfall, humidity, or most other meteorological parameters. By altering the atmospheric mixing that occurs as wind passes over a site, they do have the potential to affect certain aspects of the wind regime, but for several reasons the potential effects are minor.[32]

- First, they would extract only a small percentage of the wind energy that passes over Kaheawa Pastures; most would remain in the atmosphere.
- Second, because their blades are elevated well above ground level, the greatest of even these modest effects are greatly diminished at ground level.
- Finally, no uses are anticipated in the area that could be affected by minor changes in wind speed and/or velocity that have the potential to be harmed by what few changes in air flow might occur.

In view of the absence of significant localized effects, the most important effects on climate are positive ones that stem from the proposed project's ability to reduce the combustion of fossil fuels and, therefore, the emissions of greenhouse gases (GHGs) that are contributing to global warming.

The remainder of this section is divided into two parts. Section 4.2.1 discusses the concept of global warming and the contribution of emissions from the combustion of fossil fuels to that phenomenon. Section 4.2.2 describes the extent to which operation of the proposed project could eliminate a portion of those emissions.

4.2.1 GLOBAL WARMING: MAGNITUDE AND CAUSES

4.2.1.1 Magnitude of Global Warming

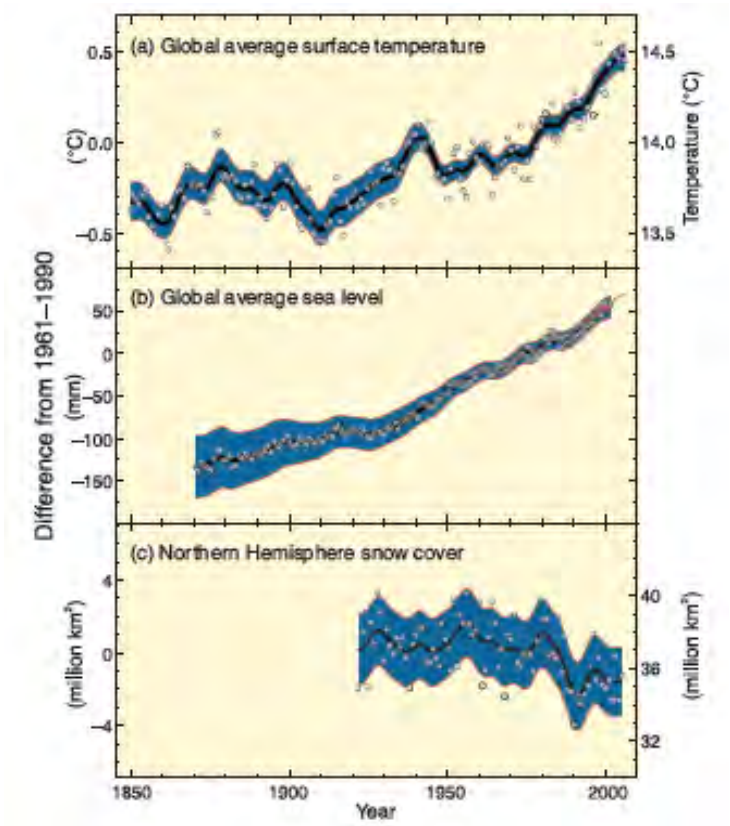
The global scientific community is in general agreement that human activities, specifically those resulting in the emission of GHGs, are contributing to a rise in average global temperatures. The GHGs associated with human activities that are of greatest concern are CO_2 from the combustion of fossil fuels and industrial processes (e.g., cement manufacturing), methane, nitrous oxide, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride. Of these six gases, CO_2 is the most prevalent.[33]

The EPA (EPA September 1998) estimates that global mean surface temperatures increased 0.6-1.2°F between 1890 and 1996. The 9 warmest years in this century all have occurred in the last 14 years of that period. The average temperature in Honolulu has increased 4.4° F over the past century. Other observed environmental changes, including a decrease in Northern Hemisphere snow cover, a decrease in Arctic Sea ice, and continued melting of alpine glaciers, tend to corroborate the temperature data (see Figure 4.1). In addition, global sea levels have risen 4 to 10 inches over the past century, and precipitation over land has increased slightly.

[32] A theoretical study authored by Dr. Somnath Baidya Roy and reported in the November 2, 2004 edition of the *New York Times* modeled the impact of a hypothetical large-scale wind farm in the Great Plains. Published in *The Journal of Geophysical Research*, the study concluded that WTGs can affect local weather, but only when thousands of turbines are concentrated in one area. The authors conclude that the impact comes not so much from the turbines' rotor blades slowing down the air but rather from the atmospheric mixing that occurs in the blades' wake. The relatively few existing and proposed WTGs at Kaheawa are far below the threshold at which such an effect could occur.

[33] Readers should note that CO_2 is not the only "greenhouse gas". In fact, on a pound-for pound basis, it is less serious than a number of other pollutants that are believed to contribute to global warming. A common unit of measurement is needed to compare the global warming potential of different gases, and scientists have settled on the use of "carbon dioxide equivalents" (CDE) as the generally accepted unit of comparison. For example, the CDE of methane over a period of 100 years is 25, which means that over this specified period of time the GWP of one million metric tons of methane emissions is equivalent to the GWP of 25 million metric tons of carbon dioxide. CDE values are obtained by multiplying the a specified mass of GHG emissions by the GWP of the gas.

Figure 4.1 Average Temperature, Sea Level, and N. Hemisphere Snow Cover Changes



Source: IPCC *Climate Change 2007 Synthesis Report: Summary for Policymakers (Figure SPM.1)*. Observed changes in (a) global average surface temperature; (b) global average sea level from tide gauge (blue) and satellite (red) data and (c) Northern Hemisphere snow cover for March-April. All differences are relative to corresponding averages for the period 1961-1990. Smoothed curves represent decadal averaged values while circles show yearly values. The shaded areas are the uncertainty intervals estimated from a comprehensive analysis of known uncertainties (a and b) and from the time series (c).

The Intergovernmental Panel on Climate Change (IPCC) has concluded that "…*the balance of evidence suggests a discernible human influence on global climate*." The IPCC estimates that a global average warming of 1.0 to 4.5°F (0.6-2.5°C) in the next 50 years and 2.5 to 10.4°F (1.4 to 5.8°C) by the year 2100, compared with the global average temperature in 1990. Model calculations by the EPA (EPA, September 1998) are on the same order of magnitude, suggesting that the global surface temperature could increase an average of 1.6 to 6.3°F by the year 2100, with significant regional variation. These temperature changes would be far greater than recent natural fluctuations, and they would occur significantly faster than any known changes in the last 10,000 years.

Projections by the IPCC and results from the United Kingdom Hadley Center's climate model (HadCM2) suggest that by 2100 temperatures in Hawai'i could increase by 3°F (with a range of 1-5°F) in all seasons, slightly more in fall (EPA, September 1998). The most obvious effect that an increase in average global temperature could have on Hawai'i is a rise in ocean level. It could also alter climatic patterns, and this, in turn, could have a number of secondary effects (e.g., changes in rainfall, increased air pollution, etc.). Future changes in precipitation in Hawai'i are highly uncertain. This is because they depend in part on how El Niño might change, and no reliable projections of this are available. However, it appears possible that quite large precipitation increases could occur in summer (particularly) and fall. Other climate models may show different results, especially regarding estimated changes in precipitation.

4.2.1.2 Factors Contributing to Global Warming

While it is clear that global temperatures fluctuated significantly long before there was any potential for them to be influenced by human activities, the scientific evidence indicates that the recent increase in global temperature is mainly due to the combustion of fossil fuels and deforestation.[34] Data from entrapped air inclusions in ice cores obtained from the Russian Vostok station in East Antarctica provide direct records of atmospheric trace-gas composition over the last 400,000 years. While the data indicate that temperature and atmospheric CO_2 concentrations have fluctuated substantially over that period, the recent values for CO_2 concentrations are well outside the historical range. The IPCC (2007) estimates that after remaining nearly constant during the thousand years before the Industrial Revolution, the concentration of carbon dioxide has grown by more than 30 percent since pre-industrial times and is still increasing at an unprecedented rate of on average 0.4 percent per year.[35]

The same source estimates that global greenhouse gas emissions produced by human activities (also called "anthropogenic" emissions) increased 70 percent between 1970 and 2004 (see Figure 4.2), with most of the increase attributable to combustion of fossil fuels. It is very likely that the observed increase in CH_4 concentration is predominantly due to agriculture and fossil fuel use. CH_4 growth rates have declined since the early 1990s, consistent with total emissions (sum of anthropogenic and natural sources) being nearly constant during this period. The increase in N_2O concentration is primarily due to agriculture.

4.2.2 PROJECT-RELATED EFFECTS ON GREENHOUSE GAS EMISSIONS

The operation of the proposed wind turbine generators will provide MECO with approximately 70,000 MWh/year of electricity, on average. Based on the national average CO_2 emissions of slightly fewer than 2 pounds per kilowatt hour[36], the proposed project has the potential to reduce CO_2 emissions by approximately 126,000,000 pounds per year.[37] While this represents the theoretical maximum reduction that could be achieved by substituting wind-generated power for that derived from fossil fuels, the actual reduction will be less. This is because the variable nature of wind requires that MECO maintain some fossil fuel-fired backup capacity on-line even while the wind power is being utilized. The extent to which this occurs varies substantially over the course of a day and from day-to-day and estimates of it are necessarily imprecise. However, KWP II and MECO estimate that the actual reduction in the combustion of fossil fuel will be on the order of 85 percent. Assuming this is achieved, operation of the proposed facilities will reduce CO_2 emissions by 107 million pounds per year.

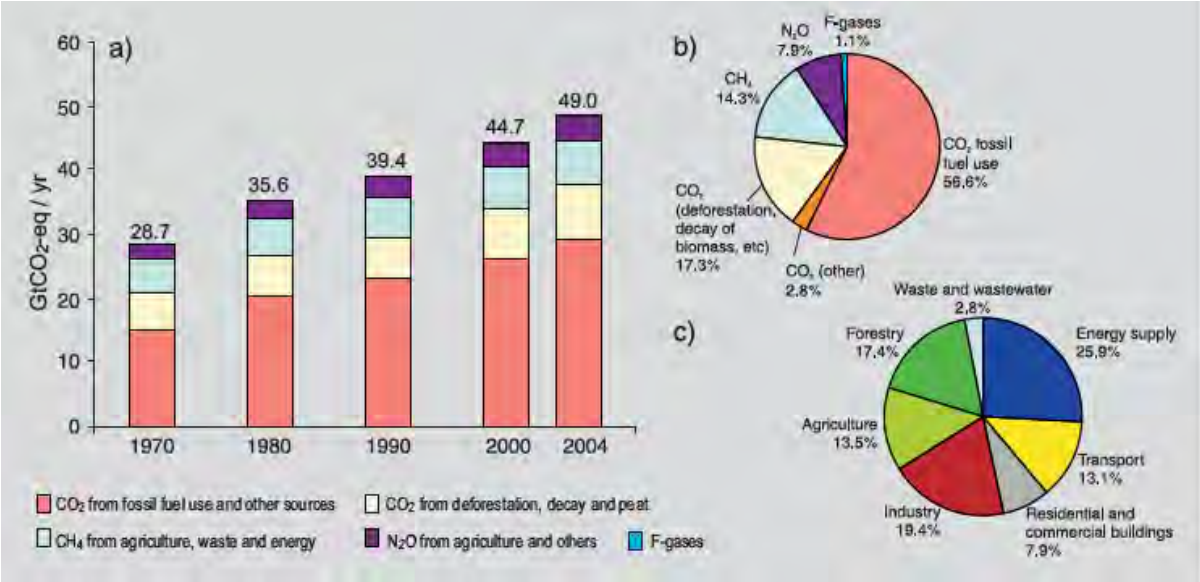
[34] The changing isotopic composition of the atmospheric CO_2 shows the fossil origin of the increase, linking it to human activity. Currently, about 7 billion tons of carbon (as carbon dioxide) are emitted each year during the combustion of fossil fuels and 1-2 billion tons per year from land clearing.

[35] Analyses of the composition of air bubbles trapped in Antarctic ice shows that carbon dioxide concentrations are now higher than at any time in the past 400,000 years and that it may be higher than it has been for 20 million years. If proven representative, these results indicate that the current rate of increase of carbon dioxide is greater than at any time in the past 20,000 years.

[36] Note that the CO_2 output rate (in pounds CO_2 per kWh) is based on the 1999 U.S. average for all generating units burning petroleum as reported by the U.S. Department of Energy and U.S. Environmental Protection Agency in (2000).

[37] Manufacturing the WTGs and transporting them to Kaheawa Pastures does involve activities that result in the release of GHGs. Similarly, vehicle-trips associated with the transport of operating personnel, supplies, and related items to the site also results in the release of small amounts of GHGs. The quantity of such releases is extremely small in relationship to the fuel combustion that is avoided and is not analyzed here.

Figure 4.2 Anthropogenic Greenhouse Gas Emissions



Source: IPCC *Climate Change 2007 Synthesis Report: Summary for Policymakers (Figure SPM.3)*

4.3 IMPACTS ON AIR QUALITY

The proposed project's principal effect on air quality will be through the long-term reduction in emissions from combustion of the fuels that would otherwise be burned to generate the electricity that KWP II will provide. Those reductions are discussed in Section 5.2 of this report (see especially Table 5.1).

While the air quality impacts are largely beneficial, construction and operation of the proposed facilities involves certain activities with the potential to affect air quality. The nature and magnitude of the likely changes are described below. Section 4.3.1 discusses construction-period effects, while Section 4.3.2 covers effects once the facilities are operational. Because it does not involve the operation of any significant sources of air pollutants, the principal regulatory standard that must be met is the requirement that reasonable precautions be taken to prevent particulate matter emissions during construction or material handling, and "best practical operation or treatment" must be implemented to prevent visible emissions of fugitive dust beyond the property line.

4.3.1 CONSTRUCTION PERIOD IMPACTS & MITIGATION MEASURES

Project-related construction activities will generate two types of air emissions: (*i*) exhaust emissions from construction vehicles and (*ii*) fugitive dust from earthmoving operations.[38] Of the two, fugitive dust from earth-moving is by far the larger source. Nearly all of the fugitive dust emissions will be limited to the area in and around the proposed WTG pads, site access roads, substation site, and warehouse/control building sites. However, small quantities of construction-related fugitive dust emissions will also result from vehicles carrying equipment and workers up and down the existing Kaheawa access road. All of the construction-related emissions would be short-term and all except the highway vehicle emissions would occur away from existing development. Consequently, none

[38] It now appears possible that a contractor may wish to use on on-site crusher to produce properly sized gravel for select fill, particularly in the case of the Preferred Alternative. This would preclude the need to obtain the elsewhere and truck it to the site. It would also make it easier to balance the cut and fill. If this does occur, crusher operations might require a Temporary Covered Source Permit from the State Department of Health as provided for under Hawai'i Administrative Rules (HAR), Chapter 11-60.1 and State and Federal ambient air quality standards.

would be substantial so long as proper pollution control measures are implemented as part of the construction work. KWP II will limit fugitive dust emissions in compliance with HAR 11-60.1-33 (e.g., through the use of such measures as regular watering).

Use of heavy equipment and earth moving operations during this work will generate fugitive dust and internal combustion engine emissions that may have temporary impacts on local air quality. Specific information concerning the construction equipment that would be used will not be available until a construction contractor is selected. Consequently, overall construction emissions were estimated using engineers' estimate of construction duration (see Table 4.2) and screening emission rates and procedures recommended in the *Air Quality Handbook: A Guide For Assessing the Air Quality Impacts for Projects Subject to CEQA Review* (San Louis Obispo Air Quality Control District, April 2003) (see Table 4.3).

Table 4.2 Forecast Construction Disturbance (in acre-months)

Project Element	***Area (ac)***		***Months Disturbed***		***Acre-Months of Disturbance***	
	Pref. Alt.	***Alt. 2***	***Fully***	***Part***	***Pref. Alt.***	***Alt. 2***
Wind Turbine Generator (WTG)	21	21	1.5	0.5	42	42
Site Road	16	30	1.5	3	72	135
Permanent Meteorological Towers	0.2	2	0.5	0.5	0.2	2
Baseyard	2	2	1.5	1.5	6	6
Buried Collector System	4	3	0.2	0.2	1.6	1.2
Lay-Down Area	2	2	12	1.5	27	27
	45.2	60			148.8	213.2

Source: Preferred Alternative - SSFM September 28, 2009; Alternative 2 - AECOM April 21, 2009. Duration estimates by KWP II LLC.

Table 4.3 Screening Emission Rates for Construction Operations

Pollutant	*grams/Yds^3 of Material Moved*	*Lbs/ Yds^3 of Material Moved*	*Yds^3 of Material Moved*		*Emissions (lbs)*	
			Preferred Alt.	*Alt 2*	*Preferred Alt.*	*Alt 2*
Diesel PM	2.2	0.0049[1]	390,165	773,000[2]	1,916	3,790
Carbon Monoxide (CO)	138.0	0.304	390,165	773,000	118,610	224,050
Reactive Organic Gases (ROG)	9.2	0.0203	390,165	773,000	7,920	14,960
Oxides of Nitrogen (NO_x)	42.4	0.0935	390,165	773,000	36,480	68,910
Sulfur Oxides (SO_x)	4.6	0.010	390,165	773,000	3,902	7,370
Fugitive Dust (PM_{10})	0.75 tons/ acre-month o				116 tons	160 tons

Notes:
(1) These rates assume an average of 0.27 gallons of diesel fuel is burned for each cubic yard of earth moved.
(2) This preliminary estimate of earthwork includes both cut and fill volumes and is therefore conservative.

Sources: Bay Area Air Quality Monitoring District: *Guidelines for Assessing Impacts of Projects and Plans* - April 1996, and EPA-AP 42.

In view of the location of the work that would be undertaken under both alternatives and the fact that they are in an air quality attainment area, neither would result in significant adverse air quality effects so long as appropriate dust control measures are implemented. In order to minimize any adverse effect on air quality, KWP II will require construction contractors to take the following measures to avoid or minimize potential air impacts.

- Maintain all construction equipment in proper tune according to manufacturer's specifications.
- Fuel all off-road and portable diesel powered equipment, including but not limited to bulldozers, graders, cranes, loaders, scrapers, backhoes, generator sets, compressors, auxiliary power units, with motor vehicle diesel fuel.
- Maximize to the extent feasible, the use of diesel construction equipment meeting the latest certification standard for off-road heavy-duty diesel engines.
- Minimize the extent of disturbed area where possible.
- Use water trucks or sprinkler systems in sufficient quantities to minimize the amount of airborne dust leaving the site.
- Cover or continuously wet dirt stockpile areas containing more than 100 cubic yards of material.
- Implement permanent dust control measures identified in the project landscape plans as soon as possible following completion of any soil disturbing activities.
- Stabilize all disturbed soil areas not subject to re-vegetation, paving, or development using approved chemical soil binders, jute netting, or other methods.
- Lay building pads and foundations as soon as possible after grading unless seeding or soil binders are used.

- Limit vehicle speed for all construction vehicles moving on any unpaved surface at the construction site to 15 mph or less.
- Cover all trucks hauling dirt, sand, soil, or other loose materials.

4.3.2 OPERATIONAL PERIOD IMPACTS

Once operational, the proposed facilities have limited potential to affect air quality aside from the indirect benefits of reducing fossil fuel consumption and minor emissions from certain project-related activities such as maintenance work, vehicle-trips made by staff and vendors traveling to and from the site, and the operation of the electrical substation and BESS equipment. These are so limited that we have not attempted to quantify them.

4.3.3 INDIRECT EFFECTS ON AMBIENT AIR QUALITY

The proposed WTGs are intended to provide power that would otherwise be provided by the island's existing fossil fuel-fired generating units. This will significantly reduce emissions from MECO's existing fossil-fuel-fired power plants at Mā'alaea and Kahului and it will allow emissions from MECO's proposed new power plant at Waena to be less than would otherwise be the case (see Section 5.2 for discussion). These reductions would have a beneficial effect on air quality.

While it is estimated that KWP II will provide electricity that is equal to or less than the cost of the electricity that MECO would otherwise have available for sale to its customers, any potential change in electric rates resulting from the addition of this new electrical power generation would not markedly promote or discourage economic activity. Consequently, it would not lead to growth or changes in the character of economic activity (e.g., the opening of new industries not previously practical) that might have secondary air quality impacts.

4.4 HYDROLOGY AND WATER RESOURCES

4.4.1 PROJECT COMPONENTS WITH POTENTIAL IMPACTS ON HYDROLOGY

There are no streams, springs or ponds on either of the alternative WTG sites and no other hydrologic or water resources to be affected directly. During construction and operation of the wind farm, all water used on site would be trucked in, and the very small amounts of domestic waste that would be generated would either be collected in a septic tank or in portable toilets to be periodically trucked away for disposal at an approved facility. Because there is very little impervious surface in the proposed facilities, their presence would not measurably reduce groundwater recharge.[39] Hence, potential effects are limited to localized alterations in drainage patterns resulting from the construction of building pads and roads (see Section 4.4.2) and changes in water quality associated with development of presently undisturbed areas (see Section 4.4.3).

4.4.2 EFFECTS ON VOLUME AND ROUTING OF STORMWATER RUNOFF

Construction of the proposed facilities for either of the alternatives will involve substantial site grading and the construction of new site access roads that will alter the path taken by stormwater runoff. Drainage culverts will be constructed beneath these roads in order to maintain their integrity. While the facility will change the path of sheet flow across developed portions of the site, runoff that does not percolate into the ground or evaporate will continue to flow into the adjacent gulches.

[39] The only impermeable surfaces are the Operations/Maintenance Building, the BESS enclosure, the foundations of each of the WTGs, and concrete pads within the electrical substation. Altogether they total approximately 42,000 square feet, or about the size of 20 typical single-family homes. Moreover, because the impermeable surfaces are widely scattered, stormwater runoff from them will not be concentrated. Instead, it will flow onto adjacent permeable areas.

Because very little impermeable surface will be added, the proposed facilities will not significantly increase the volume of stormwater runoff that reaches established watercourses. Engineers have not yet prepared detailed calculations of the runoff, but preliminary estimates indicate that if the WTG pads are topped with course gravel, stormwater runoff from them may actually be less than it is at present.

4.4.3 EFFECTS ON STORMWATER RUNOFF QUALITY

The ground disturbance that will occur during construction of either of the alternatives will increase the potential for sediment and other pollutants present to become entrained in stormwater runoff and flow into adjacent gulches. Because the area to be disturbed is well over an acre, KWP II LLC is required to prepare a Notice of Intent for construction-related stormwater runoff pursuant to National Pollutant Discharge Elimination System (NPDES) regulations. The NPDES application will identify potential drainageways for runoff leaving the site. In the case of the Preferred Alternative, Malalowaiaole Gulch will receive most of the runoff from construction areas, with only the runoff from the Baseyard flowing into Manawainui Gulch. For Alternative 2, it would be Manawainui Gulch, Manawaipueo Gulch, Pāpalaua Gulch, Mokumana Gulch, and Ka‘alaina Gulch, all of which are dry gulches. The ultimate repository of runoff from either development alternative is the Pacific Ocean. The NPDES NOI-C application that is submitted to the Clean Water Branch of the State of Hawai‘i Department of Health will quantify the anticipated volume of runoff into each receiving water and identify Best Management Practices (BMPs) that will be used to prevent pollutants such as sediment, oil and gas, and concrete wash water from leaving the site via stormwater runoff. The remainder of this section estimates the nature of the anticipated changes and outlines the measures that KWP II will take to minimize sediment and other pollutant concentrations in the runoff from the property it will use.

The potential pollutants associated with construction activities and the BMPs that KWP II LLC will use to prevent them leaving the site are listed in Table 4.4.

In addition to the BMPs identified in Table 4.4, the following general construction management techniques will be implemented:

- Erosion and sediment control measures will be in place prior to initiating earth moving activities. Functionality will be maintained throughout the construction period.
- Clearing and grubbing will be held to the minimum necessary for grading, access and equipment operation.
- Existing vegetative ground cover will not be disturbed more than 20 days prior to scheduled construction work.
- Construction will be sequenced to minimize the exposure time of the cleared surface area.
- Temporary soil stabilization measures will be used on disturbed areas remaining exposed for more than 30 days.
- Disturbed areas will be protected and stabilized prior to initiating new disturbance.
- Control measures will be inspected once weekly during dry periods and repaired as necessary. Control measures will be inspected and repaired as needed within 24 hours after a rainfall event of 0.5 inches or greater in a 24-hour period. During periods of prolonged rainfall, daily inspection will occur.
- Records for all inspections and repairs will be maintained on site.
- Permanent soil stabilization (i.e., graveling or re-planting of vegetation) will be applied as soon as practical after final grading, as discussed in the draft *Kaheawa Wind Power II Post-Construction*

Revegetation and Restoration Plan that is reproduced in Appendix D. KWP II LLC will coordinate with DLNR regarding selection of appropriate species for re-vegetation.

Table 4.4 Potential Pollutants from Construction Activities & Proposed Control Measures

Pollutant	*Source/Activity*	*Control Measure (BMP)*
Vegetation/Rock	Excavation, Grubbing, Grading, Stockpiles	Silt Fences, Temporary Soil Stabilization
Soil/Sediment	Excavation, Grading, Stockpiles, Watering for dust control	Silt Fences, Protection of Stockpiles, Natural Vegetation, Sand Bags, Construction Entrance Stabilization, Temporary Soil Stabilization, Geotextile Mats (internal access road slopes), Avoid excess dust control watering
Oil and Gas	Construction Equipment, Vehicles	Regular vehicle and equipment inspection, Prohibition of on-site fuel storage, Drip pan for on-site tanker fueling, Spill kits
Construction Waste	Construction debris, select fill, paint, chemicals, etc.	Protection of stockpiles, Dumpsters, Periodic waste removal & disposal, Compaction & Swales (for rock fill), Containment Pallets (for chemicals).
Concrete Wash Water	Pouring of WTG foundations	Containment in Wash Water Pits, Silt Fences
Equipment & Vehicle Wash Water	Construction Equipment	Containment berms around equipment washing area, Off-site vehicle washing
Sanitary Waste	Portable Toilets or Septic Tank	Sanitary/Septic Waste Management
Note: Best Management Practices are adopted from and defined in the City and County of Honolulu's *"Best Management Practices Manual for Construction Sites in Honolulu"* (May 1999).		

4.5 NATURAL HAZARDS

As discussed in Section 3.5.1, all of the facilities included in the Preferred Alternative and in Alternative 2 are well outside the flood hazard areas identified in the FIRM maps and none are within the tsunami inundation zone. Hence, constructing either alternative as proposed would not increase the electrical system's exposure to these risks.

The facilities would be exposed to certain other natural hazards, however. Consequently, while they have been designed to meet all applicable codes and are outside of defined hazard zones, the WTGs, operation/maintenance building, substation, and site access roads are exposed to certain other risks, and these are discussed below. Because the exposure is the same, the discussion applies to both alternatives.

4.5.1 SEISMIC HAZARDS

As discussed in Section 3.5.2, the entire island of Maui is in Seismic Zone 2B, in which an earthquake with a force ranging from 0.15 to 0.20 g is expected to occur once every 50 years (USGS 1997). This designation was the governing seismic code for KWP I, and is within the design envelope of the GE 1.5se turbine utilized on that project and proposed to be used at KWP II. All the other structures planned as part of the project will conform to Seismic Zone 2B Building Standards, the level recommended by the U. S. Geological Survey.

Structural analyses conducted by the manufacturer suggest that the WTGs are capable of withstanding seismic forces well above those that the standards are intended to protect against. Hence, it would take an extremely rare seismic event to damage the facilities. In the event such an extreme event was to occur it could lead to the toppling of one or more towers. Because of the large separation (minimum 400 feet) between each of the WTGs and the WTGs' equally large separation from the substation, warehouse, and other above-ground facilities, there is no potential for the collapse of one tower to cause damage to others on the site.

4.5.2 HURRICANE AND HIGH WIND HAZARDS

As outlined in Section 3.2.4, Hawai'i is periodically exposed to tropical storms and hurricanes that impose high wind loads on structures. Recognizing this, KWP II LLC has adopted a standard operating procedure (SOP) for implementation in the event of a "Weather Emergency." The SOP stipulates that when the National Weather Service has issued a severe weather watch for the site (for events such as a hurricane, a tornado, or a severe thunderstorm), the operations manager or his designee will determine if the warning affects its site location, and if so, immediately warn employees of the pending emergency. In addition to warning, KWP II LLC's corporate policy calls for employees to be provided with shelter or to be sent to a safe place offsite. At the time of the warning, all employees are responsible for evacuating to their assigned shelters. Head counts will be taken to ensure all employees have reached an area of safe refuge. KWP II LLC employees, as well as all contractors and site visitors, are prohibited from accessing wind turbines during such emergencies until such time as it is deemed safe to do so by the operations manager.

The GE 1.5 MW WTGs proposed for the KWP II project are designed to operate (i.e., generate power) in wind speeds between 9 and 55 mph. At winds above that velocity the WTGs automatically cut out and the blades feather to an inactive position (i.e., perpendicular to the wind). The structural design of the WTGs allows them to withstand winds of at least 120 mph when the blades are in the feathered position. KWP II engineers' analysis of the available wind data indicates that winds in excess of the design speed are extremely rare at Kaheawa Pastures. Further, as of late 2008, GE reports that of the more than 5,000 of its turbines that have been erected worldwide, none of these have failed in a way that injured people or caused property damage to others.[40] Hence, KWP II LLC believes it is very unlikely that the equipment will be overstressed to the point of breakage during the 20-year project life span. In any event, the safety protocols described above, coupled with the distance of the facility from residences and other public areas make it virtually certain that an equipment failure would not cause significant damage to life or property (beyond the existing facilities at the site).[41]

[40] http://www.gepower.com/prod_serv/products/wind_turbines/en/15mw/index.htm

[41] The only non-KWP II owned facilities in the project area which could be affected by an equipment failure are the Lahaina Pali Trail (which would almost certainly be unused during periods of extremely high winds) and the existing MECO transmission lines. This, coupled with the already slim chances of a failure mean that risk to these facilities is extremely slight.

4.5.3 FAILURE FROM LIGHTNING STRIKE

Because of their height and location in generally open areas WTGs are subject to lightning strikes. The frequency of lightning tends to be lower in Hawai‘i than in many areas where WTGs have been erected, but it does occur. While the grounding systems that are inherent in their design minimize the potential for adverse effect from this source, there have been instances where lightning strikes have shattered blades. Most of the blades have stayed partially attached to the WTGs, but in a few instances broken pieces of blade have detached and been thrown some distance. In no case has the distance exceeded the distance that would result from the more catastrophic event described above.

4.5.4 FIRE HAZARD

4.5.4.1 Potential Exposure and Impacts

Construction Period. During construction of the project, ignition sources for accidental fires include errant sparks from a variety of vehicles, equipment and tools, and wrongly discarded matches and cigarette butts. These are of limited intensity, and under most conditions are unlikely to spark a grass or other fire. Fire-fighting equipment is maintained in work vehicles and at the existing KWP I operations building, and would be available if needed. While they are being constructed, the facilities will also continue to be at risk for the kinds of naturally occurring wildfires discussed previously in Section 3.5.3.

Operational Period. The WTGs and other facilities that will be present for the operating life of the facility do not contain equipment or involve activities that represent an unusual fire hazard. Nonetheless, the presence of petroleum-fueled mobile equipment (trucks, cranes, etc.), petroleum-based lubricants, and other flammable materials means that a slight potential for fire will exist that is not now present. The presence of the additional facilities also means that there will be a greater number of facilities exposed to naturally occurring wildfires than is currently the case.

If a fire does occur on (or spreads to) the proposed KWP II facility, some equipment damage is possible but is not expected to be significant.[42] The towers supporting the turbines are of 3/4-inch plate steel, mounted on concrete foundations; the interconnecting electrical systems are below ground; and the O&M facility will be constructed of noncombustible construction and exterior finishes (the building permit for the O&M facility will be reviewed by the County of Maui Department of Fire Control). Damage from fire could occur to the on-site substation and would potentially disrupt the facility's provision of electricity to MECO, though it would not jeopardize MECO’s ability to provide electricity services to its customers.

4.5.4.2 Proposed Fire Prevention and Response Measures

KWP II LLC has developed a detailed fire contingency plan for KWP II. The two most important preventive measures consist of educating all on-site contractors and personnel and properly maintaining all vehicles, equipment, tools, and turbine hardware.

Firefighting Equipment. During all phases of the project, basic on-site fire-fighting resources will include fire extinguishers in the O&M facility, at the substation, and in all project vehicles, and shovels and backpack pumps in the O&M facility and maintenance vehicles. During construction, firefighting resources will include the provision of fire extinguishers in all construction vehicles and trailers. Additionally, during some periods of construction, earthmoving equipment will be present on-site and able to assist in creating fire breaks. Lastly, water that is stored in the existing tank at the base of the access road can also be used for firefighting.

Maintenance of Fire Buffers. Existing vegetation in both of the alternative project areas consist of low brush and grass that is subject to relatively fast-moving fires of modest intensity and duration.

[42] The wildfire that affected the area in 2006 caused little damage to KWP I and did not interfere with its ability to supply electrical power to the grid.

During and after construction, KWP II staff will maintain (i.e., cut and/or clear) vegetation adjacent to key facilities. Cleared areas around each wind turbine, the O&M facility, and the substation/interconnection facility will be covered with gravel to assist in fire prevention and to form fuel breaks around individual project components. It will maintain the following minimum vegetation-free buffers:[43]

- O&M Facility – 30 feet.
- Substation and BESS – 30 feet.
- WTG concrete foundation pad – 20 feet.

Additional fire breaks/fuel breaks will be provided by project roadways running along the turbine array and from the highway to the project site. Areas that will be cleared during construction will be re-vegetated with species currently present on-site or otherwise appropriate plants that both (a) present limited hazards from a fire control perspective and (b) are non-attractions for wildlife.

Ongoing operation and maintenance of the completed project will involve routine checks of electrical connections, washing substation equipment as outlined in the final design specifications, and periodic infrared reconnaissance of electrical components to identify potential faults before they lead to a failure. As previously noted, all project vehicles will carry fire extinguishers. State and County emergency response personnel will be given unrestricted access to the area so that they can carry out their duties.

Ongoing Vegetation Management. The operator will coordinate closely with DOFAW to ensure that appropriate vegetation control is implemented. This may include creating fire breaks near the Manawainui Plant Sanctuary or elsewhere as necessary.

4.6 TERRESTRIAL FLORA

4.6.1 PROJECT COMPONENTS WITH POTENTIAL TO IMPACT FLORA

The principal means through which the project could affect terrestrial flora is through ground-clearing. These would occur during the construction phase. Factors related to the ongoing operation of the facilities (e.g., noise, vehicular traffic, and other emissions associated with the ongoing operation of the facilities) are so limited that they do not have the potential to cause significant effects of this nature.

4.6.2 EFFECTS ON TERRESTRIAL FLORA

As discussed in Section 3.6, all of the plant species identified on the Preferred Site and the 18 identified on the Alternative 2 site are widespread and fairly common in Hawai‘i. None is listed by the State or Federal government as a Threatened or Endangered species (USFWS 1999). Neither is any a candidate for such status or identified as species of concern (Hobdy 2006; Hobdy 2009). While the removal of the existing vegetative cover is not problematic from a protected species standpoint, it has ecosystem implications that cannot be ignored. The following sub-sections characterize the extent to which vegetation will be affected by the facility and describe the measures that KWP II will implement during construction and operation in order to assure that vegetation re-growth is reasonably rapid and is supportive of the State’s policy of encouraging the reintroduction of native species to areas that have been overrun by invasive species. This information is drawn in part from the Wild Land Fire Contingency Plan that is in place for KWP I. As the two alternatives are quite similar with respect to vegetation-related concerns, both alternatives are discussed together.

[43] The size of these buffers will be increased if deemed necessary by State forestry and/or County fire personnel.

4.6.2.1 Invasive Species Prevention/Control

The spread of invasive species at the expense of native vegetation is of widespread concern throughout the Hawaiian Islands, particularly in areas where previous pastoral or agricultural practices have eliminated the original native cover. Accordingly, KWP biologists are working actively to minimize and reduce the ingress of certain undesirable invasive plant species in accordance with the requirements of its Conservation District Use Permit. For instance, KWP I biologists co-established the Fireweed Working Group (FWG), a coalition of conservationists on Maui, to address the fireweed issue and its effect on the landscape of West Maui, including Kaheawa Pastures. The group is composed of representatives from the County of Maui, State of Hawaii, Maui Invasive Species Committee, KWP I, and other concerned parties. This issue has been a concern as fireweed appears to have increased at KWP I and elsewhere since the 2006 wildfires swept through the region. Together with the Working Group participants, KWP I has developed and implemented collaborative work plans that include manual removal and disposal of invasive plant species, coupled with substantial replanting of cleared areas with A‘ali‘i and other hardy native plant species that are fire-adapted and reduce fire risk, while continuing subsequent monitoring. The participants are sharing the findings of these kinds of trials, which do not rely on chemical treatments, with other land owners facing challenges with fireweed on Maui.

KWP II intends to continue measures to minimize and avoid the introduction of invasive species to the region during the proposed wind farm development. Accordingly, KWP II LLC will support and collaborate with the FWG on existing efforts to control and manage fireweed. These efforts include implementing measures during and after construction to reduce the likelihood of fireweed and other invasive species from being introduced to the area and include:

- Surveying areas proposed for expansion and ground clearing in advance to delineate proximity to established beds of fireweed;
- Implementing control and management initiatives aimed at excluding fireweed propagules on bare ground using manual and, where warranted, chemical treatments;
- Working in advance with local experts and stakeholders to obtain the best recommendations for control measures and to develop protocols for documentation and sharing results;
- Inspecting potential off-site sources of materials (gravel, fill, etc.), and prohibiting the import of materials from sites that are known or likely to contain seeds or propagules of invasive species;
- Requiring that vehicle operators transporting materials to KWP II from off-site follow protocols for removing soils and plant materials from vehicles and equipment prior to entry onto the site.

KWP II LLC will consult with the Hawai‘i Department of Agriculture and Maui Invasive Species Commission to establish protocols and training orientation methods for screening invasive species introductions. The Kaheawa Pastures region is particularly prone to the ingress of invasive flora in part due to its propensity for periodic wildfire inundation and the widespread occurrence of aggressive pasture weeds. The area receives a significant amount of wind-borne seed material from adjacent lands that harbor undesirable invasive species capable of quickly becoming established in disturbed (burned) landscapes. The invasive flora challenges at Kaheawa affect each rangeland and pasture manager in Hawai‘i and are being approached at Kaheawa based on the best management and scientific advice available while adhering to previously established requirements for the facility.

4.6.2.2 Revegetation

Approximately one-third of the 43-acres that would be disturbed under the Preferred Alternative, and one to two-thirds of the approximately 60-acre area for Alternative 2, will be revegetated upon completion of earthwork. The remainder will have either a gravel or concrete cover. As discussed in detail in the draft revegetation plans in Appendix D, KWP II proposes to do one stage in the Preferred Alternative and two stages for Alternative 2.

Source: KWP, LLC (2008)

Photo above depicts several native plant species successfully outplanted on a turbine cut slope at KWP I as part of long-term revegetation efforts.

4.6.2.2.1 Immediate Revegetation for Both Alternatives

The first stage entails immediate revegetation of disturbed areas to minimize soil erosion/maximize soil development and retention. At the time the February, 2009 DEIS was published, KWP II LLC was proposing to use Kikuyu grass for revegetation as Alternative 2 as it is a naturalized species that occurs at Kaheawa Pastures, emerges quickly and becomes easily established as a ground cover. However, in response to comments received that Kikuyu grass has the potential to displace native plant communities, KWP II has eliminated Kikuyu grass from its plans. Instead, it proposes applying annual ryegrass to areas of exposed soil along the edges of turbine pads and along road cuts and fill slopes for immediate revegetation for both alternatives. Annual ryegrass was selected for erosion control because it provides rapid initial vegetation cover and forms an extensive, dense, yet relatively shallow root system (Valenzuela and Smith 2002). This species is expected to gradually die back and allow natural recruitment of neighboring species or species present in the seed bank. Hydroseeding with annual ryegrass will require supplemental irrigation for a 90-day period and monitoring to ensure establishment of stabilizing cover.

If it is determined that excessively steep areas require additional erosion control, annual ryegrass may be combined with out-planting of hardy native seedlings, as feasible. The specific species, sizes, and quantities of native out-plantings will be determined based on site-specific factors such as slope, erosion potential, and the size of the area.

4.6.2.2.2 Long-Term Revegetation for Alternative 2

Plans to approach the long-term revegetation of the Alternative 2 site will follow the native plant reintroduction efforts that have proven successful at the existing KWP I facilities. Due to the disturbed condition and the lack of rare or sensitive native plant species or habitats on or near the Preferred Alternative area (Hobdy 2009), long-term native plant restoration is not considered a goal in its revegetation plan. Because the Alternative 2 area is situated further uphill closer to native vegetation, KWP II LLC proposes to re-introduce native plants in discrete locations within the Alternative 2 area over several years. This will be done with the intent of eventually re-establishing some of the key elements of the plant communities that historically existed on the site. This phase will involve collecting native seeds and cuttings in the area, propagating these species at local nurseries, and subsequently outplanting these species at the site. Native species that may potentially be used during this phase include ‘a‘ali‘i (*Dodonaea viscosa*), pili grass (*Heteropogon contortus*), ‘ulei (*Osteomeles anthyllidifolia*), and ‘ilima (*Sida fallix*). These relatively fast-growing and easily propagated species provide excellent root structure for maintaining surface substrate retention as well as provide a native seed source for the project area. The specific species, sizes, and quantities of native out-plantings will be determined based on site-specific factors such as slope, erosion potential, and the size of the area.

Because this phase will occur after the immediate revegetation phase, many of these plantings will be installed in or adjacent to areas that were previously stabilized with Annual ryegrass mixture and temporary measures (e.g., coir mats and logs). KWP II LLC will consult with the Hawai‘i Department of Agriculture, the Maui Invasive Species Commission, and other experts for long-term revegetation of disturbed areas and make a concerted effort to follow their recommendations.

4.7 TERRESTRIAL & AVIAN FAUNA

4.7.1 IMPACTS ON MBTA AND NON-PROTECTED SPECIES

Based on preliminary plans, KWP II estimates that the Preferred Alternative will affect approximately 43 acres, most or all of which is presently vegetated with the array of grasses and low shrubs described in Section 3.6. Of this area, approximately one-third will be revegetated following construction, In the Alternative 2 project area, approximately 60 acres will be affected and of that, approximately two-thirds will be revegetated following construction. Both alternatives will result in the permanent conversion of the remaining areas to structures, gravel, rock and other unvegetated surfaces. The unprotected species that use these areas are mostly exotic, and the amount of suitable habitat that will be converted is a very small part of the total range available to them. Further, unvegetated soil and rocky land is a common component of the local landscape already, and the incremental reduction in vegetated area will not measurably reduce the carrying capacity of the site for these species.

MBTA and non-protected species may occasionally collide with the operating wind turbines, other structures, or be struck by vehicles operating on the site. In the first three and half years of operation, fatalties of six individuals of non-protected species have been documented at the KWP site, due to turbine collision or other causes: two ring-necked pheasant (*Phasianus colchicus*), two barn owl (*Tyto alba*), and two spotted doves (*Streptopelia chinensis*). One fatality of a short-eared owl (*Asio flammeus sandwichensis*), which is protected under MBTA, was reported along the access road - cause of death was likely a vehicle collision. Fatalities of a similar or lesser magnitude are likely to occur at the KWP II project, commensurate with the smaller number of turbines. Such levels of take will not adversely affect local or regional populations of these species.

4.7.2 IMPACTS ON ESA-PROTECTED SPECIES

The potential for wind energy turbines to affect birds and bats adversely is well-documented in the continental United States (e.g., Horn et al. 2008, Kunz et al. 2007, Kingsley and Whittam 2007, Kerlinger et al. 2005, Erickson 2003, Johnson et al. 2003a, 2003b). Moreover, a low level of take has occurred at the KWP I wind farm. Consequently, KWP II LLC anticipates that the incidental take of four listed species (Hawaiian Petrel, Newell's Shearwater, nēnē, and Hawaiian Hoary Bat) may potentially occur as a result of the construction and operation of the proposed project. As discussed in Section 3.7.2, these species are known to be present in both of the siting areas being considered and could be injured or killed if they collide with WTGs, temporary and permanent met towers, overhead collection lines, construction equipment, or other proposed facilities.

Estimates of the potential for each of these protected species to collide with KWP II project components (i.e., "direct take") were prepared using the results of on-site surveys, information about the Preferred Alternative and Alternative 2 project designs, and the results of ongoing post-construction monitoring at the adjacent KWP I facility (ABR January 2009 and SWCA October 2009). The seabird fatality estimate models developed for KWP I and adapted for the proposed KWP II project incorporated rates of species occurrence, observed flight heights, encounter rates with turbines and met towers, and also estimated the ability of birds to avoid project components.[44] SWCA also estimated the level of "indirect take" that would occur. Indirect take occurs when a bird that is directly taken is tending to eggs, nestlings, or dependent fledglings (or in the case of bats has dependent juveniles) and the death of the adult leads to the loss of the eggs or dependent young. Loss of eggs or young would be "indirect take" attributable to the proposed project and are factored into the take estimates for the alternative sites.

Table 4.5 presents the baseline annual take estimates anticipated for each species based on modeling and the best available scientific information.[45] In order to account for the effects of unobserved direct take and to comply with the recommendations of DLNR and the Endangered Species Recovery Committee (which recommend that annual take limits allow for at least one observed take per year), the baseline take level for which KWP II LLC is requesting authorization under an ITP and ITL is higher than the actual anticipated take (see Table 4.6).

As shown by Table 4.5, the estimated mortality resulting from the project is very low, commensurate with the very low level of observed bird and bat activity at both the Preferred and Alternative 2 sites and low documented mortality at KWP I. The following subsections discuss the bases of the take estimates for each of the four protected species.

[44] The fatality estimates for KWP II also take into account "unobserved direct take" based on searcher efficiency and scavenging trial results. This will account for individuals that may be killed by collision with project components but that are not found during the monitoring effort. It is generally accepted that some birds and bats killed through collision with wind turbines are not found by searchers for various reasons, including heavy vegetation cover and scavenging.

[45] The HCP for KWP II also identifies annual take scenarios (and associated mitigation measures) that are lower and higher than the baseline take levels presented here. The other take levels are included in the HCP to allow for the probability that annual take from the project may vary, and that over time take from the proposed facility could be shown to be less or greater than Baseline, thus requiring KWP II LLC to adapt its mitigation program. These take levels (and their associated mitigation programs) would come into effect only in the event that post-construction monitoring shows lower or higher take levels after a period of five years and are discussed in detail in the HCP.

Table 4.5 Estimated Take of Protected Species at KWP II

Species	*Expected Rate of Take*			
	Preferred Alternative		*Alternative 2*	
	Annual Average	*20-Year Project Life*	*Annual Average*	*20-Year Project Life*
Nēnē	0.55 adults and 0.05 fledglings	11 adults and 1 fledgling	0.76 adults and 0.07 fledglings	16 adults and 2 fledglings
Hawaiian Petrel	0.83 adults and 0.83 chicks	17 adults and 17 chicks	0.39 adults and 0.39 chicks	8 adults and 8 chicks
Newell's Shearwater	0.50 adults and 0.23 chicks	10 adults and 5 chicks	0.22 adults and 0.10 chicks	5 adults and 2 chicks
Hawaiian Hoary Bat	0.33 adults and 0.59 juveniles	7 adults and 6 juveniles	1.25 adults and 2.25 juveniles	25 adults and 23 juveniles
Source: SWCA (January 2009, October 2009)				

Table 4.6 Requested Authorized Take of Protected Species at KWP II

Species	*Requested ITP/ITL Take Authorization*			
	Preferred Alternative		*Alternative 2*	
	Annual Limit	*20-Year Project Life*	*Annual Limit*	*20-Year Project Life*
Nēnē	2 adults and 1 fledgling	18 adults and 2 fledglings	2 adults and 1 fledgling	24 adults and 12 fledglings
Hawaiian Petrel	2 adults and 2 chicks	20 adults and 20 chicks	2 adults and 2 chicks	20 adults and 20 chicks
Newell's Shearwater	2 adults and 1 chick	14 adults and 7 chicks	2 adults and 1 chick	20 adults and 10 chicks
Hawaiian Hoary Bat	4 adults and 3 juveniles	20 adults and 15 juveniles	5 adults and 3 juveniles	40 adults and 24 juveniles
Source: SWCA (January 2009, October 2009)				

4.7.2.1 Hawaiian Petrel

4.7.2.1.1 Risk of Hawaiian Petrel Collision with WTGs

KWP I and KWP II LLC have commissioned several independent studies using visual observations, ornithological radar, and other data to estimate the movement rates for Hawaiian Petrels and Newell's Shearwaters through the site during the roughly eight month spring-fall breeding season when these birds are present in the area. Most of these (Cooper and Day 2004b; Day and Cooper 1999, Sanzenbacher and Cooper 2009) focused on the KWP I and Alternative 2 areas. However, the Preferred Alternative area has also been surveyed, most recently in Summer 2009 (Cooper and Day 2009), and Fall 2009 (Cooper and Sanzenbacher in prep).

The primary objective of the studies was to document movement rates of Hawaiian Petrels and Newell's Shearwaters over the two WTG siting areas (Preferred and Alternative 2) under consideration. The movement rates were then used to derive estimated annual fatality rates of petrels/shearwaters at the proposed turbine tower locations. Fatality estimates also took into account avoidance rates, which represent the proportion of birds that will detect and actively avoid turbines upon encountering them.

Preferred Alternative: Cooper and Day's Summer and Fall 2009 study of the Preferred site (see Appendix H for complete report) documented movement rates of Hawaiian petrels and Newell's

shearwaters over the Preferred Alternative project area during the nesting and fledging period.[46] These movement rates were then used to estimate annual fatality rates of petrels/shearwaters at the proposed WTG locations.[47] Cooper and Day (September 2009) prepared fatality estimates for avoidance rates of 90 percent, 95 percent and 99 percent because previous studies have indicated a high rate of avoidance of power lines and communication towers for these species that is consistent with this range (Cooper and Day 1998, TetraTech 2008).[48] They forecast that this avoidance behavior would enable the species to avoid WTGs the vast majority of the time. Taking this into account, Hawaiian petrel fatality estimates range from 0.015 – 0.20 birds per turbine per year, or 0.21to 2.73 birds per year for all 14 turbines combined based on 90 percent, 95 percent and 99 percent avoidance rates.[49]

In order to assess which of these three different avoidance rates best matches actual experience, SWCA reviewed the data collected during the first 3.5 years of operation of the existing KWP I wind farm, where the average annual total direct take of Hawaiian petrels was approximately 0.5 bird/year. KWP I is the only operating wind energy generating facility in Hawai‘i where activity patterns and mortality of Hawaiian Petrels and Newell’s Shearwaters are consistently being studied. Using that measured take, they then “worked backwards” through the modeling to estimate that the species probably exhibited an avoidance rate of approximately 97.5 percent. Therefore, for the purposes of estimating fatality rates at the Preferred Alternative site, a 97.5 percent avoidance rate was used with the seabird fatality modeling from Cooper and Day (2009). This resulted in an estimated fatality rate for Hawaiian petrels of 0.049 birds/turbine/year or 0.69 adult birds/year for all 14 turbines combined. SWCA also estimated direct take from the permanent meteorological monitoring tower at 0.036 birds per year (assuming a 95% avoidance rate). These results are summarized in the top half of Table 4.7.

Table 4.7 Seabird Mortality Estimates

Alternative	***Estimated Average Mortality / Year***			
	Hawaiian Petrel		***Newell’s Shearwater***	
Preferred Alternative				
Direct Take from Turbines (97.5% avoidance rate)	0.69		0.38	
Direct Take from Met Tower (95% avoidance rate)	0.036		0.02	
Direct Take from Collector Line	0.10		0.10	
Indirect Take	0.83		0.23	
Total Take	1.66		0.73	
Alternative 2	***1 Met Tower***	***2 Met Towers***	***1 Met Tower***	***2 Met Towers***
Direct Take from Turbines (97.5% avoid.)	0.16	0.16	0.09	0.09
Direct Take from Met Towers (95% avoid.)	0.12	0.23	0.07	0.13
Indirect Take (at 1.0 * direct take)	0.28	0.39	0.07	0.10
Total Take	***0.56***	***0.78***	***0.23***	***0.32***
Source: Compiled by SWCA (September 2009)				

[46] A Fall 2009 study to document passage rates during the fledging period was recently completed and results are in preparation.

[47] Because the visitation rates by adults to feed their chicks decline as much as 80 percent in the last quarter of the nestling period (Simons 1985), the passage rate over the Preferred Alternative site in Fall 2009 is expected to be significantly lower. Consequently, the mortality estimates presented here are a conservative overestimate and can be expected to decrease when data from the Fall study are available and incorporated into the models.

[48] Avoidance rates represent the proportion of birds flying near the WTGs that will alter their flight paths to avoid them.

[49] Cooper and Day (September 2009) “used the timing of inland flights at the nearby Ukumehame site from Cooper and Day (2003) to correct for proportions of targets that were Hawaiian petrels and those that were Newell’s Shearwaters; those data suggest that 60% of the targets were Hawaiian petrels and 40% of the targets were Newell’s Shearwaters;….”

Alternative 2: Sanzenbacher and Cooper (January 2009) had previously prepared Hawaiian Petrel fatality estimates for the Alternative 2 site using the same methodology that Cooper and Day (2009) had used for the Preferred Site. Their mortality estimate (prepared at a time when less data had accumulated from KWP I) assumed a 95 percent avoidance rate. For the purpose of this report the calculation was updated using the same 97.5% avoidance rate for WTGs and 95% avoidance for met towers employed for the Preferred Site.[50] The direct seabird take estimates for Alternative 2 are summarized in the bottom half of Table 4.7.

4.7.2.1.2 Other Direct Take of Hawaiian Petrels

In addition to collisions with turbines and met towers, some limited potential exists for Hawaiian Petrels to collide with cranes during the construction phase of the project for either alternative. Cranes used during construction are typically comparable in height to the turbine towers (Kaheawa Wind Power, LLC 2006). However, the construction phase is expected to last six to eight months, with cranes active on-site for only three to four months. Moreover, during that period and at other times when cranes are present, their booms will be lowered and stored in a horizontal position during the hours when Hawaiian Petrels are transiting the area. Hence, the potential for Hawaiian Petrels to collide with cranes during construction is negligible.

A crane will permanently be available for KWP II (probably shared with KWP I) for maintenance purposes and will be present at KWP II as needed. Except for emergencies, this crane would be used only during the day and stored in its horizontal position when not in use and at night. Consequently, this crane is not considered to pose a collision threat to Hawaiian Petrels. No Hawaiian petrels were reported to have collided with cranes during construction of KWP I.

Some potential exists at the Preferred Alternative site for Hawaiian petrels to collide with the 1,225- to 1,570-foot long overhead electrical collection circuit that KWP II proposes to install across the small unnamed gulch above the Preferred Site the project area (see Figure 2.4). As described in Table 2.4, this circuit would consist of two 3-wire circuits (each arranged vertically) plus a lightning arrestor wire (i.e., four levels) mounted on poles that extend no more than 80-90 feet above ground. Observation of Hawaiian petrels on Kaua‘i by Day *et al*. (in review) suggests that collision avoidance rates of power lines by Hawaiian petrels is very high (out of 207 birds observed flying near power lines, 40 birds exhibited collision avoidance responses and no birds collided with lines). Rather than assume a value of zero (which might be justified given the fact that the lines would be largely below the surrounding terrain, SWCA assigned a value of 0.1 birds/year (one bird every ten years). The collection line will be outfitted with marker balls to maximize its visibility and minimize the potential for avian collisions.

Construction or maintenance vehicles may very occasionally strike downed petrels (birds already injured by collision with turbines or towers) while traveling project roads. Project personnel will be trained to watch for downed petrels and other wildlife and speed limits (10 mph) will be enforced to minimize potential for vehicular strikes to result in death of birds that otherwise might have been able to be rehabilitated. As these birds have already been accounted for in the direct take estimates, no adjustment is needed.

4.7.2.1.3 Indirect Take of Hawaiian Petrel

Adult birds have potential to collide with turbines and associated structures while commuting between nesting and feeding grounds during the pre-laying period (late February to April) and incubation or chick-feeding periods (May through October). If they do, the death of the adult can

[50] Sanzenbacher and Cooper’s study modeled fatality based on 55 meter guyed lattice towers. The design has since changed to include 65 m guyed lattice towers. Consequently, the fatality estimates provided by Sanzenbacher and Cooper (2008) were modified to reflect the change in horizontal exposure due to the increased footprint of the taller met tower. The footprint was increased beyond its maximum expected size to provide a conservative estimate of fatality rates in the interim. It is expected that current interim fatality estimate will be a slight over-estimation of the expected fatality rate.

lead to the death of a chick as well. Table 4.7 accounts for this "indirect take"; the basis for the estimate is discussed below and summarized in Table 4.8, which is applicable to both alternatives (SWCA 2009).

Table 4.8 Calculation of Indirect Take for Hawaiian Petrel

Hawaiian Petrel	*Season*	*Average no. of chicks per pair (A)*	*Likelihood of breeding (B)*	*Parental contribution (C)*	*Indirect take (A*B*C)*
Adult (M/F)	May-Aug	1	0.89	1.0	0.89
Adult (M/F)	Sept	1	1.0	1.0	1.0
Adult (M/F)	Oct	1	1.0	0.5	0.5
Adult (M/F)	Nov - Apr	--	0.0	--	0.0
Immature	All year	--	0.0	--	0.0
Source: Draft KWP II HCP (SWCA, 2009).					

The likelihood that offspring will survive the death of a parent is a function of the time at which the parent is lost. Both parents alternate incubating the egg (May-June), allowing one or the other to leave the colony to feed. Therefore, during the egg-laying/incubation period both parents are essential for the successful hatching of the egg (Simons 1985). Both parents also contribute to the feeding of chicks. Chicks are fed 95 percent of the total food they will receive from their parents within 90 days of hatching (Simons 1985); in the case of Newell's Shearwaters this is generally by the end of September. After this time, it is likely that many chicks could fledge successfully even without further parental care.[51] Consequently, it is considered probable that after this time many chicks would also be capable of fledging if subsequent care was provided by only one parent. Based on this, for the purposes of this assessing indirect take, both parents are considered essential to the survival of a Hawaiian petrel chick through September, but it is assumed that a chick has a 50% chance of fledging successfully if adult take occurs in October.

Not all adult Hawaiian Petrels visiting a nesting colony breed every year. Simons (1985) found that 11 percent of breeding-age females at nesting colonies were not breeding. Most non-breeding birds and failed breeders leave the colony for the season by mid-August (Simons 1985). Therefore, SWCA estimates that there would be an 89 percent chance that an adult petrel taken from May through August was actually breeding, but a nearly 100 percent chance that birds taken in September or October would be tending to young. Based on these life history parameters, indirect take would be assessed at the rate of 0.89 chicks per adult taken between May and August, 1.0 chicks per adult taken in September, and 0.50 chicks per adult taken in October (see Table 4.8).

4.7.2.1.4 Population-Level Impacts on Hawaiian Petrels

There are estimated to be a total of 20,000 Hawaiian Petrels with 4,000 to 5,000 breeding pairs (Mitchell et al 2005). The seabird colony at Haleakalā, Maui is composed of as many as 1,000 nesting pairs, or approximately one-fifth to one-quarter of the breeding population (Mitchell et al. 2005, Tetra Tech EC, Inc., June 2008). For the expected KWP II baseline take level, SWCA (2009) concluded that the risk of adverse effects to Hawaiian Petrel at the population level is low.

Predation by introduced mammals and downing due to urban lighting are considered the primary threats to recovery of Hawaiian Petrel. The proposed mitigation measures described in Section 4.7.4

[51] Simons (1985), for example, reports that some chicks have survived and fledged up to three weeks after having been abandoned by their parents.

and in the Draft HCP for KWP II are expected to more than offset the anticipated take and contribute to recovery of the species by providing a net conservation benefit, as required by State law. For this reason, no significant adverse impacts to the species' overall populations, and no significant cumulative impacts to the species, are anticipated. With the low expected rate of take, the proposed mitigation measures are expected to produce a measurable net benefit in the form of a marginal increase in the population of Hawaiian petrels.

4.7.2.2 Newell's Shearwater

4.7.2.2.1 Risk of Newell's Shearwater Collision with WTGs and Met Towers

Preferred Alternative: SWCA (2009) prepared fatality estimates for Newell's shearwater using the same methodology employed for the Hawaiian petrel. Those estimates are summarized on the right-hand side of Table 4.7. They indicate a direct take of this species by the WTGs of 0.38 birds per year and a direct take for one permanent un-guyed 213-foot (65-m) lattice met tower of 0.020 birds per year.

Alternative 2: SWCA's estimates of Newell's Shearwater fatalities from Alternative 2 are summarized in the right-hand bottom portion of Table 4.7. The average Newell's Shearwater fatality rate is 0.09 birds per year for all 14 turbines combined. Approximately 0.13 birds per year for both met towers were estimated based on Sanzenbacher and Cooper (2008) and an avoidance of 95 percent.

4.7.2.2.2 Other Direct Take of Newell's Shearwaters

For the reasons discussed above in Section 4.7.2.1.2, the potential for Newell's Shearwaters to collide with construction cranes is considered negligible. The possibility does exist for collisions for Newell's shearwaters to collide with the short overhead electrical collection line that crosses the gulch at the upper portion of the project area, but is expected to be very low. For the purpose of this report, it was assumed to be the same 0.1 birds/year (one bird every ten years) as that used for Hawaiian Petrel.

4.7.2.2.3 Indirect Take of Newell's Shearwater

Newell's Shearwaters exhibit flight patterns that are similar to those of Newell's Shearwaters and are, therefore, most likely to collide with turbines or associated structures while commuting between nesting and feeding grounds during incubation and chick-feeding periods. This is generally during the same period as the Hawaiian Petrel. Based on the above, an indirect take assessment would be applied to any adult shearwaters found directly taken from June through October. Indirect take would not be assessed to adult shearwaters found at other times of year or applied to immature shearwaters. As with Hawaiian petrels, both shearwater parents care for their eggs and chicks. As little information is available for Newell's Shearwaters on nestling growth and development or adult visitation rates, it is assumed that both parents are necessary throughout the breeding season for successfully fledging a chick. Indirect take would be applied at the rate of 0.46 chicks per adult. The calculation used to reach this number is presented in Table 4.9 below.

Table 4.9 Calculation of Indirect Take for Newell's Shearwater

Newell's Shearwater	*Season*	*Average no. of chicks per pair (A)*	*Likelihood of breeding (B)*	*Parental contribution (C)*	*Indirect take (A*B*C)*
Male	Jun-Oct	1	0.46	1.0	0.46
Female	Jun-Oct	1	0.46	1.0	0.46
Adult	Nov - May	--	0.00	--	0.00
Immature	All year	--	0.00	--	0.00
Source: Draft KWP II HCP (SWCA 2009).					

4.7.2.2.4 Population Level Impacts on Newell's Shearwaters

The most recent population estimate of Newell's Shearwater was approximately 84,000 birds, with a possible range of 57,000 to 115,000 birds (Ainley et al. 1997). However, radar studies and population modeling have indicated that the population of Newell's Shearwater is likely on a decline especially on Kaua'i (Ainley et al. 2001, Day and Cooper 2003a). Declines in Newell's Shearwater populations are attributed to loss of nesting habitat, predation by introduced mammals (mongoose, feral cats, rats, and feral pigs) at nesting sites, and fallout of juvenile birds associated with disorientation from urban lighting (Ainley et al. 1997, Mitchell et al. 2005, Hays and Conant 2007).

At KWP II, because a direct take of less than one Newell's Shearwater per year is expected, the take is not expected to exacerbate the apparent decline of the species. Moreover, the proposed mitigation measures described in Section 4.7.4 and the other provisions in the HCP for the project are expected to more than offset the anticipated take and contribute to the species' recovery by providing a net conservation benefit, as required by State law. For this reason, no significant adverse impacts to the species' overall population, and no significant cumulative impacts to the species, are anticipated.

4.7.2.3 Nēnē

4.7.2.3.1 Nēnē Collision Risk

General: Nēnē at KWP I commonly display avoidance behavior and maneuverability in the vicinity of project structures and moving rotors (Spencer pers. comm., Kaheawa Wind Power 2008b, 2008c). While this indicates that the geese generally see and avoid the WTGs, three nēnē mortalities from wind turbine collisions have been documented since June 2006, when the 20 KWP WTGs became operational. The first incident in October, 2007 occurred during an ordinary period of strong trade winds. The second and third incidents were closely correlated with abrupt changes in local weather that included increases in local wind speeds and cloud cover associated with large scale weather events that may have significantly reduced visibility of the WTGs.

Preferred Alternative: It is estimated in the KWP II Draft HCP that the total direct take at this facility after 3.5 years of operation is 1.45 birds/year or 0.073 birds/turbine/year (SWCA, 2009). As nēnē are encountered less frequently in the Preferred Alternative area than at KWP I (35 percent of all nēnē sightings have been made in the Preferred Alternative area vs. 65 percent of sightings at KWP I), the risk of nēnē colliding with the turbines is assumed to be 0.54 (=35/65) times the risk at KWP I per turbine. This results in an expected mortality of 0.039 birds/turbine/year or 0.55 birds/year for all 14 turbines combined.

Alternative 2: As indicated above, the estimated total direct take at the KWP I facility after 3.5 years of operation has been 0.073 birds/turbine. Assuming that the fatality rate per turbine at the Alternative 2 site would be similar to that realized at KWP I, the estimated rate of direct take of nēnē at KWP II is 1.02 birds/year for all 14 turbines combined (0.073 x 14).

4.7.2.3.2 Other Direct Take of Nēnē

In addition to collisions with WTGs, some potential theoretically exists for nēnē to collide with other facilities and equipment. For reasons summarized below, such take is expected to be minimal.

- No nēnē have been found to have collided with any cranes or other construction and maintenance equipment on the KWP I site during the more than four years that have passed since work began. The one permanently stationed crane is not expected to pose a collision threat to the nēnē because it will be used only during the daytime and stored in a horizontal position when not in use.
- To date, no nēnē have been found to have collided with met towers at KWP I or during investigations at the other locations where met towers have been erected and maintained.
- Nēnē should also be able to avoid collisions with the overhead collection lines while flying and the new collection lines, at the Preferred Alternative site, will be strung with marker balls to increase

their visibility. No nēnē collisions with the transmission lines already on site have been documented thus far.

- Because nēnē are comparatively large birds, staff training is good, and speed limits are low (maximum 10 miles per hour), the potential for construction or maintenance vehicles to strike nēnē is considered to be negligible.

Concerns that revegetation measures conducted on-site may present foraging opportunities for nēnē, thereby attracting nēnē to the vicinity of the turbines, have arisen during discussions with DLNR and USFWS. However, as observations by KWP biologists show that nēnē are attracted mainly during the emergent phase of the grasses, the revegetation measures will be a source of attraction for only a short period of time. As most, if not all, of the grow-in time will be before the WTGs are operational the attraction risk to nēnē due to revegetation with grasses is considered minimal.

4.7.2.3.3 Ground Displacement of Nēnē

General: The total area expected to be disturbed by turbine pads, roads, and other project-related facilities is approximately 43 acres out of the 143-acre Preferred Alternative project area and 60 acres out of the 333-acre Alternative 2 project area. Disturbed areas currently support vegetation that provides browsing opportunities and shelter for nēnē. Biologists with KWP I have been working cooperatively with Maui DOFAW personnel and routinely exchange information useful for estimating annual productivity, overall survival, and factors limiting natural productivity of nēnē in the Kaheawa region. For the first year of project operations, KWP I biologists performed surveys to evaluate the degree of interaction between nēnē and wind turbines and to evaluate how nēnē used portions of the KWP I site throughout the year. Many of these observations extended to adjacent areas, including the two areas now being considered for KWP II.

Preferred Alternative: Portions of the expected disturbed area currently support vegetation that provides browsing opportunities and shelter for nēnē. For the first 3.5 years of KWP operations, KWP and DOFAW biologists have observed nēnē using portions of the KWP and the Preferred Alternative area and nesting successfully within and adjacent to the area leased for KWP with no evidence of displacement. These observations suggest that nēnē can readily adapt to the presence of WTGs and continue to utilize habitat in the vicinity if it meets their requirements.

After surveying the area, KWP biologists have concluded that the habitat in the vicinity of the Preferred Site does not meet the nesting and nutritional requirements for nēnē nearly so well as that in the KWP I area. Unlike the vegetation in the KWP I project area, vegetation in the Preferred Alternative area is dominated by windblown, fire-adapted grasses with some scattered shrubs and trees in the gullies. Hobdy (2009) identified 15 native species in the area, although none of these provides adequate shrubland habitat to support nēnē nesting requirements. During the winter months, the bunch grass-dominated pastures produce greater numbers of seedheads, which may create a short-term source of browse for some birds. However, the absence of suitable nesting habitat and the low nutritional quality of most plant species common in the area have probably discouraged nēnē from becoming more established in this project area. Therefore, while the permanent conversion of over 20 acres of open field habitat for KWP II project-related purposes may reduce the amount of suitable habitat available for nēnē in the project area to some degree, KWP biologists have concluded that the magnitude of the change make it unlikely that it will displace any substantial part of the resident population.

Alternative 2: This area is located closer to the existing captive breeding pen, and KWP I and DOFAW biologists observe Nēnē using portions of the KWP I and the Alternative 2 area throughout the year with no evidence of apparent or direct displacement by the operating WTGs or support facilities (Kaheawa Wind Power 2008; DLNR, unpublished data). Annual surveys indicate that nēnē continue to nest successfully within the area leased for KWP I. Annual recruitment among this population remains poorly understood; however, no decline in overall productivity is apparent at this time (DLNR pers. comm.). Hence, while the permanent conversion of over 30 acres of open field

habitat that would result from implementation of this alternative would slightly reduce the amount of suitable nēnē habitat available for in the project area, the magnitude of the change is small. KWP biologists consider unlikely that it will displace any substantial part of the resident population.

4.7.2.3.4 Indirect Take of Nēnē

For several reasons, KWP biologists believe that adult nēnē are most likely to collide with turbines and associated structures during non-breeding periods (May through July) or at the end of their breeding period when the adults and young may travel as family groups. Nēnē are highly territorial during the breeding season (Banko et al. 1999) and males are likely to be defending nesting territories while the females are incubating. Upon hatching, both parents would be attending to heavily dependent young; adult nēnē also molt while in the latter part of their breeding period and are therefore flightless for 4 to 6 weeks (USFWS 2004a). These adults attain their flight feathers at about the same time as their goslings (USFWS 2004a). Consequently, such birds are more likely to be in flight within the project areas only when goslings have already fledged.

Indirect take of dependent young occurs only when adult nēnē are killed during the breeding season (August to April). Dead adults found during the months of October through March will be assumed to have had a 60 percent chance of having been actively breeding because 60 percent of the population has been recorded to breed in any given year (Banko et al. 1999). Adult nēnē that die outside the peak breeding season (April, August, and September) are estimated to have had a 25 percent chance of breeding. Male and female nēnē care for their young fairly equally, so indirect take would be assessed equally to the direct take of any male or female adult nēnē found during the breeding season. Because breeding nēnē are not expected to collide with WTGs prior to the fledging of their young, it is assumed that the number of young possibly affected by loss of an adult would be based on the average number of fledglings produced per pair (studies indicate that average number of fledglings produced annually per pair of nēnē is 0.3) (Hu 1998).

Based on these assumptions, as indicated in Table 4.10 below, the amount of indirect take that would be assessed for each direct take of an adult nēnē during the months of October through March is 0.09. Amount of indirect take assessed for each direct take of an adult bird during the remainder of the breeding season would be 0.04 based on life history data.

Table 4.10 Calculation of Indirect Take of Nēnē

nēnē	*Season*	*No. fledglings per pair (A)*	*Likelihood of breeding (B)*	*Parental contribution (C)*	*Indirect Take (A*B*C)*
Adult, any gender	Oct-Mar	0.3	0.60	0.5	0.09
Adult, any gender	April, Aug, and Sep	0.3	0.25	0.5	0.04
Adult, any gender	May - July	--	0.00	--	0.00
Immature	All year	--	0.00	--	0.00
Source: Draft KWP II HCP (SWCA 2009).					

4.7.2.3.5 Population Level Impacts to Nēnē

The population of nēnē statewide currently numbers at an estimated 1,300 individuals with 315 birds occurring on Maui (DOFAW unpub. data 2003). The proposed rate of take for nēnē is not expected to cause a decline in the status of the species. The proposed mitigation program (see Section 4.7.4 and the HCP for the project) is expected to more than compensate for the estimated take level.

Proposed mitigation measures will also contribute to the species' recovery by providing a net conservation benefit, as required by State law. For this reason, no significant adverse impacts to the species' overall populations, and no significant cumulative impacts to the species, are anticipated.

4.7.2.4 Hawaiian Hoary Bat

4.7.2.4.1 Collision Risk

While the presence of the Hawaiian Hoary Bat has been documented in the project area, the potential for take of the species by the proposed new facilities is believed to be very low. This assessment is based on: (i) the fact one fatality has been recorded at the KWP I facility in its first 3.5 years of operation, (ii) the surveys that have been conducted indicating low bat activity in the project area; (iii) the available information regarding the species occurrence on West Maui; and (iv) the apparent relatively low susceptibility of resident (versus migrating) bats to collisions with wind turbines in general. Due to the similarity in terrain between KWP and KWP II, the estimated mortality at KWP II is expected to be similar or lower than the mortality rates occurring at the existing KWP site.

The one observed fatality recorded at KWP I over its 3.5 years of operation equates to a total (i.e., observed and unobserved) direct take of 0.47 bats/year for KWP I or 0.023 bats/turbine/year. At this rate, the 14 WTGs that comprise both the Preferred and Alternative 2 projects would cause a total direct take of 0.33 bats/year for all 14 turbines at KWP II.

4.7.2.4.2 Other Direct Take of Hawaiian Hoary Bat

Potential for bats to collide with met towers or cranes is considered to be negligible because they would be immobile and should be readily detectable by the bats through echolocation. Of 64 wind turbines studied at Mountaineer Wind Energy Center in the Appalachian plateau in West Virginia, bat fatalities were recorded at operating turbines, but not at a turbine that remained non-operational during the study period. This supports the expectation that presence of the stationary structures such as met tower and cranes should not result in bat fatalities (Kerns et al. 2005). No bats have been found to have collided with the guyed met towers at KWP I after 3.5 years of operation nor with any cranes during the construction phase of that project. Potential for the bats to collide with met towers is also essentially accounted for in the estimated rate of take extrapolated from the KWP I data since the rate of take at KWP I was developed by dividing the sum of all project-related take (take caused by met towers was zero) and dividing that by the number of turbines.

4.7.2.4.3 Indirect Take

Hawaiian Hoary Bats are thought to move to higher elevations during the months of January through March (Menard 2001), and therefore may be less prevalent in the project area during those months. However given the lack of empirical data, it is conservatively assumed that levels of bat activity on-site remain constant throughout the year. Adult bats therefore are considered to have equal potential to collide with turbines throughout the year and regardless of breeding status.

Hawaiian Hoary Bats breed between April and August (Menard 2001). Females are solely responsible for the care and feeding of young, and twin pups are typically born each year, although single pups sometimes occur. To date, no breeding records for Hawaiian Hoary Bat exist for Maui, however, any female bats directly taken from April through August will be examined and, if determined to be pregnant or lactating, indirect take will be assessed. No indirect take will be assessed for female bats found at other times of year, or for male or immature bats found at any time of year. The rate at which indirect take will be assessed for pregnant or lactating female bats found during the months of April through August is 1.8 juveniles per adult female as indicated in Table 4.11.

Table 4.11 Calculating Indirect Take for the Hawaiian Hoary Bat

	Season	*Average no. of juveniles per pair (A)*	*Likelihood of breeding (B)*	*Parental contribution (C)*	*Indirect take (A*B*C)*
Female	Apr-Aug Pregnant or lactating	1.8	1.0	1.00	1.80
Female	Sep-Mar	--	0.0	--	0.00
Male	All year	--	0.0	0.00	0.00
Immature	All year	--	0.0	--	0.00
Source: Draft KWP II HCP (SWCA 2009).					

4.7.2.4.4 Population Level Impacts on the Hawaiian Hoary Bat

The most recent population estimates for Hawaiian hoary bat have ranged from several hundred to several thousand (Tomich 1969, Menard 2001). The Recovery Plan for the Hawaiian Hoary Bat (USFWS 1998) states "since no accurate population estimates exist for this subspecies and because historical information regarding its past distribution is scant, the decline of the bat has been largely inferred." Although overall numbers of Hawaiian hoary bats are believed to be low, they are thought to occur in the greatest numbers on the island of Hawai‘i and Kaua‘i (Menard 2001).

It is difficult to gauge the effect that take of Hawaiian hoary bat resulting from the proposed project may have on the population of this species because its population is not known. The identified baseline level of take is low and so it seems unlikely that take at this rate would result in a significant impact on the overall population of the Hawaiian hoary bat. Higher levels of take may adversely impact the Maui population, if the population is very small, but such take would not likely impact the status of the species on other islands where populations are assumed to be more robust. The Applicant's proposed mitigation for the anticipated take (see Section 4.7.4.4) will contribute to a greater understanding of the species' status on Maui, which in turn will help guide future management and recovery efforts and should result in an overall net conservation benefit for the species.

4.7.3 MEASURES TO AVOID AND MINIMIZE TAKE OF PROTECTED SPECIES

The following sub-sections outline the measures that KWP II proposes to take to avoid, minimize, and mitigate anticipated impacts to ESA-, MBTA- and otherwise protected species. These avoidance, minimization, and mitigation measures are described in greater detail in the Habitat Conservation Plan (HCP) that KWP II LLC has prepared for the project (SWCA 2009).

4.7.3.1 Site-Specific Project Design Considerations

The analysis of project design alternatives supports the conclusion that the proposed alternative is preferred when all impacts on the human and natural environment are considered. Because complete avoidance of risk to the four Covered Species is impossible under the preferred alternative, KWP II has sought to avoid and minimize the risk of collisions as much as possible by making the turbines less attractive, more visible, or more likely to be avoided by birds and bats.

These measures include:

- Employing relatively few turbines situated in two single rows, rather than a large number of staggered turbines or multiple rows.

- Using "monopole" steel tubular towers for the WTGs rather than lattice towers, to virtually eliminate perching and nesting opportunities. The tubular towers may also reduce collision risk because they are considerably more visible.
- Utilizing a rotor with a rotational speed (11 to 20 rpm) that makes the rotor visible during operation.
- Choosing a site in proximity to existing electrical transmission lines to eliminate the need for an overhead collection line from the project to the interconnect location (applicable to Alternative 2).
- Selecting a site in proximity to the existing KWP I facility so key infrastructure can be shared, thereby minimizing the need for new disturbance and development. Also, the considerable body of data that has been collected on endangered species at the KWP I site informs KWP II site selection and avoidance/minimization measures, as well as likely mitigation requirements.
- Placing all new power collection lines underground as far as practicable to minimize the risk of collision with new wires; overhead collection lines will be fitted with marker balls to increase visibility.
- Designing and installing the site substation and interconnect to MECO's transmission lines using industry-standard measures to reduce the possibility of wildlife electrocutions.
- Installing unguyed met towers as opposed to guyed met towers to avoid potential for avian collision with guy wires.
- Restricting construction activity to daylight hours as much as possible during the seabird breeding season to avoid the use of nighttime lighting that could be an attraction to seabirds.
- Requesting FAA endorsement of a minimal lighting plan to reduce the likelihood of attracting or disorienting seabirds.
- Having minimal on-site lighting at the operations and maintenance building and substation, using fixtures that will be shielded and/or directed downward and only utilized on infrequent occasions when workers are at the site at night (these three lighting measures will be used not only to minimize impacts to wildlife, but also to greatly reduce the visual impact for the resident and visitor population of Maui that is accustomed to, or expects, to see darkness in the West Maui mountains at night).
- Conducting pre-construction surveys for nēnē and nēnē nests prior to roadway and site clearing and construction, to identify and avoid harming or harassing (as defined under the ESA) any active nests, eggs, young, or adults; the survey protocol that was developed and used for KWP I will be used for KWP II.
- Implementation of a daily search protocol during construction to minimize the risk of direct impacts to nēnē and their nests.
- Should construction begin and nēnē and/or a nest(s) are subsequently discovered, designated environmental personnel will be immediately notified and construction activities will be modified or curtailed until appropriate measures are implemented, in consultation with DLNR and USFWS, which will reduce or eliminate adverse risk to nēnē or their nests.

4.7.3.2 USFWS Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines

While wind energy has been utilized for centuries, it has rapidly expanded relatively recently in the United States and worldwide with advances in technology and increased interest in renewable and alternative energy sources. In recognition of the growing wind energy industry in the United States, the United States Fish and Wildlife Service (USFWS) has prepared "Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines" (USFWS 2003) available through the USFWS

website, http://www.fws.gov. The guidelines were published simultaneously with a Federal Register Notice of Availability and request for comments on the guidelines.

After reviewing the comments received, the Secretary of the Interior established a Wind Turbine Guidelines Advisory Committee to provide advice and recommendations to the Secretary of the Interior on developing effective measures to avoid or minimize impacts to wildlife and their habitats related to land-based wind energy facilities. To date, no updates to the Interim Guidelines have been released, and compliance with them is considered voluntary. Nonetheless, KWP II LLC believes that these guidelines provide several substantive recommendations that are relevant and applicable to the proposed wind energy generation facility.

Table 4.12 lists the recommendations from the *Interim Guidelines* relating to site development and turbine design and operation and discusses how KWP II LLC plans to comply with these recommendations. It should be noted that these recommendations relate to all wildlife, whether or not they are protected under the Endangered Species Act or Migratory Bird Treaty Act, and the benefits of following these recommendations, where applicable, extend beyond the implementation of the KWP II HCP.

4.7.4 MEASURES TO MITIGATE TAKE OF PROTECTED SPECIES

The proposed mitigation program for KWP II was influenced greatly by the approved mitigation program for KWP I and the data that has been collected by KWP I biologists since operations commenced. In coordination with biologists from DLNR and USFWS, KWP II LLC proposes to either reproduce or expand the existing KWP II mitigation program to mitigate adverse impacts to protected species and provide a net conservation benefit to each species as required by State law. General criteria that influenced the selection of preferred mitigation measures included the following:

- The level of mitigation should be commensurate with the currently anticipated take;
- Mitigation should be species-specific and, to the extent practicable, location or island-specific;
- Mitigation measures should be practicable and capable of being done given currently available technology and information;
- Mitigation measures should have measurable goals and objectives that allow success to be assessed;
- Flexibility to adjust to changes in the level of take according to new information during project operation is desirable;
- Efforts that are consistent with or otherwise advance the strategies of the respective species' draft or approved recovery plans;
- Mitigation measures that serve to directly "replace" individuals that may be taken (e.g., by improving breeding success or adult and juvenile survival) are preferred, though efforts to improve the knowledge base for poorly documented species also have merit, particularly when the information to be gained can benefit future efforts to improve survival and productivity;
- Off-site mitigation measures to protect breeding or nesting areas for birds, and roosting areas for bats, located on otherwise unprotected private land are preferred over those on public land, and sites on State land are preferred by USFWS over those on federal land;
- Measures to decrease the level of take resulting from a private activity unrelated to the project (e.g., rescue/rehabilitation of downed seabirds outside the project area as a result of disorientation by outdoor lights not related to the proposed project) may be considered; and

Alternate or supplemental mitigation measures should be identified for future implementation if the level of take is found to be higher (or lower) as a result of monitoring. To avoid and minimize impacts to ESA-, MBTA-, and other protected wildlife species, KWP II has adopted applicable

measures based on USFWS Interim Guidance on Avoiding and Minimizing Impacts to Wildlife from Wind Turbines (issued May 13, 2003). These guidelines contain materials to assist in evaluating possible wind power sites, wind turbine design and location, and pre- and post-construction research to identify and/or assess potential impacts to wildlife.

Table 4.12 Consistency of the Proposed KWP II Facility with the USFWS Interim Voluntary Guidelines for Wind Projects (USFWS 2003)

USFWS Interim Voluntary Guidelines Site Development Recommendations	*Proposed KWP II Facility*
Avoid placing turbines in documented locations of any species of wildlife, fish, or plant protected under the Federal Endangered Species Act	There are no other locations on Maui that are both: (a) suitable for a financially viable wind energy generation facility and (b) unlikely to be visited by Covered Species. Data from the existing KWP I facility indicates that occurrence of Covered Species on the site is relatively low, and take is commensurately at or below the Baseline Level identified in the KWP I HCP. The proposed KWP II project minimizes habitat disturbance by sharing key infrastructure with KWP I and likewise incorporates measures to avoid and minimize risk to Covered Species as much as possible while still meeting the basic project purpose.
Avoid locating turbines in known local bird migration pathways or in areas where birds are highly concentrated, unless mortality risk is low (e.g., birds present rarely enter the rotor-swept area). Examples of high concentration areas for birds are wetlands, State or Federal refuges, private duck clubs, staging areas, rookeries, leks, roosts, riparian areas along streams, and landfills. Avoid known daily movement flyways (e.g., between roosting and feeding areas) and areas with a high incidence of fog, mist, low cloud ceilings, and low visibility.	This recommendation has been followed as much as practicable while still meeting the basic project purpose. Survey data collected to date has shown that birds do not occur in the either of the alternative areas in high concentrations.
Avoid placing turbines near known bat hibernation, breeding, and maternity/nursery colonies, in migration corridors, or in flight paths between colonies and feeding areas.	This recommendation has been followed, based on the little information available on Hawaiian Hoary Bats. The species is not known to hibernate or occur colonially. While a few bats have been confirmed to fly through the project areas, no habitat considered suitable for roosting or breeding is present in or adjacent to the alternative areas.
Configure turbine locations to avoid areas or features of the landscape known to attract raptors (hawks, falcons, eagles, owls). For example, Golden Eagles, hawks, and falcons use cliff/rim edges extensively; setbacks from these edges may reduce mortality. Other examples include not locating turbines in a dip or pass in a ridge, or in or near prairie dog colonies.	This recommendation has been followed, to the extent that it is applicable, by situating the turbines on high ground, outside of the Manawainui Gulch, Malawaiaole Gulch and Pāpalaua Gulch where most owl activity has been observed. Although owls have also been observed flying over the higher ground proposed for the wind farm, activity here is much lower than in the adjacent gulches.
Configure turbine arrays to avoid potential avian mortality where feasible. For example, group turbines rather than spreading them widely, and orient rows of turbines parallel to known bird movements, thereby decreasing the potential for bird strikes. Implement appropriate storm water management practices that do not create attractions for birds, and maintain contiguous habitat for area-sensitive species (e.g., Sage Grouse).	Turbines have been arranged as closely as feasible, given wind resource and terrain considerations, and in a linear fashion that is generally parallel to the direction of birds moving to and from the ocean. No potentially attractive water features will be constructed for the project.

USFWS Interim Voluntary Guidelines Site Development Recommendations	***Proposed KWP II Facility***
Avoid fragmenting large, contiguous tracts of wildlife habitat. Where practical, place turbines on lands already altered or cultivated, and away from areas of intact and healthy native habitats. If not practical, select fragmented or degraded habitats over relatively intact areas.	The majority of the natural environment in the project area has been previously disturbed by wildfires, pasturing and grazing uses. Existing areas of native cover types are fragmented and interspersed with disturbed, non-native dominated cover. Nēnē do utilize open areas and rock outcrops, and KWP II LLC has micro-sited the proposed WTGs so as not to disturb the features that are most attractive to nēnē.
Avoid placing turbines in habitat known to be occupied by prairie grouse or other species that exhibit extreme avoidance of vertical features and/or structural fragmentation. In known prairie grouse habitat, avoid placing turbines within five miles of known leks (communal pair formation grounds).	Not applicable - no such species occur in the area.
Minimize roads, fences, and other infrastructure. All infrastructure should be capable of withstanding periodic burning of vegetation, as natural fires or controlled burns are necessary for maintaining most prairie habitats.	This recommendation will be followed. A Wild Land Fire Contingency Plan is in place for KWP I and will be administered at KWP II as well (note that controlled burn and prairie considerations are not applicable).
Develop a habitat restoration plan for the proposed site that avoids or minimizes negative impacts on vulnerable wildlife while maintaining or enhancing habitat values for other species. For example, avoid attracting high densities of prey animals (rodents, rabbits, etc.) used by raptors.	This recommendation will be followed. Revegetation of disturbed areas and other habitat improvement measures will be coordinated with DLNR staff.
Reduce availability of carrion by practicing responsible animal husbandry (removing carcasses, fencing out cattle, etc.) to avoid attracting Golden Eagles and other raptors.	This recommendation is not applicable as Golden Eagles and other raptors are not a species of concern in the vicinity of the project.
Use tubular supports with pointed tops rather than lattice supports to minimize bird perching and nesting opportunities. Avoid placing external ladders and platforms on tubular towers to minimize perching and nesting. Avoid use of guy wires for turbine or meteorological tower supports. All existing guy wires should be marked with recommended bird deterrent devices (Avian Power Line Interaction Committee 1994).	This recommendation has been, and will continue to be followed. Tubular towers are being utilized for turbines; the permanent met tower(s) will be unguyed for either alternative project site.
If taller turbines (top of the rotor-swept area is >199 feet above ground level) require lights for aviation safety, the minimum amount of pilot warning and obstruction avoidance lighting specified by the Federal Aviation Administration (FAA) should be used. Unless otherwise requested by the FAA, only white strobe lights should be used at night, and these should be the minimum number, minimum intensity, and minimum number of flashes per minute (longest duration between flashes) allowable by the FAA. Solid red or pulsating red incandescent lights should not be used, as they appear to attract night-migrating birds at a much higher rate than white strobe lights.	KWP II LLC is working with the FAA to apply a minimal lighting scheme such as that which has been implemented at KWP I. Other on-site lighting will be minimal, shielded and used infrequently.

USFWS Interim Voluntary Guidelines Site Development Recommendations	***Proposed KWP II Facility***
Where the height of the rotor-swept area produces a high risk for wildlife, adjust tower height where feasible to reduce the risk of strikes.	This recommendation is generally not applicable in that the risk of strikes is not demonstrably related to the height of the rotor-swept area. However, the proposed 65-meter towers are the shortest that GE produces for its 1.5 MW machines.
Where feasible, place electric power lines underground or on the surface as insulated, shielded wire to avoid electrocution of birds. Use recommendations of the Avian Power Line Interaction Committee for any required aboveground lines, transformers, or conductors.	This recommendation is being followed; all new power lines will be placed underground where feasible.
High seasonal concentrations of birds may cause problems in some areas. If, however, power generation is critical in these areas, an average of three years monitoring data (e.g., acoustic, radar, infrared, or observational) should be collected and used to determine peak use dates for specific sites. Where feasible, turbines should be shut down during periods when birds are highly concentrated at those sites.	This recommendation is not applicable, as there is no documented seasonal concentration of birds. Though seabirds have been documented passing through the area, their numbers are low compared to other locations on Maui. Nēnē are present on site year round and flight activity does not vary with time of day. Furthermore, results of on-going acoustic monitoring of bats at KWP I and KWP II indicate low levels bat activity on site between April to November and no activity between December to March.
When upgrading or retrofitting turbines, follow the above guidelines as closely as possible. If studies indicate high mortality at specific older turbines, retrofitting or relocating is highly recommended.	This recommendation is not applicable to the current project, as it will be a new facility.
Source: Draft KWP II HCP (SWCA 2009).	

The proposed seabird and nēnē mitigation programs include funding measures to increase populations of these species. Measures intended to increase seabird population sizes will generally be aimed at eliminating predation through exclusion and eradication of predators from an enclosed breeding area. Reducing or eradicating predation can dramatically increase productivity and survival (e.g., Ebbert and Byrd 2002, Pascal *et al*. 2008, Hu et al. 2001, Hodges and Nagata 2001), thus compensating for any individuals that may be incidentally taken by the project. KWP II proposes to provide mitigation for nēnē primarily either by expanding the captive propagation and release program of nēnē goslings already established for KWP I or by improving survival and productivity of the existing nēnē populations at Hanaʻula and the KWP project areas through predator control. This will enhance efforts to establish separate breeding populations on Maui as recommended by the Draft Revised Recovery Plan for the species (USFWS 2004).

Proposed mitigation for the Hawaiian Hoary Bat consists of funding studies intended to provide a better understanding of the status and distribution of the species in order to facilitate future State, federal, or private conservation and management efforts. Subsequent funding of recommended management actions as they are identified and become practicable is also considered. As mitigation efforts may occur on State land for any of the protected species covered by the mitigation program, all required permits will be obtained before any mitigation measures commence.[52]

Results of post-construction monitoring will be used to determine annually whether take is occurring at baseline levels or whether take is higher than expected. After the first three years, results of monitoring will also be used to determine whether take is occurring at lower rates than expected. For species proposed for continuing mitigation efforts (e.g. annual predator control), mitigation will be adjusted to account for rates of take if found to differ significantly from baseline levels. No adjustments to mitigation will be made to account for lower measured levels of take until at least three years of fatality monitoring data have been collected. KWP II LLC will coordinate with USFWS and DLNR if higher rates of take are occurring in order to adjust mitigation efforts in accordance with the specific criteria and process outlined in the HCP.

The following sub-sections provide details of the measures selected for each of the four protected species, and these are summarized in Table 4.13. These measures are as currently proposed in the Draft HCP submitted to the DLNR and USFWS. Final measures will be determined based upon review and approval by USFWS and DLNR. Further, once approved, all mitigation measures will be subject to review by DLNR and USFWS over the lifetime of the project and may be either discontinued, modified, or continued without modification.

4.7.4.1 Mitigation Measures for All Species

4.7.4.1.1 Wildlife Education and Observation Program

A wildlife education and observation program (WEOP) will be implemented for all regular on-site staff in order to minimize project-related impacts to listed species and other wildlife. The program will be long-term, on-going, and updated as necessary. Staff will be trained to identify listed and non-listed native species of birds and other wildlife that may be found on-site, to record observations of native species protected by the ESA and/or MBTA, and to take appropriate steps when and if dead or downed wildlife is found. As part of their safety training, temporary employees, contractors, and any others that may drive project roads will be educated on speed limits, the possibility of downed wildlife being present on roads, and the possibility of nēnē presence on the ground or flying low across roads. Personnel will be instructed to contact the Site Safety Officer immediately if they detect any downed wildlife on-site.

[52] Because authorized take has potential to occur as soon as construction begins, but the benefits expected from mitigation efforts would not be realized until some later point in time, it is possible that take could occur before mitigation measures have allowed for increases in productivity. This would result in a lag between the time of incidental take and intended replacement, possibly resulting in a slight loss of productivity by the species over that time. Therefore, the proposed levels of mitigation are also intended to compensate for possible loss of productivity by incidentally taken, sexually mature adult birds for the anticipated lag-period.

4.7.4.1.2 Downed Wildlife Monitoring Protocol

The protocols for the recovery, handling, and reporting of downed wildlife at KWP II will follow those developed for KWP I (Kaheawa Wind Power LLC, 2006). These protocols were developed in cooperation with DLNR and USFWS. All regular on-site staff will be trained in the protocols which will include documenting all observed mortalities or injury to wildlife (including MBTA-protected birds not otherwise covered by the HCP).

The protocol provides for the USFWS and DLNR to be notified promptly upon discovery of an injured or dead individual of the protected species. Unless the agencies direct otherwise, the dead individuals will be left as found for collection by USFWS or DLNR personnel; they will be photo-documented and guarded against scavenging. Carcasses will be collected if instructed by DLNR. Injured protected species will be photographed from a discrete distance and monitored. Non-protected species will also be collected if requested by USFWS or DLNR; collections of protected species will be made only by staff personnel permitted by USFWS and DLNR to handle and salvage such wildlife. Injured individuals or carcasses will be handled according to guidelines identified in KWP II Draft HCP.

4.7.4.2 Mitigation for Petrels and Shearwaters

Mitigation for the Hawaiian Petrel and Newell's Shearwater will follow the colony protection and productivity enhancement measures presently underway on behalf of both species at the Makamakaʻole seabird breeding colony in West Maui. This colony was discovered during surveys prescribed as part of the KWP I HCP. KWP I and KWP II will cooperate to fulfill the total mitigation obligation for both projects by sharing staff and resources.[53]

Mitigation for seabirds takes into account the expected annual rate of direct and indirect take. Replacement for take of both adults and juveniles will include replacement by either increased adult survival or increased fledging success. When replacement consists of fledglings, the rate of survival to adulthood will be taken into account to ensure that a sufficient number of fledglings reach adulthood to replace those adults incidentally taken. In addition, because Hawaiian Petrels and Newell's Shearwaters mature at age five and six years, respectively, mitigation also takes into account the loss of offspring that may have been produced by taken adults during the time that it takes for replacement fledglings to reach sexual maturity. Juvenile survival rates to adulthood are assumed to be 30 percent for the Hawaiian Petrel (Simons and Hodges 1998) and 24 percent for Newell's Shearwater (Ainley et al 2001). The loss of productivity is calculated based on the percentage of the adult population breeding per year, yearly adult survivorship and the reproductive success of a pair. Table 4.14 below lists the yearly number of fledglings required to be produced to offset the Baseline level of take anticipated at KWP II assuming same-year replacements for the direct take of the adult and indirect take of the fledgling. In subsequent years, the loss of productivity can be compensated at a rate of 0.60 fledglings/year for the subsequent 4 years for the Hawaiian Petrel and at 0.30 fledglings/year for the subsequent 5 years for the Newell's Shearwater.

[53] As rates of take will likely vary between the two seabird species and mitigation efforts will likely be expended at a mixed breeding colony, the level of mitigation effort will be determined by the highest rate of take. This would be expected to result in the production of fledglings or increased adult survival for the other seabird species in excess of that which would otherwise be required. KWP II would be able to receive credit for such "extra" fledglings or adults that could then be used to compensate for take incurred in later years.

Table 4.13 Proposed Baseline Mitigation Measures for Protected Species

Species	*Mitigation Measures*
Hawaiian Petrel	Fence construction and fence maintenance around a seabird nesting area. Monitor survival and productivity within colony.
Newell's Shearwater	Fence construction, fence maintenance around a seabird nesting area. Monitor survival and productivity within fenced area.
Nēnē	Preferred Option: Fund captive propagation of seven nēnē goslings per year for the first five years of project operations for reintroduction at a suitable nēnē release site, regardless of take. Provide support for logistics, DOFAW staffing and release of goslings per same or similar cost structure as KWP I. Option 2: Predator trapping on state conservation lands within and adjacent to the KWP project area and Hanaʻula release site; support annual census and banding of birds by DLNR; develop a nēnē management plan for Hanaʻula, KWP I and KWP II; and if additional mitigation is needed to provide a net conservation benefit, implement habitat improvement at Hanaʻula or elsewhere near Kaheawa Pastures.
Hawaiian Hoary Bat	Provide $25,000 to fund research on Maui for bat occupancy analysis and population trend monitoring; work with DLNR and USGS to secure additional funding partners; conduct in-house research to document bat occupancy at different habitat types (e.g ridges versus gulches) and elevation ranges at KWP II and vicinity to support Maui bat research; and upon conclusion of 5-year bat study currently underway by USGS, or when management needs are identified, contribute funding for implementation of recommended bat management measures ($25,000 up to a maximum of $50,000).
Source: Draft KWP II HCP (SWCA, October 2009).	

Table 4.14 Baseline Mitigation Required for Hawaiian Petrel and Newell's Shearwater

Species	Baseline take level			Average annual fledgling production requirement
Hawaiian Petrel	5-year take limit	Adults	5	
		Fledglings	5	
	Annual average	Adults	1	3.33
		Fledglings	1	1.00
	Loss of productivity			2.40
	Total fledglings required annually			**4.33**
Newell's Shearwater	5-year take limit	Adults	5	
		Fledglings	3	
	Annual average	Adults	1	4.17
		Fledglings	0.6	0.60
	Loss of productivity			1.5
	Total fledglings required annually			**4.67**

Source: Draft KWP II HCP (SWCA 2009).

Predation has been shown to have significant negative effects on fledging success for the Hawaiian Petrel (Hodges 1994, Hu et al. 2001, Hodges and Nagata 2001, Telfer 1986). The dominant predator varies by location but predation mortality has been attributed to cats, mongooses, rats, and owls (Hu et al. 2001, Hodges and Nagata 2001). Hodges and Nagata (2001) identified predation as accounting for 41 percent of total terrestrial mortality (adults, fledglings, and eggs) in cases in which a cause of death could be determined. Human-related causes (road-kills, collapsed burrows, collision with structures) accounted for 49 percent of mortalities and natural causes accounting for the remaining 10 percent.

Nesting success rates can vary greatly from year to year and are probably dependent upon many environmental factors. Data from Hodges (1994), Hu et al. (2001), and Hodges and Nagata (2001) show that predator control (trapping and fencing) generally results in a significant increase in Hawaiian Petrel nesting success as shown in Table 4.15. Prior to the advent of predator-proof or exclusion fencing, predator control was the only effective means of reducing predation pressure on seabirds on mainland sites. Total eradication of predators was only possible on small offshore islets (Rauzon 2007). However, with predator-proof fencing now available, eradication efforts on mainland sites are now possible. Eradication has shown to be more cost-effective than predator control in the long-term and provides greater ecological benefits (improved breeding success) than predator control (Pascal et al. 2008).

In order to mitigate for the anticipated level of take by the proposed facilities, KWP II LLC will provide funding or in-kind support (in concert with the efforts already being undertaken by KWP I) for the installation, monitoring, and maintenance of a fence around a portion of the seabird colony at Makamaka'ole. The area chosen will be based on topography and the distribution of seabird burrows within the colony and all installation activities will be limited to the non-breeding season. The fence will be designed to encompass the largest number of nesting pairs possible under the financial and logistical constraints (i.e. topography). When the fencing is complete, KWP I (under their existing HCP) will implement a program to eradicate predators within the enclosed area.

Table 4.15 Comparison of Hawaiian Petrel Nesting Success with & without Predator Control

Location	*Year(s)*	*Nesting success (%)*		*Reference*
		w/o predator control	*w/ predator control*	
Haleakalā, Maui	n.a.	42.0	57.0	Hodges 1994
Mauna Loa, Hawaii	1995-96	41.7	61.5	Hu *et al.* 2001
Haleakalā, Maui	1982	0.0	32.7	Hodges and Nagata 2001
Haleakalā, Maui	1990	10.0	49.2	"
Haleakalā, Maui	1991	25.6	48.6	"
Haleakalā, Maui	1992	15.2	17.0	"
Haleakalā, Maui	1993	32.8	38.2	"
Haleakalā, Maui	1994	44.0	23.0	"
Haleakalā, Maui	1995	31.8	50.0	"
Haleakalā, Maui	1996	28.1	46.7	"
Unweighted Average		27.1	42.4	
Source: Draft KWP II HCP (SWCA 2009).				

KWP II LLC will implement management and protection measures during the first five years of project operation. It is anticipated that these measures will more than offset the estimated total take for both species by increasing fledgling production as summarized in Table 4.14. Colony protection and/or management measures will continue beyond Year 5 such that the ratio of birds protected to the adjusted take remains greater than 1 throughout the life of the project.

Other measures will also be employed to monitor existing seabird populations, increase knowledge of species specific predation pressure on the seabird colony, and explore methods to further enhance the productivity of the colony. Measures proposed include:

- Collecting and analyzing predator scat outside the enclosed site and at predator access points to determine species and composition of prey in samples;
- Monitoring throughout the breeding season using surveillance radar at Lower Kahakuloa-Makamakaʻole to evaluate movement patterns of petrels and shearwaters to establish a baseline for annual comparisons; and
- Examining colony enhancement measures using social attraction mechanisms (vocalization playbacks) and nesting habitat improvement (artificial burrows).

4.7.4.3 Mitigation for Nēnē

KWP I biologists maintain an ongoing collaboration with biologists from DLNR and USFWS, as well as regional experts, to identify, select, and implement appropriate measures to mitigate for take of nēnē under the terms of the KWP I HCP. Several provisions in the KWP I HCP guide mitigation for nēnē. A similar approach is proposed for the KWP II project, with the intention of providing a net ecological benefit to the species in alignment with State and federal species recovery goals. KWP II LLC will provide support for nēnē population protection and/or enhancement or nēnē propagation and release, which may include translocation. All proposed measures are intended to promote the recovery of the species within portions of its historic range.

Mitigation for nēnē will take into account the expected annual direct and indirect take of the species, as well as any loss of productivity that might occur. Mitigation for any direct take of adults and direct or indirect take of goslings will be provided through replacement by goslings (or possibly juveniles), and possibly adults. However, when adults are replaced by goslings, the survival rate of goslings to adulthood will be taken into account in determining the number of goslings needed to be released to offset expected levels of take of adult birds.[54]

Table 4.16 below identifies the number of goslings that will be required to be released annually to offset the Baseline level of take anticipated (assuming same-year replacements) for nēnē during operation of the KWP II project. As shown, the production of an additional three goslings annually is expected to be sufficient to compensate for the Baseline level of take. Two mitigation measures for the Baseline level of take are under consideration (Option 1 and Option 2). The option chosen for implementation will be decided in consultation with DLNR and USFWS and will be based upon the strategy that is practicable, will most effectively meet mitigation requirements, and best complement the recovery plans for the species. These two options are described in Sections 4.7.4.3.1 and 4.7.4.3.2.

Table 4.16 Baseline Mitigation Required for Nēnē

Species	***Baseline take level***			***Annual gosling release requirement***
nēnē	5-year take limit	Adults	6	
		Goslings	3	
	Annual average	Adults	1.2	2.34
		Goslings	0.6	0.60
Adjustment for loss of productivity				0.09
Total goslings to be released annually				**3.03 (rounded to 3.00)**
Source: KWP II HCP (SWCA 2009).				

4.7.4.3.1 Option 1: Preferred Baseline Mitigation Program

The preferred Baseline mitigation for nēnē is proposed to consist initially of providing funding ($18,000 per year) to DLNR for the propagation and release of seven goslings annually for the first five years of project operation (35 goslings total). The release would occur at a suitable off-site release pen on Maui as decided with concurrence of USFWS and DLNR. (Note: KWP I may be providing for release of goslings at this same pen.)

If the combined releases from KWP I and KWP II reach the target number of releases for that particular pen before the end of the proposed initial five-year KWP II nēnē release effort, or if circumstances change and gosling release at the chosen release pen no longer is a viable option, KWP II will provide funding (not to exceed $60,000) for DLNR to construct a second nēnē release pen on Maui, Molokaʻi, or Hawaiʻi as determined in consultation with DLNR and USFWS. The remainder of the set of 35 goslings proposed to be released over the initial five-year period would then be released at the new location.

Based on the numbers provided in Table 4.16, if take of nēnē at the KWP II facility occurs at Baseline level over the 20-year life of the project (take of 18 adults and two fledglings), this would require release of approximately 60 goslings as compensation, or three goslings per year on average.

[54] In addition, because female nēnē mature at age three and males at age two (Banko et al. 1999), the proposed mitigation may also need to account for possible loss of production during the lag years between take of adult birds and the sexual maturity of released goslings. For the purposes of mitigation, it is assumed that both genders of nēnē mature at age three, which will require accounting for one year of possible lost productivity.

Releases over the first five years would initially result in a "surplus" of released goslings, which is desirable both to guard against the possibility of take occurring at higher rates than anticipated, and to "jump-start" the newly established nēnē population by allowing for a greater number of birds to reach adulthood at an earlier time.

Following the initial release of 35 goslings over the first five years of operation, funding would be provided to DLNR for the continued propagation and release of goslings on an annual basis. The number of goslings released in subsequent years (from Year 6 onward) would at a minimum meet the number required to compensate for the adjusted take identified from the previous year. This would retain the "surplus" developed over the first five years of project operation. As time goes on, it is expected that an average rate of annual take will be identified, which will enable a prediction of how long into the project the "surplus" of goslings should be able to compensate for actual levels of take.

When the point is reached that it appears the surplus of goslings released is capable of compensating for take expected to be incurred through the end of the 20-year project life, annual releases of goslings will cease, with mitigation for subsequent take, plus a net benefit, to be provided by the surplus. However, post-construction monitoring will be continued so that actual take can continue to be measured. If the take that occurs subsequent to the termination of gosling releases is of a high enough level to cause the surplus to be insufficient to compensate for that take, KWP II LLC will provide funding to DLNR sufficient to propagate and release the number of goslings needed to compensate for the measured take plus a net benefit. As the previously identified release sites may be at capacity by that time, these goslings would be released at an appropriate site as identified through consultation with the DLNR and USFWS.

KWP II will also provide funding as identified below as part of its proposed mitigation for take at the Baseline level:

- $10,000 toward the purchase of a truck or all-terrain vehicle to support maintenance and predator control efforts at the nēnē release facility;
- $15,000 per year toward staffing operations and maintenance personnel at the nēnē release facility for five years of operation; and
- $2,000 per year toward use of a helicopter to carry each year's set of goslings to the release site.

4.7.4.3.2 Option 2: Alternate Baseline Mitigation Program

The alternate Baseline mitigation program for KWP II consists of on-site and near-site mitigation to enhance the existing nēnē population at Hanaʻula and within the KWP I and KWP II project areas. Mitigation efforts are targeted at addressing two of the seven recovery goals as identified in the *Draft Revised Recovery Plan for the nēnē or Hawaiian Goose (Branta sandvicensis)*:

> *2) Manage habitat and existing populations for sustainable productivity and survival complemented by monitoring changes in distribution and abundance;*
>
> *3) Control alien predators which addresses control of introduced mammals to enhance nēnē populations.*

KWP II LLC will work with DLNR to develop a nēnē management plan for nēnē present at Hanaʻula, and the KWP I project area within the first year of permit issuance. Yearly funding ($15,000) for the first 5 years will be provided to DLNR to support personnel that will conduct an annual census, band nēnē adults and goslings, and quantify reproductive success at Hanaʻula and the KWP I project area. Predator control measures will commence in Year 1 or 2 of project operation, depending on the availability of a baseline. In the event that baseline data on nēnē reproductive success and adult and juvenile survival are not already available, mitigation efforts will be delayed one year and the first year of nēnē monitoring and banding data collected will be used as a baseline. The baseline will be used to measure the effectiveness of predator control in increasing adult and juvenile survival and

productivity. Data from all years will also be used to document population trends and identify emerging and existing threats.

Predation has been identified as a major limiting factor in the recovery of nēnē (Banko et al. 1999), and predator control measures have proven to increase reproductive success. If this option is selected, KWP II anticipates that predator removal measures may consist of deploying traps, leg holds, and/or snares or broadcasting rodenticide. These measures are expected to significantly improve adult and juvenile survival and increase productivity of nēnē pairs commensurate with the Baseline level of take. Should on-site monitoring identify a more pressing threat to the survival of nēnē at Hanaʻula and the KWP I and KWP II project areas, additional measures to address that threat will be selected and implemented instead, with consultation with DLNR and USFWS.

If monitoring indicates that additional mitigation is required for mitigation efforts to be commensurate with the Baseline level of take or to provide a net benefit to species, habitat improvement measures will be implemented, such as providing additional water sources at appropriate locations, or mowing grasses in habitat beyond the vicinity of KWP I and KWP II to improve foraging habitat as described by Woog and Black (2001). The most appropriate measure to be undertaken will be determined based on data collected from the on-going monitoring and best available science and implemented in consultation with DLNR and USFWS.

4.7.4.4 Hawaiian Hoary Bat

Because of the lack of life history information on the Hawaiian Hoary Bat, research is identified as one of the key components in achieving the recovery of this subspecies. The Recovery Plan for the Hawaiian Hoary Bat (USFWS 1998) states:

> *"…Research is the key to reaching the ultimate goal of delisting the Hawaiian Hoary Bat because currently available information is so limited that even the most basic management actions cannot be undertaken with the certainty that such actions will benefit the subspecies…"*

Gorresen et al. (2008) recently identified the following key areas of research required to improve knowledge of Hawaiian Hoary Bat life history:

- Determining bat occupancy rates in different habitat types;
- Determining bat distribution across seasons on a local and regional scale;
- Determining seasonal and daily peak bat activity periods; and
- Monitoring population trends.

Development and implementation of a survey and monitoring program remains a high priority and a key recovery objective for the Hawaiian Hoary Bat (Gorresen et al 2008, USFWS 1998).

As part of the mitigation program for bats under its approved HCP, KWP I has contributed funding for the U.S. Geological Survey (USGS) Hawaiian Hoary Bat Research Project. This has allowed the agency to purchase equipment and to monitor bat activity which greatly increased its capacity to conduct field work at multiple sites (Letter from Frank Bonaccorso/USGS to Paula Hartzell, DLNR/DOFAW Conservation Initiatives Coordinator dated October 20, 2008). In 2007, the USGS team monitored six sites, and in 2008 expanded to 17 geographical locales across the Island of Hawaiʻi. They now plan to expand work to sites on Maui and Kauaʻi in 2009, pending a proposal with the USFWS.

KWP II proposes to mitigate for the effects that its facilities may have on the Hawaiian Hoary Bat by supporting research on Maui that will survey and monitor Hawaiian Hoary Bats within different habitat types and elevations to document bat occurrence, habitat use, and preferences. The bat activity data will also identify seasonal and temporal changes in Hawaiian Hoary Bat abundance, if

any, and provide a measure of long-term population trends on Maui. This research will be an extension of a 5-year survey already underway on the island of Hawai‘i. Another critical component identified as essential to Hawaiian Hoary Bat recovery was the need to develop a standardized survey protocol for the Hawaiian Hoary Bat monitoring program to enable results collected by different parties to be directly comparable.

Upon issuance of the permit, KWP II would contribute $25,000 to an appropriate program to support bat research, such as the Hawaii Bat Research Cooperative (HBRC), as determined by DLNR and USFWS. The allocation of the funds would be determined by DLNR and USFWS and could be used for, but not limited to, purchase of monitoring equipment required to carry out the studies on Maui, support of personnel to conduct the research, and meeting travel expenses. However, should research indicate that other areas of study are more important or pressing in aiding the recovery of the species, the Applicant in concurrence with USFWS and DLNR will direct the funds toward whatever management or research activity is deemed most appropriate at the time.

KWP II LLC will also join the HBRC, and as a contribution to the on-going research efforts on Maui, will conduct its own in-house research at KWP II and the vicinity. Anabat detectors will be deployed at KWP I, KWP II, and adjacent lands to monitor bat activity along elevational ranges and within different habitat types found on the ridges and in the gulches as far as practicable for two years. The number of Anabat detectors deployed will be determined by the terrain and degree of habitat variability present at the different sites.

The USFWS is currently conducting a five-year study of Hawaiian Hoary Bat on the Island of Hawai‘i. After the conclusion of this study and with the information gathered on bats on Maui, it is expected that practicable management measures would have been developed to aid in the recovery of the species. At that point in time, KWP II LLC will contribute an additional negotiated amount ($25,000, but up to a maximum of $50,000) to fund an appropriate management program at a level that is commensurate with the actual take and will provide a net benefit to the species. If no recovery mitigation is determinable from the research results, KWP II LLC will acquire land or an easement to protect and manage foraging and/or roosting habitat supporting a number of bats commensurate to achieve the mitigation requirement. The allocation of the funds would be determined by KWP II LLC in consultation with USFWS and DLNR toward whatever management or research activity is deemed most appropriate at the time.

KWP II believes this in-house research will advance the scientific understanding for developing effective avoidance and minimization strategies at wind facilities for the Hawaiian Hoary Bat in Hawai‘i and elsewhere.

4.8 NOISE IMPACTS

The following discussion is divided into three main parts.

- Section 4.8.1 summarizes applicable noise standards. It also defines two key terms used in the analysis.
- Section 4.8.2 describes the effects that operation of the proposed facilities would have on noise levels.
- Section 4.8.3 describes construction-related noise impacts.

4.8.1 APPLICABLE NOISE CONTROL STANDARDS

As discussed in Section 3.8.1, Hawaii Administrative Rules (HAR) Title 11, Chapter 46, Section 4 (§11-46-4) defines the maximum permissible community sound levels in dBA. These differ according to the kind of land uses that are involved (as defined by zoning districts) and time of day (daytime or nighttime). They are as shown in Table 3.7.

Definitions of two technical terms used in this discussion are as follows:

- A-Weighted Sound Level (dBA). The sound level, in decibels, read from a standard sound-level meter using the "A-weighting network". The human ear is not equally sensitive in all octave bands. The A-weighting network discriminates against the lower frequencies according to a relationship approximating the auditory sensitivity of the human ear at moderate sound levels.
- Decibel (dB). This is the unit that is used to measure the volume of a sound.[55] The decibel scale is logarithmic, which means that the combined sound level of 10 sources, each producing 70 dB will be 80 dB, not 700 dB. It also means that reducing the sound level from 100 dB to 97 dB requires a 50 percent reduction in the sound energy, not a 3 percent reduction. Perceptually, a source that is 10 dB louder than another source sounds about twice as loud. Most people find it difficult to perceive a change of less than 3 dB.

The maximum permissible sound levels specified in HAR §11-46-4(b) do not apply to any particular distance from a source (such as a WTG). Instead, they apply to sound levels at the parcel boundary. Because of this, a source that is set well back from the property line of the parcel in which it is located can be much louder than one set close to the property line and still be consistent with the standard. Thus, even though the parcel on which Kaheawa Pastures is located and the adjoining parcels fall into the Class A (most restrictive) category, the fact that they are set back from the property line by a substantial amount means that this need not be a problem.

4.8.2 NOISE FROM OPERATIONS

4.8.2.1 Source Noise Level Estimates

In order to determine if the proposed WTGs could be operated in a way that is consistent with the limits established in §11-46-4(b), D.L. Adams Associates, Ltd. (January 9, 2009) began with the manufacturer's sound level performance specifications for the GE 1.5sle wind turbine.[56] These specifications represent the wind turbine as a point source at the hub (rotor center) and were determined in accordance with IEC International Standard 61400-11, Wind Turbine Generator Systems – Acoustic Noise Measurement Techniques.

The specifications indicate that the maximum sound *power* level for the 1.5sle wind turbine is 104 dBA. Because the sound *pressure* level at 50 feet is approximately 32 dBA less than the sound power level of a point source[57], this is equivalent to a sound pressure level of 72 dBA at 50 feet. The GE 1.5sle reaches its maximum sound power level (the level used in this impact analysis) at an electric power output of approximately 60 percent of full generating capacity. This level of operation is achieved with a wind speed of 9 meters per second (20.1 mph) at the hub height of the wind turbine. Although not used in our analysis, sound levels can decrease by up to 8 dB or more for lower wind speeds.

4.8.2.2 Sound Propagation Model

D.L. Adams & Associates (October 16, 2009 and January 9, 2009) used the DataKustik CadnaA (version 3.7.123) software program to model sound propagation from the WTGs.[58] The model is

[55] The sound pressure level in decibels is equal to twenty times the logarithm to the base ten of the ratio of the pressure of the sound measured to a reference pressure of 20 micropascals, or 0.0002 dynes per square centimeter.

[56] The 20 existing wind turbines are GE Model 1.5se turbines with 55 meter hub heights and 70.5 meter diameter three-blade rotors. The 14 proposed wind turbines are identical except that the hub height is 65 meters. The actual sound power level data for the GE 1.5se turbines is GE's proprietary information.

[57] From attenuation due to hemispherical radiation = 10 log ($2\rho R^2$) where R is the distance in meters.

[58] The software program uses the calculation procedures of International Standard ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation. Topographical data for the areas surrounding the project site was obtained from the USGS National Elevation Dataset (NED 14609935).

conservative (i.e., the actual sound levels due to turbine sound propagation should be equal to or less than the predicted levels). The conservatism stems from the incorporation of several assumptions.

- It assumes that meteorological conditions are favorable for sound propagation and that receptors were downwind (both "worst-case" assumptions). That is, every receiver is assumed to be downwind in the presence of a well developed temperature inversion. In reality, every receiver cannot be downwind simultaneously so this provides a somewhat worst case scenario, which is consistent with ISO 9613-2.
- The model assumes an average temperature of 70° Fahrenheit and relative humidity of 65 percent, based on available climate information for the area. It also assumes that the receiver (i.e., listener) is 1.5 meters (~5 feet) above ground; this is the height at which testing for compliance with the Community Noise Control Rule is normally done.
- The modeling assumed a ground attenuation coefficient of 0.0. The coefficient can range from 0.0 to 1.0. A ground attenuation coefficient of 1.0 indicates an acoustically absorptive surface such as dense foliage or fresh powder snow; a coefficient of 0.0 indicates an acoustically reflective surface such as still water or concrete. Based on the terrain in the area, a realistic average ground absorption coefficient is probably between 0.2 and 0.4. Hence, using a coefficient of 0.0 leads to "worst-case" results for this factor.[59]
- After investigating the possibilities, KWP II concluded that it is unlikely that a noise abatement package for the wind turbines would reduce the sound levels sufficiently to meet the property line limit fully. Hence, no special noise abatement features were assumed in the modeling.

4.8.2.3 Forecast Sound Levels

Sound from the additional WTGs will increase the ambient sound levels in nearby areas. Figure 4.4 (for the Preferred Alternative) and Figure 4.4 (for Alternative 2) show the predicted sound level contours and sound levels for 45 dBA and higher at locations along the KWP II site property lines.[60] Figure 4.5 and Figure 4.6 are more detailed views and show the predicted sound levels at various locations along the Lahaina Pali Trail for the Preferred Alternative and for Alternative 2, respectively.

4.8.2.4 Consistency with §11-46-4 Noise Criteria

4.8.2.4.1 Alternative 2

The results of the modeling indicate that Alternative 2 would be in general compliance with the 55 dBA daytime limit but may exceed the Community Noise Rule, Class A nighttime property line sound level limit of 45 dBA.[61] The areas near the WTGs for both alternatives are uninhabited. Hence, the only persons who would be in a position to hear them are (i) individuals working on the project site, (ii) persons using the existing road to access the forest and conservation land above Kaheawa Pastures, and (iii) individuals and groups using the Lahaina Pali Trail. The first two categories of people are engaged in activities that would not be adversely affected by the forecast sound levels, either because they are present as part of their work on the wind farm itself or are simply briefly transiting the area. In view of this, it is unlikely that there would be a complaint due to sound at the property line. If KWP II LLC wished to be in full compliance with the standard, it could request a variance from the State of Hawai'i Department of Health as provided for in HAR §11-46-8.

[59] The ground attenuation coefficient has only a modest effect on the model predictions. For example, using a ground absorption coefficient of 1.0 instead of 0.0 reduces the predicted sound levels on the Lahaina Pali Trail by 0-1dB at most locations, and 1-3 dB at the locations nearest the site.

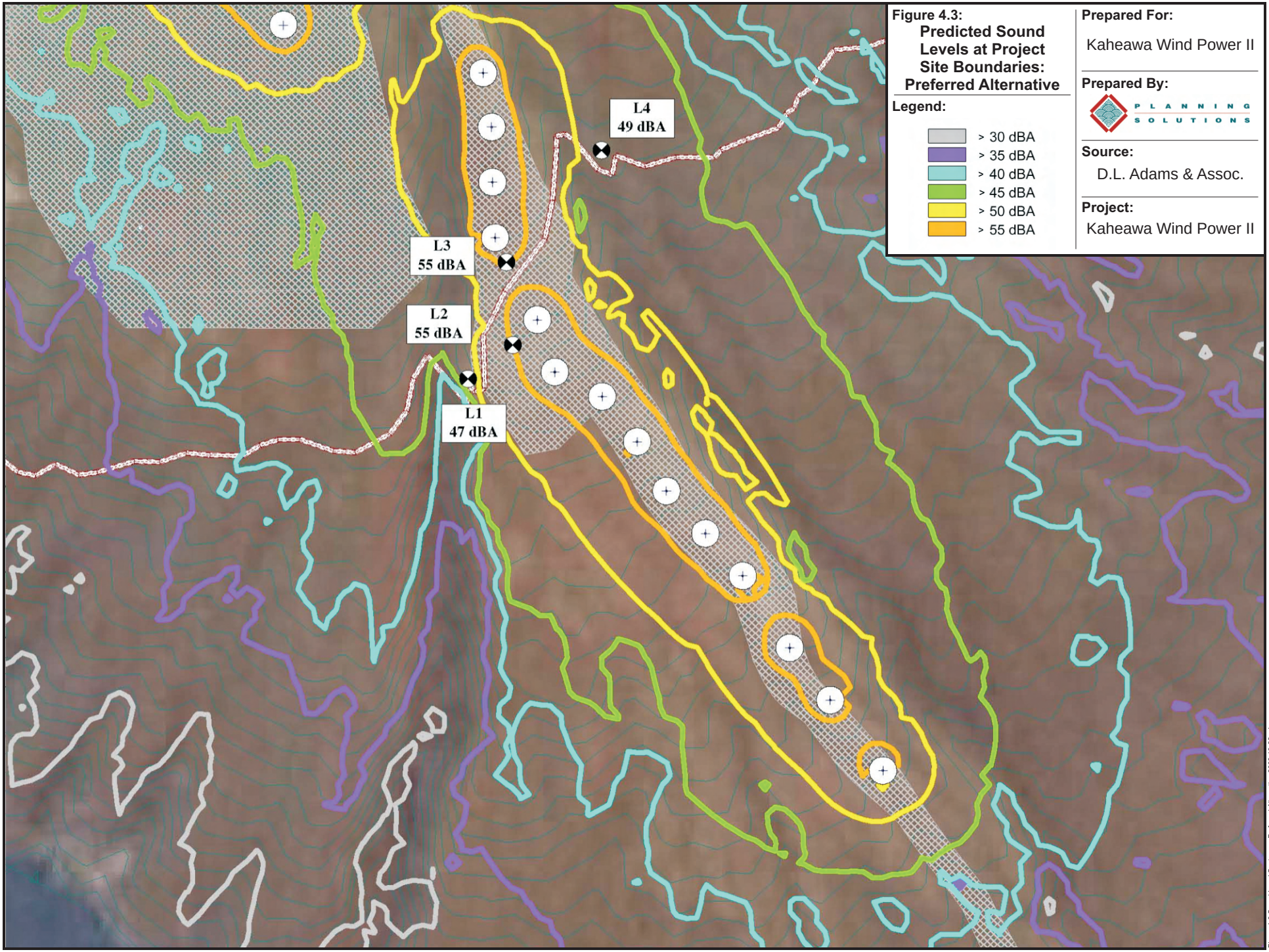
[60] The lease area boundaries are used for the property lines.

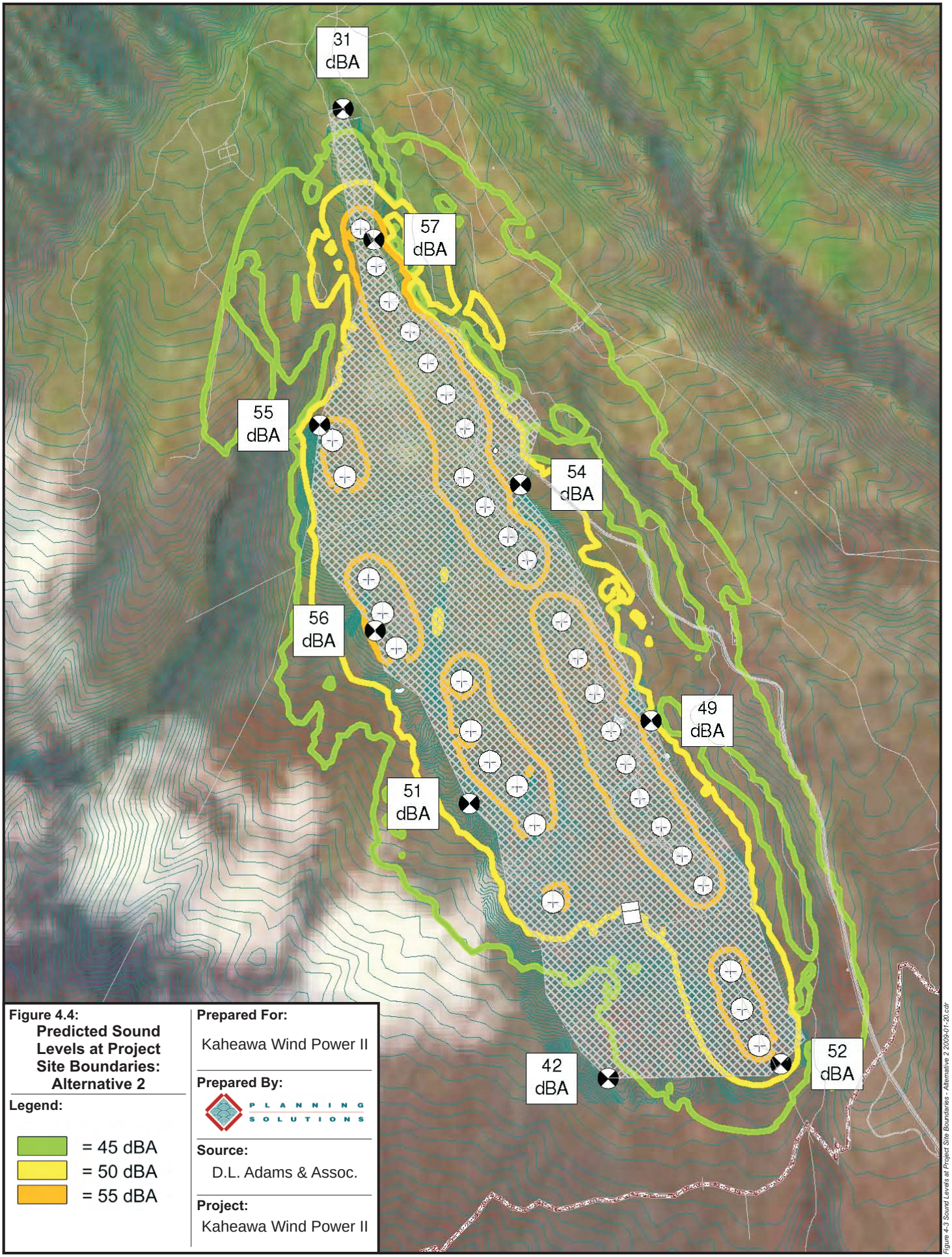
[61] There are 0ne or two short property line segments where the model suggests the sound levels could be slightly higher. In no case is the exceedance greater than 2 dB, an amount that is within the range of error of the model.

Figure 4.6 shows the predicted sound level area contours and sound levels at selected locations along the Lahaina Pali Trail. The model results indicate that sound from the wind turbines may be audible along parts of the trail that are closest to the turbines but that project-related impacts on trail users would be low. Not surprisingly, sound would be most noticeable (41 to 44 dBA) on the stretch of trail closest to the existing access road. However, even there the predicted sound levels are lower than the 45 dBA limit that applies to conservation and preservation lands during the nighttime hours (10:00 PM to 7:00 AM). They are also below the ambient levels experienced now during all but the calmest wind conditions. Hence, it should not interfere substantially with enjoyment of the trail.

4.8.2.4.2 Preferred Alternative

Because the area that would be leased for the Preferred Alternative is smaller, the WTGs that are part of this alternative would necessarily be closer to the site boundaries. As a consequence, the 45 dBA contour for that alternative extend across the site boundary, thereby exceeding the nighttime property line limit.


L4
49 dBA
L3
55 dBA
L2
55 dBA
L1
47 dBA
Figure 4.3:
Predicted Sound Levels at Project Site Boundaries: Preferred Alternative
Legend:
> 30 dBA
> 35 dBA
> 40 dBA
> 45 dBA
> 50 dBA
> 55 dBA
Prepared For:
Kaheawa Wind Power II
Prepared By:
PLANNING SOLUTIONS
Source:
D.L. Adams & Assoc.
Project:
Kaheawa Wind Power II
Figure 4-3 Sound Level Contours - Preferred Alternative 2009-10-28.cdr


31 dBA
57 dBA
55 dBA
54 dBA
56 dBA
49 dBA
51 dBA
42 dBA
52 dBA
Figure 4.4:
Predicted Sound Levels at Project Site Boundaries: Alternative 2
Legend:
= 45 dBA
= 50 dBA
= 55 dBA
Prepared For:
Kaheawa Wind Power II
Prepared By:
PLANNING SOLUTIONS
Source:
D.L. Adams & Assoc.
Project:
Kaheawa Wind Power II
Figure 4-3 Sound Levels at Project Site Boundaries - Alternative 2 2009-01-20.cdr

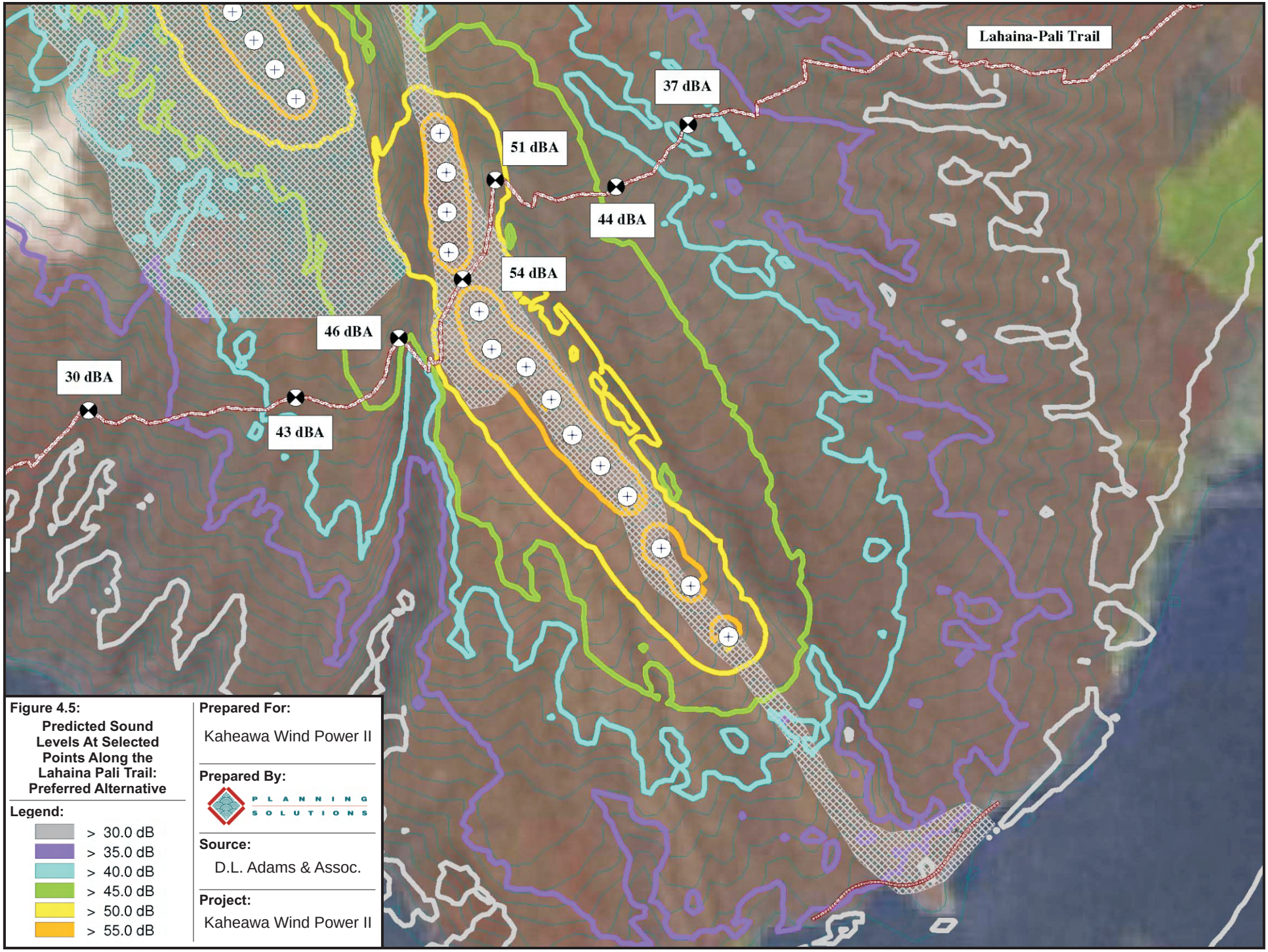


Figure 4.5: Predicted Sound Levels At Selected Points Along the Lahaina Pali Trail: Preferred Alternative

Figure 4-4 Predicted Noise Levels Along Lahaina Pali Trail - Preferred Alternative 2009-10-28.cdr

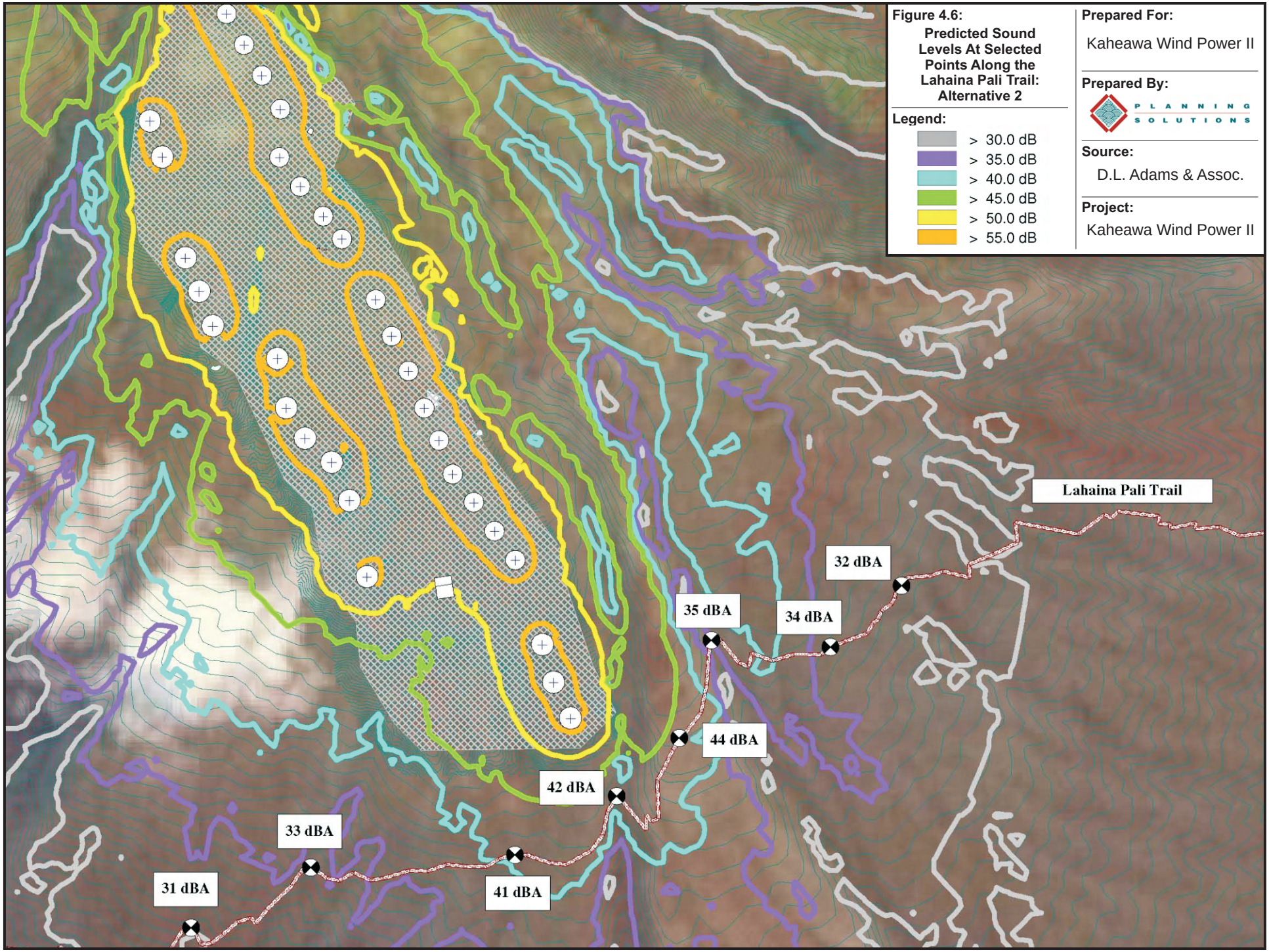


Figure 4.6:
Predicted Sound Levels At Selected Points Along the Lahaina Pali Trail: Alternative 2

Legend:

- > 30.0 dB
- > 35.0 dB
- > 40.0 dB
- > 45.0 dB
- > 50.0 dB
- > 55.0 dB

Prepared For:
Kaheawa Wind Power II

Prepared By:
PLANNING SOLUTIONS

Source:
D.L. Adams & Assoc.

Project:
Kaheawa Wind Power II

Figure 4-4 Predicted Sound Levels Along Lahaina Pali Trail - Alternative 2 2009-10-28.cdr

For reasons discussed above, the first two categories of individuals that would be exposed to noise from the WTGs that make up the Preferred Alternative (i.e., individuals working on the project site and persons using the existing road to access the forest and conservation land above Kaheawa Pastures, are unlikely to be disturbed by the forecast project-related sound. Although a majority of the Lahaina Pali hiking trail will not be impacted by the wind turbine sound, there is a portion of the trail where wind turbine sound will be easily audible over the ambient sound. Because of this, potential sound-related effects on those individuals was evaluated in more detail.

As can be seen in Figure 4.5 and in Table 4.17, the predicted wind turbine sound levels from KWP's Preferred Alternative are not expected to exceed the DOH daytime (7:00 am to 10:00 pm) maximum permissible noise limit for conservation land of 55 dBA at any point along the hiking trail. However, the DOH nighttime (10:00 pm to 7:00 am) noise limit for conservation land of 45 dBA will be exceeded at the trail locations near the turbines.

Table 4.17 Predicted Sound Levels Near the Lahaina-Pali Trail with Preferred Alternative

Station ID	*Predicted Sound Level*[1]	*Measured L_{eq}*[2] *During Moderate Winds*	*Combined Sound*[3] *Level*	*Increase due to New WTGs*
L1	47 dBA	42 dBA	48 dBA	+ 6 dB
L2	55 dBA	44 dBA	55 dBA	+ 11 dB
L3	55 dBA	42 dBA	55 dBA	+ 13 dB
L4	49 dBA	43 dBA	50 dBA	+ 7 dB

Notes:
1. Sound levels were predicted from the sound propagation model described in this report and do not include ambient sound.
2. Approximated sound levels based on the sound measurement results collected during moderate wind speeds.
3. Combined sound level is the logarithmic addition of the predicted sound level plus the measured ambient sound level.
4. The predicted change (in dB) due to wind turbines is the amount by which the ambient sound environment is expected to increase with the expansion of the KWP II project.

Source: D.L. Adams & Associates (October 16, 2009), Table 1.

During periods of moderate to high wind speeds, the WTGs that would be installed as part of the proposed project would increase sound levels along the Lahaina-Pali hiking trail by as much as 13 dB above existing ambient levels. This increase would be greatest where the trail intersects the line of the new turbines (between WTG #4 and WTG #5), and will likely be noticeable for that small portion of the trail.[62]

Several aspects of the forecast "with the Preferred Alternative" sound levels mitigate the significance of the forecast change.

- First, the overall sound level is not expected to exceed 55 dBA (the most stringent regulatory daytime noise criteria at any point along the trail between the hours of 7:00 a.m. and 10:00 p.m. when nearly all trail use takes place.

[62] Any increase of 10 dB or more for wind turbine sound, is generally considered to be substantial.

- Second, hikers will be exposed to the turbine sound for only a small portion of the trail, and it is far below the level that would interfere with communication or other necessary activities.
- Complaints of sleep disturbance or similar potential concerns are not expected, since there are no residences or other noise-sensitive land uses within audible range of the wind turbines.

4.8.3 NOISE FROM CONSTRUCTION

Construction of KWP II will involve the use of graders, excavators, bulldozers, cranes, cement trucks, haul trucks, and other heavy equipment. Some of the construction equipment and activities are inherently noisy. Earthmoving equipment, *e.g.*, bulldozers and diesel-powered trucks, would probably be the loudest equipment used on a regular basis during construction. In cases where construction noise exceeds, or is expected to exceed, the SDOH's "maximum permissible" property line noise levels, a permit must be obtained from the SDOH to allow the operation of construction equipment, power tools, etc., which emit noise levels in excess of "maximum permissible" levels. The DOH noise permit does not limit the sound level generated at the construction site, but rather the times at which noisy construction can take place.

While no detailed construction noise analysis was conducted for this report, the results of the sound modeling done for the WTGs suggest that some of the construction required for either alternative may involve work for which a contractor may wish to obtain a State DOH construction noise permit. This will require it to submit an application to the Department describing the construction activities and requesting a variance. If this is done, the State DOH may require action by the Contractor to incorporate noise mitigation into the construction plan and/or it may require the Contractor to conduct noise monitoring or community meetings inviting the neighboring residents and business owners to discuss construction noise. However, because of the isolated location of the proposed work, the Department may deem this unnecessary.

If a construction noise permit is granted, the contractor will be required to use reasonable and standard practices to mitigate noise, such as using mufflers on diesel and gasoline engines, using properly tuned and balanced machines, etc. If construction noise in excess of the standards is allowed, it will be limited to between 7:00 a.m. and 6:00 p.m., Monday through Friday and to between 9:00 a.m. and 6:00 p.m. on Saturday.

The preliminary geotechnical information that is available indicates that the area that would be used for the WTGs in the Preferred Alternative has numerous areas of rock where mechanical equipment alone may be unable to excavate to achieve the desired civil design. In these locations, the contractor will use small explosive charges (i.e., "drill-and-shoot") to fracture the rock in place. The fractured rock would then be removed and processed into a well-graded mixture in accordance with the geotechnical engineer's specifications and used on-site for surface gravel for access roads, pad construction, and potentially for deeper fills.

Because of the substantial area that is involved, it is not practical to determine the precise volume of rock that will require this treatment in advance through regular geotechnical investigations. Instead, the construction contractor will establish the need for this in the field as it encounters very hard basalt rock (Maui Blue Rock). The way in which explosives would be used is very site-specific, with the magnitude and approximate number of charges tailored to the minimum number required to break up the material sufficiently for it to be removed by heavy equipment. In this type of application, holes are drilled in the unyielding rock, the drill holes are then packed with the explosive material and filled with sand or dirt to contain the fracturing effect of the blast, and then the charges are detonated. Blast mats will be used to prevent material from being inadvertently tossed into the air. Tests will be conducted on the type of explosive material to be utilized and the drill/borehole patterns including depth will be perform for each case to insure sufficient fracturing for the mechanical machine

excavation.[63] General safety zones will be established before any explosives are used; all personnel not involved in the actual detonation will stand back at least 1,000 feet and workers involved will stand back at least 650 feet from the time the "blast imminent" signal is given until the "all clear" has been sounded. The impulsive sound levels produced by such operations is not expected to exceed the limit in HAR §11-46.

Before any use of explosives, the main access road will be blocked off and flagmen will be posted at the main access roads, the approaches of the Lahaina-Pali Trail, and all other access points so that no one is able to approach closer than 1,000 feet to the work site. The contractor will use an air horn or siren to give the proper "warnings" and "all clear" signals, in addition to radio communication to all perimeter flagmen. The actual downtime for the road is estimated to be 15 minutes per event.

4.9 IMPACTS TO ARCHAEOLOGICAL/ HISTORIC/ CULTURAL RESOURCES

Section 3.9 of this report describes the historic, cultural, and archaeological resources present in the two KWP II project siting areas being considered. The majority of these (the exceptions are the *heiau*, the Lahaina Pali Trail and Mā‘alaea branch to the south of the lease area) have been subject to data collection by qualified archaeologists and have been recommended for no further work or preservation.[64] Because the construction activities are essentially the same regardless of the site alternative selected, the potential for impact on archaeological and historic sites is considered together in Section 4.9.1 and potential impacts on cultural resources are addressed in Section 4.9.2

4.9.1 POTENTIAL IMPACTS TO ARCHAEOLOGICAL AND HISTORIC SITES

Construction has the potential to affect historic and archaeological resources directly if it physically disturbs remains at or near the ground surface. Indirect impacts are possible if construction or operation of the facilities adversely affect the ambience of remains or the context within which they are seen or used.

4.9.1.1 Effects on Known Historic and Archaeological Sites

As discussed in Section 3.9.2, the Lahaina Pali Trail and the Mā‘alaea branch of that trail are considered significant under HAR §13-284-6 Criterion D for the information yielded relative to mid-to-late twentieth century transportation patterns and evolving modes of transportation. The main trail is already governed by a management plan (Tomonari-Tuggle 1995) and it will not be directly impacted as a result of the proposed wind power project. The newly discovered remnant portion of the Mā‘alaea branch of the main Lahaina Pali Trail is also being physically preserved by the site plan, and KWP II is currently preparing a preservation plan to be submitted to DLNR-SHPD for review and approval.

All of the features of Sites 5648 and 6665 (which are considered significant under HAR §13-284-6 Criterion D for the information they have yielded and/or for the information they are likely to yield upon future study) are preserved by the proposed development plan. Because of its current proposed layout, further mitigation work is not necessary. KWP II is currently preparing a preservation plan for Site 5648 to be submitted to DLNR-SHPD for review and approval. If in the future, it is necessary to impact one or more of the site's features the State Historic Preservation Division should be contacted to address possible mitigation of impacts through data recover. Site 6665 is not

[63] Blasting will be done in conformance with the "Blasting Guidance Manual", Office of Surface Mining, Reclamation, and Enforcement, U.S. Department of Interior (OSMRE). Blasting will also be conducted in accordance with United Stated Department of Labor departments of Mine Safety and Health Administration (MSHA) and Occupational Safety and Health Administration (OSHA). The contractor will prepare a blasting plan prior to commencing project blasting. This will include sketches of each blast location, drill pattern, delay period and use of a blasting matte. It will also indicate the type and amount of explosive to be used and establishment of a safety perimeter.

[64] Readers should note that this discussion of the trails focuses on their historical values. Effects on the modern-day recreational use of the trails are discussed in Section 4.13.2.2.

exceptional and is not likely to yield further important information, thus no further work is recommended for the treatment of this site.

4.9.1.2 Monitoring and Inadvertent Finds

The information available from all of the studies conducted in the project area, as well as the fact that no artifacts or burials were encountered during construction of KWP I, indicates that the probability of encountering subsurface remains during construction is relatively low. However, it does not eliminate the potential entirely. In order to minimize the potential for KWP II construction to affect the existing *heiau* or other inadvertent archaeological finds, KWP II LLC proposes the measures described below.

- Contracting for Archaeological Monitoring of Construction. Prior to commencing construction, KWP II LLC will contract with a qualified archaeologist for on-site/on-call monitoring of construction work. The construction contract will make the contractor responsible for halting work and reporting any archaeological or cultural materials encountered to the archaeological monitor. The monitoring contract will provide for on-call monitoring. The proposed program of archaeological monitoring will be conducted in accordance with Chapter 279: Rules Governing Minimal Standards for Archaeological Monitoring Studies and Reports; Hawai‘i Administrative Rules; Title 13, Department of Land and Natural Resources; Subtitle 13, State Historic Preservation Division (adopted December 2003). The proposed monitoring plan will be submitted to the SHPD for review and approval prior to beginning work, unless otherwise agreed to by the SHPD.
- Pre-Construction Conference. Before work commences on the project, the consulting archaeologist will meet with the construction supervisors and all regular members of the construction crew to identify the location of the *heiau*, review guidelines for working in the vicinity of it, and explain what other kinds of cultural or archaeological materials might be encountered and the procedures they are to follow in the event they are uncovered during the course of construction. The archaeologist will also explain his/her role and that the monitoring archaeologist will have the authority to halt construction in the immediate area of any find.
- Treatment of Finds: If cultural deposits are discovered during monitoring, appropriate data will be collected. This would include recording their geographic location on project area maps, general written descriptions, sampling, and section drawings, plan views, and photographs as appropriate. For traditional Hawaiian deposits, this may include analysis of recovered artifacts and midden and possible radiocarbon dating of samples from cultural contexts. If historic deposits are located (e.g. older than 50 years) then analysis of associated historic artifacts may be required. If any findings are deemed significant, and if the deposit is likely to be further impacted by construction activities, the archaeologist will halt work in the immediate affected area and will develop an appropriate mitigation strategy in consultation with SHPD. All cultural and historic remains other than burials will be treated in accordance with the current requirements and specifications contained in the SHPD Hawai‘i Administrative Rules (HAR) §13-280 (Rules Governing General Procedures for Inadvertent Discoveries of Historic Properties During a Project Covered by the Historic Preservation Review Process; effective December 11, 2003).
- Any human skeletal remains would be treated in accordance with the current requirements and specifications contained in the SHPD Hawai‘i Administrative Rules (HAR) §13-300:40 (Rules of Practice and Procedure Relating to Burial Sites and Human Remains: Inadvertent discovery of human remains; effective September 1996), and HRS 6E-43.6.
- In the event that burials are encountered during the course of construction of the facilities, KWP II LLC will also adhere to the laws cited above relating to the inadvertent discovery of human remains. Once in operation, the project will have virtually no potential to negatively impact archaeological or historic sites so long as the *Heiau Preservation Plan* continues to be complied with.

4.9.2 POTENTIAL IMPACTS ON TRADITIONAL CULTURAL RESOURCES AND PRACTICES

No on-going cultural practices have been identified for the two proposed project areas (see 0). However, archaeological studies have identified two traditional cultural properties and documented three significant sites with possible cultural properties which merit preservation. The following subsections outline the framework for the evaluation, discuss potential effects, and outline the appropriate mitigation measures that KWP II will take.

4.9.2.1 Evaluation Framework

The OEQC "Guidelines for Assessing Cultural Impact" referred to in Section 3.9.4 identify several possible types of cultural practices and beliefs that are subject to assessment. These include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs. The guidelines also identify the types of potential cultural resources, associated with cultural practices and beliefs that are subject to assessment. Essentially these are nature features of the landscape and historic sites, including traditional cultural properties.[65] "Traditional" as it is used, implies a time depth of at least 50 years, and a generalized mode of transmission of information from one generation to the next, either orally or by act. "Cultural" refers to the beliefs, practices, lifeways, and social institutions of a given community. The use of the term "Property" defines this category of resource as an identifiable place. Traditional cultural properties are not intangible, they must have some kind of boundary. With one important exception, they are subject to the same kind of evaluation as any other historic resource; the exception stems from the fact that, by definition, the significance of traditional cultural properties is determined by the community that values them.

As the OEQC guidelines do not contain specific criteria for assessing the significance of traditional cultural properties, the CIA adopts the State's criteria for evaluating the significance of historic properties, of which traditional cultural properties are a subset. Thus, to be significant the traditional cultural property must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

A. Be associated with events that have made an important contribution to the broad patterns of our history;

B. Be associated with the lives of persons important in our past;

C. Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;

D. Have yielded, or is likely to yield, information important for research on prehistory or history;

E. Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

It is DLNR-SHPD's practice to consider most historic properties significant under Criterion D at a minimum; by definition, traditional cultural properties are also significant under Criterion E.

A further analytical framework for addressing the preservation and protection of customary and traditional native practices specific to Hawaiian communities resulted from the State of Hawai'i Supreme Court's decision in the Ka Pa'akai O Ka'āina v Land Use Commission court case. That decision established a three-step process for evaluating potential impacts:

- identify whether any valued cultural, historical, or natural resources are present the extent to which any traditional and customary native Hawaiian rights are exercised;

[65] The origin of the concept of traditional cultural property is found in National Register Bulletin 38 published by the U.S. Department of Interior-National Park Service.

- identify the extent to which those resources and rights will be affected or impaired; and
- specify any mitigative actions to be taken to reasonably protect native Hawaiian rights if they are found to exist.

4.9.2.2 Anticipated Cultural Impacts

For a complete discussion of existing archaeological and historical resources and potential impacts to them in the KWP II area, please see Section 3.9 and 4.9.1. As a noted above in Section 4.9.1, one site with cultural significance was identified that had the potential to be impacted by the KWP II. SIHP Site 5232 is an upland *heiau* located in the east-central portion of the KWP II Alternative 2 area along the western edge of the existing wind farm. Oral-historical information gathered during the current study indicates that this *heiau* is named Hikiʻi; and it is suggested by both the archaeological studies and the oral-historical information that Hikiʻi Heiau was linked to navigational activities, perhaps associated with travel between Maui and Kahoʻolawe. Site 5232 is considered significant under Criterion D because of its important research potential and under Criterion E because of its important traditional cultural value. This site was recommended for preservation (Athens 2002; Clark and Rechtman 2006), and a site preservation plan has already been prepared, approved, and partially implemented (Tomonari-Tuggle and Rasmussen 2005). As recommended in that plan, KWP II will ensure that an archaeological monitor will be present during any development activities (e.g., grading) that occur within 500 feet of the *heiau*.

In addition to cultural values associated with these identified historic and archaeological sites, archival research and oral-historical information indicate that there are two additional potential traditional cultural properties associated with the KWP II project area.

- The first of these potential cultural properties is the exposed red dirt Honuaʻula Ridge is considered to have functioned as a visual marker, or *koʻa*, associated with local navigational practices. While the WTGs are quite noticeable, they do not obscure this natural navigation aid; hence, their impact can be considered negligible in that the ability to use this landscape feature is not diminished by their presence.
- The second potential traditional cultural property is more general in nature and includes the greater project area and beyond, identifying it as a *kulamanu*, a place where birds (namely *nēnē*, *pueo*, and *ʻuaʻu*) have historically gathered (and continue to gather) before moving in flocks to other part of Maui and to Kahoʻolawe. The US Fish and Wildlife Service has recognized this area as a significant bird habitat resources and have directed KWP II LLC to abide by a habitat conservation plan in an effort to protect and perpetuate indigenous and endangered avian species.

In general, interviewees expressed a preference for the proposed Preferred Alternative, *makai* of KWP I, citing that it was further from the culturally important *kulamanu* and the *wao akua*, or divine space. Kupuna Paolo Kamakehau Fujihiro also expressed his belief that the wind is better on the lower slopes.

4.9.2.3 Mitigation Measures

The CIA makes three recommendations with respect to maintaining an on-going commitment to the preservation and enhancement of cultural properties and practices.

- Limit additional WTGs and related development to areas below (i.e., lower in elevation) the existing facilities. This will ensure that they do not intrude into what is culturally considered *wao akua*, or divine space.
- Continue and expand upon the education outreach programs conducted by the operators of the existing wind farm. In particular, resources should be devoted to *mālama ʻāina* (land and resource management), *hoʻokele waʻa* (navigation and voyaging), and *papahulilani* (Hawaiian study of atmosphere).

- Work with cultural practitioners and genealogical descendants of the area to establish a *Kupa ʻĀina* Council as an advisory group for the project area to help with educational and resource conservation planning as well as community outreach.

KWP II LLC has agreed to implement these measures.

4.10 LAND USE & SOCIOECONOMIC EFFECTS

4.10.1 LAND USE IMPACTS

The proposed KWP II facility would be located in open meadows and adjacent to existing roadways on a remote ridge. It is close to the existing KWP I wind-generating facility. There are no existing uses of the pasture area other than wind generation. Discussions with DLNR staff have indicated that the proposed KWP II project will not interfere with other existing or potential uses of the State land that the proposed facilities would encumber (via the proposed lease). The presence of the WTGs, site access roads, substation, and related facilities would not limit access to other land served by the existing access road.[66] As discussed elsewhere in this report, the proposed facilities will not degrade the usefulness of the upland area as habitat for nēnē or other important avian species.

The parcels in which the proposed project and existing access road are situated, are designated as Section(b) Ceded Lands. These lands belonged to the Hawaiian Kingdom at the time of the 1893 overthrow and later transferred ("ceded") by the United States government to the State of Hawaiʻi upon statehood. Today, the State holds the Ceded Lands corpus in trust for Native Hawaiians and the general public. OHA receives a portion of all revenues generated on these lands and will, therefore, receive a portion of the amount that KWP II LLC pays to the Department of Land and Natural Resources for the lease of the 333-acre project site.

The presence of the proposed facilities will not interfere with continuing recreational use of the Lahaina Pali trail, although it will be quite visible from portions of it (see Section 4.11.4.1). The proposed KWP II facilities would be visible from only a few other areas, none of which is proposed for land uses that might be particularly sensitive to the presence of the WTGs and/or related facilities. Hence, the construction and operation of the proposed facilities will not interfere with any existing or likely future land uses.

4.10.2 SOCIO-ECONOMIC IMPACTS

Construction and operation of the proposed facilities will have a number of socio-economic impacts. Direct socio-economic effects of the proposed facilities include: (1) construction employment and business activity; (2) ongoing employment of facility staff (which would be relatively limited); and (3) ongoing expenditures for materials and outside services; and (4) State revenues in the form of excise taxes, lease revenues, and other taxes. These are discussed below. Additional benefits are discussed in Section 1.2.

4.10.2.1 Construction Employment and Expenditures

As reported in Section 2.2.12, the total estimated cost for construction is $79 million for the Preferred Alternative and $85 million for Alternative 2. In order to estimate the effect that these expenditures would have on the Maui and State economy, KWP II LLC first split each of the construction cost line items in Table 2.6 for the Preferred Alternative between those that would be spent in-state and those that would be spent out-of-state. Those estimates indicate two-thirds of the expenditures are allocated for equipment and materials that would be purchased out of Hawaiʻi; the remaining one-third would be spent in-state. The construction costs overall for Alternative 2 are higher by approximately $6

[66] Note that the State restricts use of the existing access road at the present time and will continue to do so in the future. It must grant permission to those who wish to use it and allow them entrance through the locked gate that is at the intersection of the access road and Honoapiʻilani Highway.

million or an increase of about 7 percent. As nearly all of this would be for the access road and site development. As the great majority of those expenditures would be in Hawai‘i, the out-of State/in-State numbers for Alternative 2 would be roughly $50 million and $35 million.

Table 4.18 Allocation of Preferred Alternative Construction Costs Between Out-of-State and in Hawai‘i

Item	*Order-of Magnitude Cost (in million 2009$)*	*Location of Expenditures (% of Total)*		*Expenditures (in million $) by Location)*	
		Out of State	*Hawai‘i*	*Out of State*	*Hawai‘i*
Access Road/Site Development	$14.0	0%	100%	$0	$14.0
Wind Turbine Equipment	$27.0	100%	0%	$27.0	$0.0
Wind Turbine Installation/Balance of Plant	$10.0	40%	60%	$4.0	$6.0
Transportation and Logistics	$5.0	50%	50%	$2.5	$2.5
Electrical Substation, Collection Lines, & Interconnect	$22.0	70%	30%	$15.4	$6.6
Operation and Maintenance Facility	$1.0	0%	100%	$0	$1.0
TOTAL	$79	**62%**	**38%**	**$48.9**	**$30.1**

Source: Compiled by Planning Solutions Inc. based percentage and cost on estimates by KWP II LLC.

The State of Hawai‘i Department of Business, Economic Development, and Tourism (DBEDT) has developed an econometric model that allows it to estimate the impact that construction expenditures such as those shown in Table 4.18 have on the State and County economies (see Figure 4.7).[67] The figure shows how money spent in construction expenditures creates *indirect* economic activity in addition to the *direct* economic activity in the construction industry itself. The figure shows that, on average, a dollar in *direct* construction spending actually generates, nearly $1.27 of total output in the economy.[68]

A module of the State Input-Output model refines the statewide figures and allows the model to produce estimates of the effect that construction expenditures in individual Counties will have on the overall level of business output, earnings, and employment. The multipliers in that model were applied to the $30.1 million dollar in-state direct expenditure estimate for the Preferred Alternative to calculate the direct, indirect and induced output effects (in dollars) and jobs (in person-years of employment) that are shown in Table 4.19.

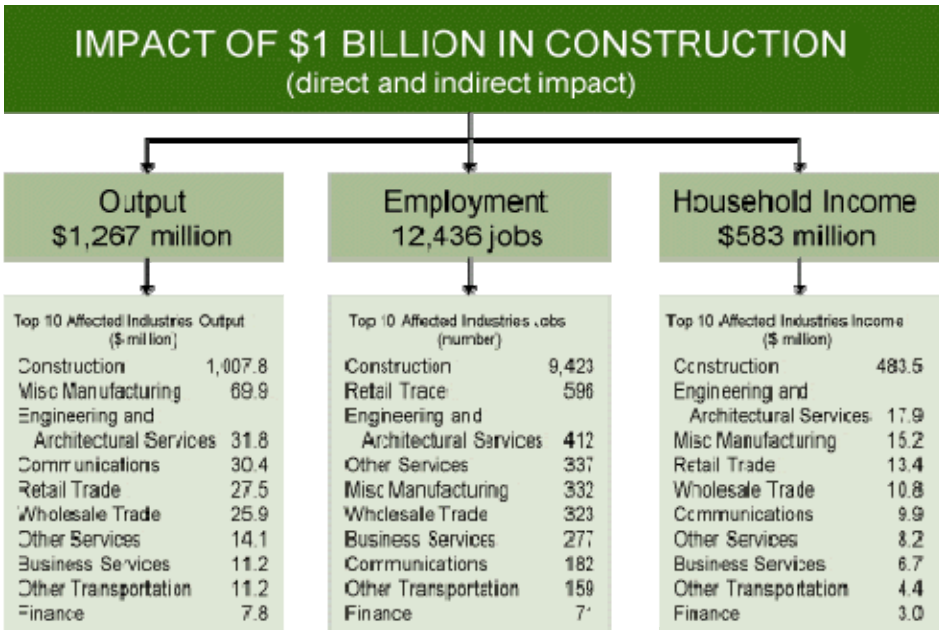
The lower boxes in Figure 4.7 provide a rough indication of the way in which this economic activity is likely to be distributed among the key industries that provide inputs into the construction sector. They show that most of the output, jobs, and income from construction spending generated is in the construction industry itself.[69]

[67] The estimates are the product of the State of Hawai‘i Department of Business, Economic Development and Tourism (DBEDT, 2002) Hawai‘i Input-Output Model. This input-output model, which is based on historical economic data in Hawai‘i, estimates the extent to which the direct economic inputs from various activities lead to indirect economic effects.

[68] The output is defined as the value of sales for most industries and "trade margins" for a few industries such as retail and wholesale trade, which do not actually make the goods they sell.

[69] Note, that this more detailed breakdown applies at a statewide level and should not be compared directly with the estimates from the County-level model.

Figure 4.7 Impact of Construction Expenditures on Hawaii Economy



Source: Department of Business, Economic Development, and Tourism.

Table 4.19 Impact of Project-Related Expenditures on Economic Output, Earnings, and Employment in Hawai‘i for Preferred Alternative

Parameter	*Type 1 (Direct & Indirect*		*Induced*		*Total (Type 2)*	
	Multiplier	*Amount*	*Multiplier*	*Amount*	*Multiplier*	*Amount*
Output	1.42	$42.7 million	0.54	$16.3 million	1.96	$59 million
Earnings	0.45	$13.5 million	0.14	$4.2 million	0.59	$17.8 million
Jobs	13.00	391 Person-yr	5.30	160 Person-yr	18.30	551 Person-yr

Source: Compiled by Planning Solutions, Inc. using Expenditures from Table 4.18 and factors from State of Hawai‘i Department of Business, Economic Development and Tourism (DBEDT, 2007) Hawai‘i Input-Output Model (Maui Inter-County module).

4.10.2.2 Operational Employment

KWP II estimates that 10-12 workers will be present at the proposed facility once the project is completely operational. The team of employees will consist of 1-2 biologists, a plant manager, contractor, road maintenance worker, and a crew of 6 people from General Electric. Not all of these will be on-site at one time.

4.10.3 STATE REVENUES

KWP II LLC will lease the property on which the proposed facilities would be constructed from the State of Hawai‘i. The exact terms of the lease have not yet been negotiated, but based on the precedent set for KWP II, it expects that the amount will be based, in part, on the amount of power that the facilities produce and the terms of the power purchase agreement that KWP II LLC is able to negotiate with MECO. Assuming that those are as described elsewhere in this report, the State would receive approximately $6 million dollars per year. The State would also derive tax revenues from in-state purchases of equipment and supplies and from taxes on workers' and businesses' incomes.

4.11 SCENIC AND AESTHETIC RESOURCES

This section discusses the effect that construction and operation of the proposed facilities would have on scenic and aesthetic resources. It is divided into four main parts.

- Section 4.11.1 identifies the project-related structures and activities that have the potential to affect these resources.
- Section 4.11.2 describes the methodology that was used to identify and evaluate these effects.
- Sections 4.11.3 and 4.11.4 discusses the anticipated visual effects of the proposed facility from various public vantage points.

4.11.1 PROJECT COMPONENTS WITH POTENTIAL TO IMPACT SCENIC & AESTHETIC RESOURCES

Some of the proposed structures (e.g. the operations and maintenance building, the electrical substation, the warehouse-type structure housing the BESS system, etc.) are relatively low and resemble other structures that are present in remote upland parts of the West Maui Mountains. They would not be visible/barely visible from the lowland areas where most people are present so long as care is taken to avoid highly reflective surfaces. Even from the Lahaina Pali Trail, the one public right-of-way that passes close to the KWP II site, these facilities would be relatively unobtrusive.

The proposed WTGs are slightly (~33 feet) taller than the ones already present at Kaheawa; in addition the KWP II WTGs and are located in an area that is more visible than the existing units from the vantages noted in Section 4.11.3.[70] Because of this, the analysis focuses on that component of the proposed action.

Once constructed, the KWP II facility will produce no visible airborne emissions and likely will result in a decrease of visible emissions in the region by decreasing the amount of fossil fuel that MECO must burn at its Mā‘alaea and Kahului Generating Stations. The visible impact to air quality therefore will be limited to the construction period, where some dust and smoke produced in the construction process may be temporarily generated (see Section 4.3.1).

[70] Because of their height, the permanent meteorological monitoring towers would also be visible, but they are much less bulky than the WTGs. Because of this, they are not included in the visual simulation graphics.

4.11.2 VISUAL IMPACT ASSESSMENT METHODOLOGY

The visual impact assessment methodology involved two principal steps. The first was aimed at identifying locations on the island from which the proposed facilities would be visible and providing a quantitative measure of the extent to which they might be obtrusive. The second step was designed to produce photo-renderings that illustrate the appearance of the hillside from selected vantage points with and without the proposed project. The methodologies used for each of these steps are summarized in the following subsections.

4.11.2.1 Methodology Used to Identify Areas from which the Facilities Would be Visible

Identifying areas on the island from which the proposed facilities would be visible and providing a quantitative measure of their visibility involved the following tasks:

- Creating a computer model of the terrain to graphically depict the viewshed. This was done using elevation data downloaded from the USGS National Elevation Dataset (URL: http://seamless. usgs.gov/website/ seamless/ viewer.htm).
- Geo-referencing the turbine locations. This was done using X-Y (latitude-longitude) coordinates from First Wind for each of the WTGs.
- Adding a Z (height) value to each of the WTG locations. This was done using information on the proposed tower height (212 feet above ground level, or agl), the height of the tips of the blades (328 feet agl), and the height of the observer (6.5 feet agl).
- Mapping the Areas from Which the Proposed WTGs Could be Seen. This was done using ESRI® ArcView® Spatial Analysis Extension software together with the terrain model and information on the WTGs described above.[71] The Spatial Analysis software provided digital rasters with pixel sizes of 0.00028 degrees latitude and longitude (which represents approximately 10,000 square feet).
- Graphically Depicting and Tabulating the Model Results. The ESRI software produced maps showing areas from which the proposed (i.e., KWP II) WTGs could (and could not) be seen.
- Depicting the Extent of Change in WTG Visibility. The ESRI software also produced maps and tables showing the extent to which proposed additional Kaheawa WTGs would increase the area from which Kaheawa WTGs would be visible. Two viewsheds were considered in producing the tabulations; one that consists only of the land area of the island of Maui; the other included the entire available digital elevation data set encompassing surrounding waters and islands like Molokini and the northern exposure of Kahoʻolawe. This viewshed analysis revealed the locations on and offshore of the Island of Maui from which the proposed KWP II facility would be most visible.

4.11.2.2 Methodology Used to Produce Photo-Renderings

Producing the photo-renderings that illustrate the appearance of the hillside from selected vantage points with and without the proposed project involved the following:

- Identifying the critical vantage points to consider. Previous studies and environmental impact evaluations of the existing KWP I wind generation facilities were reviewed to determine which types of vantage points are of greatest concern to the people and businesses that would see them. Comment letters on the EIS for the existing KWP I facility were helpful in this regard.
- Selecting Vantage Points for Detailed Analysis. These vantage points included: (1) North Kīhei/Māʻalaea; (2) Wailea; (3) Kapoli Street near Māʻalaea Harbor; (4) Central Maui (Kuihelani

[71] The facility would also be visible from some locations offshore or above Maui (i.e., boats or aircraft flying overhead). These were not mapped.

Highway), (5) Olowalu; and (6) Lahaina Pali Trail[72]. Initially it was thought that we would also depict the effect on views from up-country on Haleakalā, but a site visit to that area confirmed that the proposed KWP II facilities are too far from that region and from the closest point on the National Park to have a measurable effect on views from that area.[73]

- Creating a Computer Simulation of Views from the Selected Vantage Points. ESRI® ArcView® Spatial Analysis Extension software was used with the terrain and facility information to create a 3-dimensional computer model that allowed the appearance of the proposed facilities to be represented from the selected vantage points.
- Converting the Computer Simulation into a Photo-Simulation. In order to make the graphical representation of the proposed project's appearance as realistic as possible, actual photographs of the terrain taken from the selected vantage points were combined with photographs of GE 1.5 MW WTGs of the type that are proposed to create a photo-simulation of the project as seen from each of the selected locations. The computer model allowed the graphical representations of the WTGs to be sized accurately.

4.11.3 ISLANDWIDE VISIBILITY

4.11.3.1 Baseline (Existing) Visibility

As shown by the viewshed analysis maps in Appendix C, the existing KWP I WTGs are visible from a substantial part of the island. The fact that "visibility" depends upon whether one is talking about an ability to see the very tips of the blades from a single WTG, the very top of a single WTG tower, or some number of these that is greater than one, some generalizations are possible.

- The existing WTGs are not visible from Kahului, from Honoapiʻilani Highway or Highway 380 as they cross the Maui isthmus from Kahului to Māʻalaea, or from Māʻalaea Harbor.
- They are visible from Mokulele Highway, but off to the west and at distances ranging from 5 to 8 miles.
- They are also visible from the Kīhei and Wailea shorelines, but at distances of 6 to 23 miles.
- They are not visible from the Māʻalaea Harbor area or from any points on West Maui except the mountainous area immediately surrounding the existing facilities.

4.11.3.2 With-Project Visibility

There is a measurable difference between the two alternatives with respect to the extent to which the proposed new WTGs would be visible from populated areas and public vantage points. In most cases the Preferred Alternative is the more visible of the two. The differences that are most readily apparent from the viewshed maps reproduced in Appendix C are summarized below, but readers should refer to Section 4.11.4 for details.

4.11.3.2.1 Visibility of the Preferred Alternative

Intervening terrain (principally Kealaloloa Ridge) makes it impossible to see the WTG towers that would be constructed as part of the Preferred Alternative from Honoapiʻilani Highway as it skirts the eastern side of the West Maui Mountains, but the tips of some blades would be visible to persons looking closely from southbound vehicles once they pass the intersection with Highway 380. In this

[72] This photo-simulation was done for Alternative 2 only. The trail passes between WTG4 and WTG5 in the Preferred Alternative at such a close distance as to make simulations ineffective at representing the appearance of the facilities.

[73] The proposed KWP II WTG array may be visible on clear days from certain vantage points on the slopes of Haleakalā. With a distance of over 15 miles to Makawao, and 20 miles to the summit of the volcano, it is unlikely that many people at these viewpoints would notice the wind turbines unless they were specifically looking for them or were using magnification apparatus like a telescope, binoculars or a telephoto lens and only in the clearest possible weather and visibility conditions. Also, because of the intervening Kealaloloa Ridge, most areas on Haleakalā would have limited line of sight to the proposed facilities.

alternative, portions of 10 or more the proposed WTG Towers (of the 14 total) would be visible from all points to the east of Honoapiʻilani Highway. From Māʻalaea Harbor, one of the closest vantage points, the nearest WTG would be a little more than a mile away; the distance from the Māʻalaea Harbor to the uppermost of the WTGs in this alternative is approximately 1.75 miles.

Because the WTGs that would be constructed under this alternative are lower on the hillside and slightly to the east of the existing ones, they would not only be visible from more places, they would appear slightly larger from the closest viewpoints than do the existing WTGs. The nature of the differences can be seen by referring to the visual simulations in the following section of this report.

4.11.3.2.2 Visibility of Alternative 2

As can be seen from the drawing in Appendix C depicting the area from which this alternative's WTGs could be seen, the new WTGs in this alternative would be substantially less visible from the most populous areas of the island than are the existing WTGs that make up KWP I. People in most of the areas from which the new WTGs would be visible can already see the existing turbines, and in general the existing turbines are more visible than would be the new array as laid out in this alternative. The area that would experience the greatest visual change as a result of the additional WTGs is Olowalu and the shoreline immediately east of that. Even there, the change is modest (see Section 4.11.4.5 for a detailed discussion).

4.11.4 VISUAL IMPACT ANALYSIS BY LOCATION

Wind turbine generators are, by their nature and design, conspicuous. Some people enjoy them, either because they find them aesthetically pleasing or because they symbolize a desired movement towards a sustainable lifestyle. For other observers, however, they represent an undesirable intrusion on views of the existing landscape. Because of this, KWP II LLC paid considerable attention to the siting of the machines, choosing an area close to the existing wind farm (to avoid creating an entirely new visual object). Alternative 2, in fact, has very low visibility from developed areas and important viewpoints. The remainder of this section uses real photographs and the visual simulation methodology described in Section 4.11.2.2 to depict the effect that construction and operation of the WTGs associated with both the Preferred Alternative and Alternative 2 would have on views from the selected vantage points that were previously discussed.

4.11.4.1 Appearance from North Kīhei/Māʻalaea Bay

Views from this location are representative of those from other shoreline segments at a similar distance from the KWP II site. The views are also available (in slightly modified form) to persons in the upper floors of buildings further east in Kīhei and to drivers and passengers in cars on Honoapiʻilani Highway. Residents of low-rise buildings and people in cars on Kīhei Road generally cannot see Kaheawa Pastures because of intervening vegetation and buildings.

4.11.4.1.1 Preferred Alternative

As depicted in the photo-simulation reproduced in Figure 4.8, the additional WTGs that would be constructed under this alternative represent an extension of the existing line of WTGs on the hillside. (The 14 on the left-hand side represent the new WTGs; the others are the existing machines). Because they are slightly nearer (and slightly taller) than the existing machines, the proposed new ones appear slightly more distinct and marginally larger; they also add to the cumulative effect. However, they do not introduce a visual element that is not already present or one that is inherently more intrusive. Viewers who are comfortable with the existing facility will generally find the additional WTGs acceptable, possibly even pleasing. Those who do not like the existing machines are likely to dislike the existing ones as well. The distance from this viewpoint to the nearest of the new WTGs is over five miles.

4.11.4.1.2 Alternative 2

Most of the WTGs that can be seen along the ridgeline from the vantage point in the photo-simulation reproduced as Figure 4.9 (which is situated along the shoreline of Mā‘alaea Bay near the western end of Kealia Pond) belong to KWP I. Only four proposed WTGs (the ones on the far left) are fully visible; the very tops of a few other KWP II machines can be seen intermingled with the existing turbines. The distance (3.7 miles and 3.8 miles to the closest proposed and closest existing, respectively) makes all of them appear relatively small, but they are still an obvious presence on the otherwise undeveloped West Maui Mountain. Nonetheless, the presence of the existing turbines means that the proposed addition will not alter the situation significantly. In this regard it is worth noting that as discussed in Section 2.3.1 of this report, the “upwind siting area” that was being considered at the time the EISPN for the project was issued was eliminated from further consideration in part because of its greater visibility from central Maui.

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

First Wind
(Photo taken October 2, 2009)

Figure 4.8:

Simulated View of Preferred Alternative from North Kīhei/Mā'alaea Bay

Kaheawa Wind Power II

Figure 4-8 Simulated View of Preferred Alternative from Maalaea Bay 2009-10-28.cdr

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

First Wind
(Photo taken April 22, 2008)

Figure 4.9:

Simulated View of Alternative 2 from North Kīhei/Mā'alaea Bay

Kaheawa Wind Power II

Figure 4-9 Simulated View of Alternative 2 from Maalaea Bay 2009-10-28.cdr

4.11.4.2 Appearance from Wailea

As indicated by the photograph to the right (which was taken from the shoreline near Wailea), as one moves farther from the West Maui Mountains all of the features become indistinct. Because of this, there is no potential for the project to have a significant impact on views from this area. Nonetheless, because views from residences are a particular concern, KWP II LLC prepared a visual simulation of views from existing development at Wailea (which is a little less than 10 miles from Kaheawa Pastures) as a means of illustrating the changes that would occur if the proposed project is approved and constructed.

Figure 4.10 (for the Preferred Alternative) and Figure 4.11 (for Alternative 2) show the results of that simulation. [Please note that because the WTGs would have been indistinct if they were portrayed at the size they would actually appear to the human eye, the scene had to be magnified (i.e., made larger than they would actually appear to the unaided eye). This means that the photo-simulation overstates the visibility of the wind farm.]

In both instances the existing WTGs are the ones on the right hand side of the figures; the proposed new turbines are on the left. Because of the great distance between the viewpoint and the nearest WTG, there is relatively little difference between the two alternatives. Because the viewpoint is elevated (the ground elevation is approximately 160 feet above sea level), it is possible to see all of the existing and proposed machines, not just the top portions as is the case from some of the closer vantage points.

Because the proposed WTGs are joining ones that are already present, they do not represent an entirely new feature on the mountainside. Instead, they add to the cluster that is already visible. For viewers who have grown accustomed to the existing wind farm and have positive attitudes toward renewable energy, the addition will tend to go largely unnoticed. For those who are already bothered by the intrusion of large structures into an area that is otherwise natural, either alternative is likely to be considered an imposition.

4.11.4.3 Appearance from Kapoli Street at Mā‘alaea

This simulation (see Figure 4.12) is from the parking lot of the small commercial complex in Ma‘alaea that lies in the triangle formed by Honoapi‘ilani Highway on the west, Kapoli Street on the South, and Mā‘alaea Boat Harbor Road on the east. Because it is relatively close to the West Maui Mountains, the steep terrain to the east makes it impossible to see anything except the tips of a few of the existing WTG blades.

4.11.4.3.1 Preferred Alternative

The terrain blocks views of the lower part of the WTGs that would be constructed as part of the Preferred Alternative, but the upper portions of most of the towers and virtually all of the blades would be visible. Hence, this alternative introduces a visual element to the area that is not now present. It is to an area that is commercial in nature, and for that reason is not likely to be considered intrusive.

4.11.4.3.2 Alternative 2

None of the facilities that would be constructed for Alternative 2 would be visible from this location.

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

First Wind
(Photo taken on September 21, 2009)

Figure 4.10:

Simulated View of Preferred Alternative from Wailea

Kaheawa Wind Power II

Figure 4-10 Simulated View of Preferred Alternative from Wailea 2009-10-15.cdr

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

Planning Solutions, Inc.
(Photo taken on April 22, 2008)

Figure 4.11:

Simulated View of Alternative 2 from Wailea

Kaheawa Wind Power II

Figure 4-11 Simulated View of Alternative 2 from Wailea 2009-11-10.cdr

Prepared For:	Prepared By:	Source:	Project:	Figure 4.12:
Kaheawa Wind Power II	PLANNING SOLUTIONS	Photographs taken by First Wind on August 24, 2009	Kaheawa Wind Power II	**Simulated View of Preferred Alternative from Kapoli Street Near Mā'alaea**

Figure 4-12 Simulated View of Preferred Alternative from Kapoli Street in Maalaea 2009-10-16.cdr

4.11.4.4 Appearance from Central Maui Isthmus (Kuihelani Highway)

There are no residences or other visually sensitive land uses in this area. However, large numbers of people traverse the Central Maui isthmus as the drive between Kahului and West Maui. This simulated view is from a point along the highway that is approximately 4 miles north-northeast of its intersection with Honoapiʻilani Highway.

4.11.4.4.1 Preferred Alternative

As discussed in Section 4.11.3, the existing wind farm is only marginally visible from this location (just the blade-tips of several of the WTGs). Construction of the Preferred Alternative will alter this. As can be seen in Figure 4.13, the upper portions of the 14 WTGs that are proposed as part of this alternative would be visible along the ridge line. Their appearance is softened both by the distance between the viewpoint (over 5 miles) and by the fact that no more than half the height of any tower is visible. They are not visually dominant, but they do represent a manmade element that is not now present.

4.11.4.4.2 Alternative 2

None of the facilities that would be constructed for Alternative 2 would be visible from this location.

4.11.4.5 Appearance from Olowalu

All of the viewpoints discussed thus far are located to the east and northeast of the project site. Other potential viewpoints were considered as well. Terrain makes the existing wind farm and the KWP II site invisible from Lahaina and other urbanized areas on West Maui. Hence, the facilities are only visible from the West as one reaches and passes the small town of Olowalu. Even from there, the effect is limited. None of the existing WTGs at Kaheawa Pastures are visible from the developed areas of Olowalu at the present time. This is due to the effect of intervening terrain and existing vegetation. There are some points along the shoreline in the Olowalu area from which a few of the existing WTGs are visible, but the fact that most of the structures are obscured by the terrain and the considerable intervening distance mean that they are a minor part of the landscape.

4.11.4.5.1 Preferred Alternative

None of the facilities that would be constructed for the Preferred Alternative would be visible from this location.

4.11.4.5.2 Alternative 2

As can be seen by the photo-simulation reproduced as Figure 4.14, construction of the proposed project will place a few more WTGs within eyesight of people along the shoreline when there is no intervening vegetation. However, because of the distance that is involved (approximately 4.3 miles from the point where the picture was taken to the closest turbine), the proposed new WTGs and other facilities will not significantly alter views even from the few locations where they would be visible.

4.11.4.6 Appearance from Lahaina Pali Trail

The Na Ala Hele website describes the Lahaina Pali Trail as follows:

> *"Trail runs from a point near Māʻalaea Harbor with refreshment stands and restrooms, over a ridge and down to a long, sandy beach with snorkeling, surfing and picnicking facilities. Ranging in elevation from 100 to 1,600 feet, the trail offers excellent scenic vistas of Kahoʻolawe and Lānaʻi islands. Whales can be observed during the winter months. Scrub vegetation at the lower elevations gives way to endemic dry-land plants as the trail climbs. The Old Lahaina Trail is part of the historic around-the-island trail system on Maui."*

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

First Wind
(Photo taken September 29, 2008)

Figure 4.13:

Simulated View of Preferred Alternative from Central Kuihelani Highway

Kaheawa Wind Power II

Figure 4-13 Simulated View of Preferred Alternative fromCentral Kuihelani 2009-10-15.cdr

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

Planning Solutions, Inc.
(Photo taken on April 22, 2008)

Figure 4.14:

Simulated View of Alternative 2 from Olowalu

Kaheawa Wind Power II

Figure 4-14 Simulated View of Alternative 2 from Olowalu 2009-11-02.cdr

Many of the existing WTGs are visible from the trail, and both alternatives under consideration would add to the number that can be seen from it. The additional WTGs that are part of both alternatives would both increase the number of wind machines that can be seen and cause persons using the trail to pass closer to them. Hikers along the Kaheawa Pastures section of the trail would have a clear view of these turbine arrays, with little natural vegetation to screen them from their presence.

Figure 4.15 presents a photo-simulation of the way the WTGs that comprise Alternative 2 would appear from a segment of the Lahaina Pali Trail. Two factors help limit the significance of the impact. First, the turbine nearest the trail would still be more than 900 feet away and would only be closely visible as hikers traverse the project site (which constitutes a small segment of the overall trail). Second, the fact that the additional WTGs are nearly identical in appearance to the existing WTGs means that the fundamental nature of the views will not significantly change. Nonetheless, it is evident that the proposed new turbines will have a more commanding appearance when seen from the trail than do the existing WTGs, even though the latter are more numerous.

The Preferred Alternative places WTGs even closer to the trail, with the nearest being between 300 and 400 feet from the bases of WTG4 and WTG5. Instead of being seen as something apart, hikers will find themselves within the wind farm. Some trail users are likely to find this an added treat to the hiking experience; others will feel it reduces the pleasure. In both cases, the fact that the existing WTGs are already relatively close means that the change will be marginal rather than striking. The trail passes between two of the proposed WTG sites in this alternative, and trail users would walk so near to their bases that a traditional visual simulation would be meaningless for this alternative.

4.12 HAZARDOUS MATERIALS

Construction and operation of the proposed KWP II project will involve the use of small amounts of several hazardous materials that require special handling and storage. These may include such materials as waste aerosols, gel-cell batteries, combustible liquid materials, chemicals and paint. Operation of the facility will require on-site storage of cleaning products and mineral, hydraulic and lubricating oils for maintenance of the substation and WTG equipment. As noted previously, the batteries that are part of the BESS system do not contain hazardous materials.

These will be identified, along with measures for containment and spill prevention, in a SPCC Plan for the KWP II facility. The plan will comply with applicable federal, State, and local regulations that govern the use of hazardous materials and the disposal of hazardous wastes. The following sections summarize the possible hazmat issues and the types of containment, spill prevention and cleanup measures that KWP II will include in its SPCC.

4.12.1 CONSTRUCTION PERIOD RISKS

Releases or spills of hazardous materials during construction could occur during transport of construction materials to the site, temporary storage and staging, or during grading or construction of the proposed WTGs, substation, and associated structures. Petroleum products used to power and lubricate the construction equipment are by far the most likely of the potential contaminants. The risk of harm will be minimized by requiring the contractor to follow best management practices, including proper containment of staging and stockpiling areas, provision of spill kits, regular waste collection and disposal, frequent equipment inspection, and off-site refueling and vehicle washing at an approved location.

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

Planning Solutions, Inc.
(Photo taken on November 24, 2008)

Note: This view does not show the proposed new access road or substation.

Figure 4.15:

Simulated View of Alternative 2 from Lahaina Pali Trail

Kaheawa Wind Power II

Figure 4-15 Simulated View of Alternative 2 from Lahaina Pali Trail 2009-11-02.cdr

4.12.2 OPERATIONAL PERIOD RISKS

Operational releases of hazardous materials would most likely emanate from one of the areas where they will be stored. These storage areas will include: 1) the Operations and Maintenance (O&M) building; 2) the WTG sites; and 3) the substation and BESS enclosure. Each of these is discussed in further detail below.

Operations and Maintenance Building. The O&M building will contain products/materials needed for routine O&M which includes mineral oil (~55 gallons), hydraulic oil (~5 gallons), grease tubes (5 to 6 cases), a waste oil container (~55 gallons), and cleaner/degreaser (~20 gallons). These items will be stored on a spill retentive skid or absorbent sheets. Diesel fuel will be stored in small containers (i.e., 5 gallon capacity) outside the O&M building.

Wind Turbine Generators. Each wind turbine site will include two storage containers: (1) a gear box; and (2) a step-up transformer. The gear box stores 64 gallons of hydraulic and lubricating oils and is contained within the nacelle, which is located on top of the WTG tower. Nacelles have catch basins capable of containing small oil spills. Larger spills would overflow into the tower and be contained at the tower's base, which is sealed at the foundation. A pad-mounted step-up transformer is located adjacent to the base of each wind turbine. Each transformer contains approximately 522 gallons of mineral oil. There is no secondary containment in place.

Electrical Substation. The new substation that would be constructed for KWP II will contain a large transformer, a distribution step-up transformer and a grounding transformer. Together, these will cumulatively store approximately 4,000 gallons of mineral oil. The main transformer will be surrounded by a containment dike. The distribution transformer will be pad-mounted and surrounded by six inches of ¾-inch washed gravel, and the grounding transformer will be mounted on an aerial platform and also surrounded by 6 inches of ¾-inch washed gravel.

4.12.3 CONTAINMENT, SPILL PREVENTION & CONTROL MEASURES

The SPCC Plan that KWP II LLC will prepare for the KWP II facility will include emergency contacts, an emergency action plan, organizational roles and responsibilities, site-specific contingency plans, information on hazards analysis, response functions, public information and community relations, as well as information on spill containment and cleanup. It will likely closely follow the existing SPCC for the KWP I facility. The SPCC will include (but will not be limited to) the following types of prevention and control measures:

- *Personnel Training:* As required by 40 CFR 112.7(f)(1) and (3), oil handling personnel will be trained to prevent discharges. KWP II personnel will participate in periodic training for oil spill prevention and cleanup. This training will include familiarization with oil pollution prevention measures at the site, the Spill Prevention, Control, and Countermeasure Plan, and available spill cleanup supplies. Contractors and other transient personnel will be advised of applicable spill prevention measures upon entering the site.
- *Security:* The project is located in a remote area on State Conservation lands above McGregor Point in the West Maui Mountains. Access to the state lands is controlled by a locked gate and signage warning that the road is closed to the public. The Lahaina Pali Trail runs across the access road about 3,000 feet to the south of the southernmost existing WTG. Signage is in place to warn hikers that the access road is closed to the public and to stay on the trail. The gear boxes are located within the nacelle and require no additional security. The step-up transformers at the individual wind turbine sites are located on access roads that are closed to the public. These transformers have pad-locked and wrenched locked cabinets which prevent access to the level gauges and valves that could result in oil discharge. Security fencing and gates are installed around the substation where the largest oil containing transformers are located. These factors ensure that

vandalism is a low risk. The O&M building is kept locked. The 5 gallon diesel containers are stored outside and in an area that is not easily seen while approaching the building.

- *Inspection Protocols and Recording:* Facility inspections will be conducted monthly for wind turbine sites, the substation, all containment structures, and all storage containers. The results will be documented and the records retained in accordance with 40 CFR 112.7(e).
- *Spill Response, Reporting and Cleanup:* KWP II LLC will develop "Spill Response and Reporting Procedures" for the proposed facility. The procedures will specify the clean-up and reporting requirements for small spills (less than 5 gallons) and larger spills (equal to or greater than 5 gallons). If the spill or release cannot be contained, the Maui Fire Department will be contacted. Spill reporting may include notifications to the National Response Center (NRC), US EPA, the State Department of Health Office of Hazard Evaluation and Emergency Response, and the State Department of Land and Natural Resources.
- *Transformer Inspections.* The large transformer in the substation will be inspected for rainwater monthly. If there is no sheen present, the rainwater will be pumped out of the concrete pit. If sheen is present, a spill response contractor or facility personnel will provide clean-up.
- *Containment Measures:* The SPCC regulations in 40 CFR 112.8(b) require facilities to prevent potential discharges from un-diked areas (such as the land containing the step-up transformers located at the base of each wind turbine) by designing facility drainage systems to flow into catchment basins or lagoons. Many of these areas are located such that a spill would not reach navigable waters or cause a violation of water quality standards due to the existing topography and/or the distance to wetlands or surface water. KWP II LLC will conduct a site visit and analysis to determine which, if any, of the WTG sites are situated so that a spill could potentially reach navigable waters. At these turbines, KWP II LLC will identify appropriate secondary containment measures.
- *Spill Prevention Procedures:* No fuel will be transported to or stored at the KWP II facility with the exception of a very small quantity of diesel fuel (~5 gallons). When transferring hazardous product to or from a storage container, personnel will be instructed to load or unload in approved locations only, verify the remaining volume of the receiving container, allow sufficient volume (approximately 10 percent of the total capacity) in the container for thermal expansion, and visually inspect all valves for leakage when transfer is complete.

4.13 PUBLIC INFRASTRUCTURE AND SERVICES

The proposed KWP II project has little potential to affect public infrastructure and services adversely.[74] It would consume only small amounts of electrical power, and this would be delivered through the substation and power distribution equipment that are being installed as part of the project. All of the water needed for the facility would be trucked up to the site; no new potable water service would be required. Similarly, no significant impacts on transportation, telecommunications, or other utilities are anticipated.

4.13.1 TRANSPORTATION FACILITIES

This section describes the effects that the proposed project would have on transportation facilities in the region. While the focus is principally on land transportation facilities (i.e., roads and highways), the discussion also covers air and water transportation.

[74] The need for public agencies to respond in the event of an accident is an exception to this general rule. However, this responsibility already exists and would minimally alter any of the action alternatives being considered.

4.13.1.1 Vehicular Traffic & Roadways

All of the equipment, employees, and materials needed for construction and operation of the WTGs and related facilities would access the site from and the existing roadway serving KWP I. Honoapiʻilani Highway is the main highway serving West Maui, and it is designed and constructed to accommodate heavy vehicular traffic. The existing Kaheawa Pastures access road is owned by the State of Hawaiʻi and was upgraded in conjunction with the development of KWP I. Access is controlled by DLNR, which shares responsibility for the road's upkeep with KWP I LLC. As indicated in Section 3.13.1, existing traffic on Honoapiʻilani Highway is moderately high during the day, but there is remaining capacity.

4.13.1.1.1 Construction-Phase Trip Generation

Construction of the proposed facilities would generate vehicle traffic on area roadways throughout the construction period. Most of these trips would be associated with employee commute trips to and from working areas and with the delivery of construction materials to staging areas. No work is planned in existing highway rights-of-ways under the preferred alternative, however the transport of large pieces of equipment may cause temporary traffic delays and will require traffic control measures to minimize disruption. Those measures are outlined in Section 4.13.1.1.3.

Employee Work Trips. Compared with large-scale development projects, construction of the proposed facilities involves relatively few employees. During much of the time on-site employment is expected to range between 30 and 60 workers; it could reach as many as 100 workers for a few weeks during the busiest period. Because of the limitations of the access road and the need to give first priority to construction materials and equipment, it is expected that most employees will car pool. In some cases this will be from company baseyards located in Kīhei, Kahului, or elsewhere; in others the workers will rendezvous in the parking area situated adjacent to the intersection of the access road and Honoapiʻilani Highway.

When all factors are considered, we estimate that employees will average at least two persons per vehicle and will, therefore, generate an average of 30 to 60 one-way vehicle trips per day to and from the highway/access road intersection. Nearly all of these are expected to be to and from Central Maui, although a few may be to and from West Maui. During its busiest week, this might rise to 100 one-way-vehicle-trips per day. Assuming typical work schedules, most of the "to-work" trips would be between 6:30 and 7:00 a.m.; most of the "from-work" trips would be between 3:30 and 4:00 p.m.

Equipment Delivery Trips. Construction of KWP II will involve the importation of several relatively large pieces of equipment.[75] These include the WTGs, transformers, and substation equipment. Many smaller pieces of equipment will be needed as well. Figure 4.16 contains photographs of some of this equipment. These will have to be imported to the Island. Most of the larger pieces of equipment are presently being stored in Kīhei and would be trucked from there to the project site as needed.

Each WTG tower is made up of four oversize pieces. The rotors are also comprised of four large pieces (the hub three blades). Each of those, together with the nacelle (which contains the generator and gearbox), must be transported individually to the project site and trucked up the mountain to their final positions. While the total number of delivery trips needed for this equipment will be low (8*14=126), with fewer than 4 to six occurring on even the busiest day, the oversize vehicles that are needed for the deliveries slow traffic from the posted speed limit to about 25 miles per hour.

[75] The WTG support poles will be brought to the area in sections and assembled there, limiting the size of the pieces that must be transported over public roadways.

A. Harbor unloading of WTG segment.

B. Trucking of WTG tower segment.

C. Truck transport of WTG blade.

D. Truck transport of WTG nacelle.

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

First Wind

Figure 4.16:

WTG Equipment Transport Photographs

Kaheawa Wind Power II

Figure 4-16 WTG Equipment Transport Photographs 2009-01-20.cdr

Concrete and Steel for Foundations. Substantial amounts of steel and concrete are required for each of the WTG foundations. While the exact amount will not be determined after final geotechnical and structural analyses are completed, it is expected that each foundation will require 300 to 400 cubic yards of concrete. Assuming the 11-cubic yard-capacity concrete mixer trucks that would be used can be filled to no more than 80 percent of their capacity because of the steepness of the grade of the roadway access to the site and the need for one large truckload of reinforcing steel, each foundation would require 35 to 50 round-trips by heavy vehicles. Because concrete must be poured within 90 to 120 minutes of the time it is placed in the mixer trucks and the pour must be continuous (i.e., all of the concrete must be placed without interruption), the pours concentrate these concrete truck-trips over a period of a number of hours.

Excavated Material and Select Fill. The plans for the project call for a balancing of cut and fill during the civil works portion of construction. Hence, only select material (mostly gravel) must be brought to the site by truck; the remainder will simply be used from one place to another within the overall site. The majority of select fill would be used on the access road, but some would also be used for the WTG pads, the substation site, and other purposes.

Current estimates are that a total of approximately 20-30 truckloads of material will need to be delivered to the site over a period of about 12 weeks (amounting to 2 or 3 truckloads per week). Because this road work cannot readily take place on days when the access road must be used for other purposes, this component of traffic generally does not overlap other project-related traffic.

Total Construction Period Trip-Generation. As can be seen from the preceding discussion of trip generation by various components of the project, project-related vehicle-traffic will vary greatly over the course of construction with respect to the number and timing of trips made each day and the kinds of vehicles that will be involved.

- On most days, employee vehicle trips (made mostly in passenger cars, light trucks, and vans) will be the predominant type of travel, and the bulk of this will occur from 6 to 7 a.m. (arriving) and from 3:00 to 4:00 pm (departing) Monday through Saturday. Little other project-related traffic will be generated during these hours. Hence, the proposed project will generally add from 30 to 50 vehicle-trips to the existing highway traffic during these hours.
- The concrete pours, which will generate the most intense volume of project-related truck traffic, will occur on only fourteen days (one for each of the WTG tower foundations). Because the trips will be spread over a number of hours during the work day, the total vehicle-trips produced by this component in any given hour will be substantially less than the number of trips during the morning and afternoon commute period.
- Transportation of the large pieces of equipment that make up the project will generally occur during off-peak hours. This is outside the hours during which other construction is underway and will not, therefore, have a cumulative effect on traffic. Hence, it is the large size of the transport vehicles and the need for them to move carefully and slowly when turning into and out of the access road that is of greatest concern here.

4.13.1.1.2 Operational Phase Vehicle-Trip Generation

The majority of the vehicular-traffic associated with the proposed facilities would be employees reporting to or leaving the facility; service trips by MECO maintenance personnel would add a few additional vehicle-trips to this. The number of trips that this would generate is summarized in Table 4.20. The compilation, which is for the initial years of operation when the facility is likely to demand the greatest staffing, makes it clear that operation of the project would not place significant numbers of vehicles on area roadways.

Table 4.20 Anticipated Vehicle Trips During Operation of KWP II

Time Period	*Category*	*In-Bound Vehicle-Trips*	*Outbound Vehicle-Trips*	*Total Vehicle-Trips*
5:00 am to 9:00 am	Employee	5	1	6
	Other	0	0	0
9:00 am to 3:00 pm	Employee	1	2	3
	Other	2	2	4
3:00 pm to 11:00 pm	Employee	2	5	7
	Other	0	0	0

Note: Periodic inspections and maintenance activities would bring a few additional personnel to the facility for at most a few days each year. These might increase the number of round-trip employee commute trips by 5-10 per day for up to a week.

Source: Compiled by Planning Solutions, Inc. using employee estimates by KWP II LLC.

4.13.1.1.3 Traffic Impact Mitigation Measures

As discussed above, project-related construction and operation traffic will not significantly increase the number of vehicles traveling on Honoapiʻilani Highway. However, two aspects of the construction period vehicle-trips do require particular attention and mitigation. The first is the large size of the trucks needed to transport components of the WTGs to the access road. The second is the intense movement of concrete mixer trucks to and from the site when the foundations for the WTGs are being poured.

These issues were dealt with successfully during work on the KWP I project, and the measures take to accomplish that will be used during construction of the facilities that are proposed for KWP II as well. Those measures include the following:

- *Police Escort*. The trucking company that will transport the large WTG pieces now being stored in Kīhei to the intersection of the site access road and Honoapiʻilani Highway will arrange for a police escort. The escort will ride ahead of the truck warning other traffic of the oncoming load and stopping other vehicles for the few turns that are required.
- *Traffic Control at Honoapiʻilani Highway/Access Road Intersection*. The entrance to the access road will be manned by two people during construction working hours. They will work as flagmen to stop other traffic for the 1-2 minutes that are needed for the large trucks to turn into and out of the site access road.
- *Traffic Control on Site Access Road*. Different trucks are used to carry heavy equipment up the hill than are used to deliver it to the staging area at the bottom. Trucks regularly using the road are equipped with radio communication equipment so that they can be contacted while on-route, and turn-out areas are provided along the side of the road so that passing can be coordinated.

4.13.1.2 Impacts to Airports & Air Traffic

The proposed project would not generate significant amounts of passenger or cargo traffic at Maui's airports. Consequently, the only mechanism through which it could affect air transport is by obstructing the airspace used by the aircraft that provide this service.

The proposed wind turbines are of a height that requires KWP II to submit a construction Notice of Intent to the Federal Aviation Administration. This was done for the existing WTGs, and the FAA

determined that so long as they were properly lighted they would not constitute a hazard to air navigation.

KWP II LLC filed notification to the FAA that describes the proposed new structures. It anticipates that the FAA will determine that the structures would have no substantial adverse effect on the safe and efficient utilization of the navigable airspace by aircraft or on the operation of air navigation facilities. It further expects that the FAA will determine that the structure would not be a hazard to air navigation provided the structure is marked and/or lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting. This is the same condition included in the FAA's determination for KWP I.

The FAA reviewed and approved the neighboring KWP I facility, which is closer to the ridgeline facing central Maui. Hence, while the FAA has not yet made a determination on the project, KWP II LLC anticipates that the proposed facilities will be determined not to adversely affect navigable airspace so long as they are properly marked and lighted.

4.13.1.3 Impacts to Harbors & Ocean Navigation

All of the major pieces needed to erect the WTGs have already been landed on Maui. Additional equipment for the electrical collector lines, substation, and BESS will need to be imported. However, only a limited amount of this will be needed and the individual pieces are of a size and nature that allows them to be handled as general containerized cargo. Hence, they will not place an unusual demand on the harbor facilities.

4.13.2 UTILITIES & PUBLIC SERVICES

4.13.2.1 Water Supply

As discussed in Section 2.2.8, water for the proposed facilities will be stored in a 60,000-gallon tank at the base of the access road for emergency purposes and for irrigating native plants that are being reestablished in the area. KWP II LLC estimates that daily water usage from the tank during normal operation will amount to about 250-450 gallons. The small bottled potable water and eye wash station that will be provided in the operations building do not constitute significant uses of water. Consequently, the facility is not expected to be a burden on Maui's municipal water supply.

4.13.2.2 Recreational Facilities

The Preferred Alternative involves erection of WTGs on either side of the Lahaina Pali Trail. For safety purposes, it will be necessary to interrupt use of the portion of the trail passing the site for short periods during construction. In most cases the interruption would be for no more than fifteen minutes at a time. KWP II would provide appropriate signage along the Lahaina-Pali Trail so as to provide advance notice about such temporary closures. When closures are needed, traffic personnel would be utilized to ensure safe crossing by Trail users. KWP II LLC anticipates that passage across this section of the trail will be interrupted no more than a few hours per week over the course of peak construction lasting 2-3 months.

KWP II has met with representatives of the Na Ala Hele Council, including a visit to the site in October 2009. KWP II will communicate frequently and regularly with the DLNR and the Na Ala Hele Council on the status of KWP II construction work. Based on discussions to date, KWP II also anticipates providing signage to the Na Ala Hele Council for use along the Lahaina-Pali Trail nearby or at the KWP II site. The content of such signage could be on matters pertaining to the history of the Trail, cultural and archaeological significance of the Trail, discourse on the botany and biology of the Kaheawa area, other information the Na Ala Hele Council deems appropriate, and perhaps information on wind and other forms of renewable energy.

4.13.2.3 Wastewater Collection, Treatment, and Disposal

As discussed in Section 2.2.8, KWP II LLC is considering the installation of a 60,000-gallon tank adjacent to the existing O&M Building, which could be filled with non-potable water periodically trucked into the site and installing a septic tank to collect waste from sinks and restrooms. If this does not prove feasible due to permitting or cost considerations, KWP II LLC will use bottled water and portable toilets, as is currently done at the KWP I facility. The waste that accumulates in the portable toilets or septic tank will be collected by a private contractor and transported to the Kīhei Wastewater Treatment Facility or other approved location for disposal. The small amount of sanitary wastewater that this represents can easily be accommodated in the existing treatment and disposal facilities.

4.13.2.4 Telecommunications

Telecommunications provided by Hawaiian Telcom exist at the KWP I site, and these will be extended to the proposed O&M building at KWP II. A fiber optic cable will be installed to connect the new substation with the facility and MECO control systems. These additions will not substantially increase the burden on Hawaiian Telcom's system.

4.13.2.5 Police and Fire Service and Public Safety

The proposed facility would be accessed through a locked gate. The facility has 24-hour on-site security staff and a video monitoring system at the gate. KWP II would not place substantial additional demands upon the existing police service in the area. Similarly, as described in Section 4.5.4, the facility design includes fire water storage and other fire protection facilities, thus reducing the potential for additional burden on the Fire Department. All facilities will comply with the National Fire Protection Association's (NFPA) recommendations, local codes, and other applicable fire protection regulations.

4.13.2.6 Health Care Facilities

The nearest hospital to the proposed KWP II site is the Maui Memorial Hospital in Wailuku. In case of emergencies, paramedic/ambulance services are available from the Wailuku and Kīhei areas, both of which are approximately 20-25 minutes drive from the facility. There is nothing in the makeup of the proposed project that would produce injuries or illness of a type or magnitude that would place an undue burden on emergency services. Neither do the proposed facilities have the potential to cause long-term health issues among workers or others that would increase the burden on the island's health care system.

4.13.2.7 Solid Waste

The wind energy generating facility as proposed in the preferred alternative would produce very small amounts of municipal solid waste. While no exact estimate is available, installations of the type proposed typically maintain a small dumpster on-site that is emptied once per week. KWP II LLC will contract with a private solid waste management company for the collection and disposal of this refuse. The contractor would pick up the refuse once each week and haul it to a permitted landfill for disposal. No hazardous material is present in this waste stream.

5.0 NO ACTION ALTERNATIVE

5.1 INTRODUCTION

Section 2.1 of this report sets the framework for the consideration of Alternatives and Section 2.2 describes the action-alternative (the Preferred Alternative and Alternative 2) whose potential effects are evaluated in detail in this EIS. Chapter 2 also describes a number of other alternatives that KWP II LLC considered but eliminated when it became clear that they would not satisfy the objectives of the proposed action.

This chapter discusses the potential effects of the "No Action" alternative as required by HAR §11-200-17(f) (1). "No Action" consists of foregoing the installation of additional wind generating capacity at Kaheawa Pastures and hence the opportunity to add additional renewable energy generating capacity to Maui's grid at this location. While other currently proposed or future renewable energy projects might eventually provide some or all of the renewable energy generating capacity that would be foregone if this alternative were selected, KWP II LLC believes the existing infrastructure at Kaheawa, the excellent proven wind resource at that location, and the progress that it has made on obtaining the approvals and permits needed to implement its project make "no action" undesirable from environmental and economic standpoints.

As discussed in Chapter 4 of this report, the adverse environmental impacts that would be avoided by choosing the No-Action alternative are limited. KWP II believes they are far outweighed by the benefits that 21 MW of clean energy would bring in energy security, quality of life and improved air quality for Maui's residents. Further, the environmental impacts of the KWP II project are likely to be significantly less than those associated with a "green fields" renewable energy project where no infrastructure (e.g., roads, transmission lines, interconnection facilities, etc.) presently exists.

The No Action alternative would not meet the objectives of the proposed action listed in Section 1.3. It is included to fulfill the requirements of Chapter 343, Hawai‘i Revised Statutes and to provide a baseline against which the proposed action can be compared. If additional generating capacity is not installed at Kaheawa Pastures, the island of Maui will be faced with two choices. The first is to obtain a larger proportion of its electrical energy through the combustion of fossil fuels than it would if the proposed project is placed in operation. The second is to obtain an equivalent amount of electrical energy from other alternative renewable sources (either different technologies or wind power development in other locations on the island).[76] The remainder of this chapter briefly discusses the probable effects of each of these two possibilities.[77]

5.2 IMPACTS OF CONTINUED RELIANCE ON FOSSIL FUELS

KWP II LLC estimates that the electrical energy that would be produced by the proposed project would allow MECO to forego the combustion of approximately 138,000 barrels per year of fossil fuel. If the "no action" alternative leads MECO to continue to obtain this amount of electrical energy by burning fossil fuel, this will have substantial environmental and economic effects.

5.2.1 ENVIRONMENTAL EFFECTS OF FOSSIL FUEL ALTERNATIVE

If the unavailability of wind or other renewable energy sources forces MECO to continue to rely on its existing or future fossil fuel-fired units, they will release a substantial volume of pollutants into the

[76] It is theoretically possible for wind energy generated elsewhere in Hawai‘i (e.g., on Lāna‘i or on Moloka‘i to be transmitted to Maui for use there, but at the present time neither of the two large-scale wind power projects that are proposed for those two islands plan an interconnection with Maui.

[77] Note that while it is always desirable, energy conservation (i.e., using less energy than is anticipated) is not an alternative as the reduction is unlikely to reduce the level of electrical energy use to the point where the megawatt hours produced by KWP II could not be used.

atmosphere. The exact amount will depend upon the exact way in which the units are operated, something which it is not possible to specify at this time. However, an order-of-magnitude sense of the emissions can be obtained by considering what the emissions would be from the most efficient type of units in MECO's system when they are run in their most efficient (and least-polluting) mode.

The *Final Environmental Impact Statement for the Waena Generating Station* estimates potential emissions from the use of diesel fuel in the 58 megawatt capacity Dual-Train, Combined-Cycle Combustion Turbines (DTCC) that would be used at the Waena Generating Station when it is placed in operation sometime during the next decade. These are the same types of units that MECO now operates at its Mā'alaea Generating Station. The report estimates tons per year emissions of key pollutants assuming the units operate at 100 percent of their capacity throughout the year.

This information can be used to approximate the emissions that would occur if fossil-fired energy were to be used in lieu of energy from the KWP II project. In using it, the following assumptions were made:

- The capacity of the proposed wind farm (21 megawatts) represents only 36 percent of the capacity of the 58 MW DTCC units for which the *FEIS* estimated annual emissions.
- Because WTGs are dependent upon wind that is not always present, they have an estimated net capacity factor of about 0.4.[78]

Combining these two factors means that if the WTGs that are proposed as part of KWP II project are not installed, then MECO's air emissions will be higher by the amounts shown in Table 5.1.[79]

Table 5.1 Air Emissions if Electricity from Fossil Fuel Substitutes for Electricity from KWP II

Pollutant	***Emissions (in tons per year)***
Nitrogen Oxide	53
Sulfur Dioxide	139
Carbon Monoxide	34
Volatile Organic Compounds	5
Particulate Matter	25
Particulate Matter less than 10 microns	25
Sulfuric Acid Mist	7
Beryllium	.0000504
Mercury	.0001728
Lead	.018864
Fluoride	.002592
Note: Emission estimates are based on 14.6% of amounts reported for continuous operation of 58 MW DTCC generating unit proposed for the Waena Generating Station.	
Source: Maui Electric Company Ltd, November 1997.	

[78] "Net capacity factor = the actual amount of power produced over time/the power that would have been produced if the turbine operated at maximum output 100% of the time, net losses due to operating constraints and limitations.

[79] Those amounts are equivalent to between 14 and 15 percent of the amount reported in the FEIS for one of the DTCC units that is has proposed for the Waena site.

Similarly, use of fossil fuel-fired units to provide electrical energy rather than obtaining that same amount of energy from the proposed KWP II project will entail a range of other environmental effects (e.g., noise, water consumption, traffic related to fuel transport, wastewater generation, etc.). While none of these is likely to be significant, being able to forego them is beneficial to the natural environment.[80]

5.2.2 ECONOMIC EFFECTS OF FOSSIL FUEL ALTERNATIVE

Conservatively assuming that the U.S. market value crude oil averages $80 per barrel over the life of the project, the amount of oil that KWP II would replace over its 20-year life is worth about $100 million. This is roughly 50 percent more than the estimated construction cost of the proposed wind generation facilities. Moreover, virtually all of the dollars spent on fossil fuel are spent off-island and out-of-state. Hence, they have little beneficial effect on the local economy. In contrast, once it is operating, most of the expenditures on KWP II will be spent locally and will support Maui and Hawai‘i’s economy.

It is also worth noting that many forecasts of fuel prices suggest that prices are likely to be much higher than $80 dollars per gallon and few forecasts are for less than that amount. Hence, the dollar value of the wind-generated electricity is likely to be greater than that shown. Moreover, fossil fuel pricing has not only increased markedly over time, it has been volatile, as well, and the volatility makes long-range planning and capital investment decisions difficult. Both the trend toward higher price and the volatility can be seen by comparing the price on July 11, 2008 ($147.27 per barrel) with the price at the beginning of 2007 (just over $60/barrel (see Figure 5.1).

By reducing the island’s dependence on imported fossil fuels, KWP II will help decouple electricity prices from the cost of imported fuels, thereby reducing price volatility. Moreover, because the power purchase contract with MECO will link the price paid for power from the proposed facility to the overall rate of inflation rather than to the cost of imported oil (which is expected to increase at a faster rate), it could allow island residents and businesses to pay less for electrical energy than they are likely to have to pay without it.

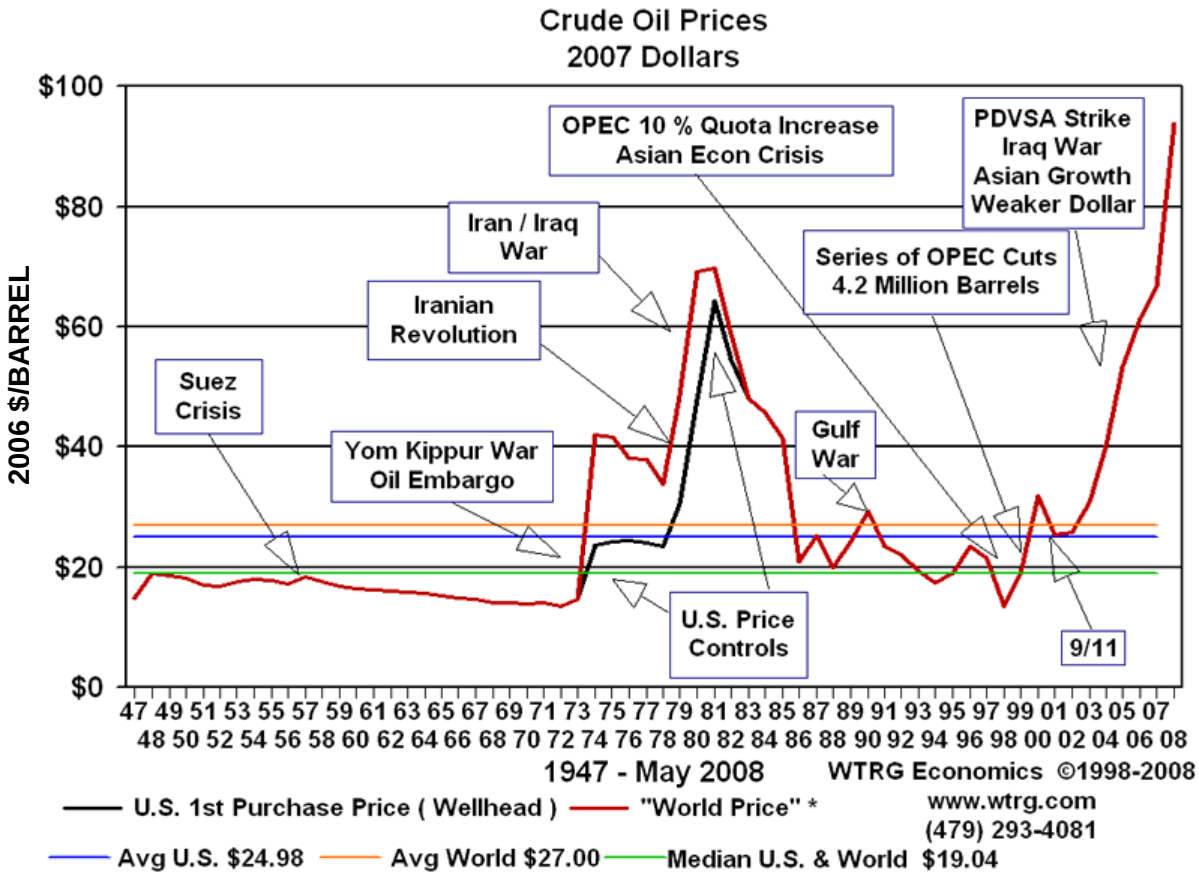
5.3 IMPACTS OF OTHER PROPOSED RENEWABLE ENERGY DEVELOPMENT

With the enactment of the Renewable Portfolio Standards, the establishment of the Hawai‘i Clean Energy Initiative, and the passing of legislation designed to encourage and facilitate the development of renewable energy projects in Hawai‘i, it is clear the State is committed to encouraging renewable energy projects to provide a sizable portion of Hawai‘i’s energy supply into the future.[81] Several wind energy projects are currently being proposed for Maui County, and more are likely to arise in response to these incentives. For example, wind projects have been proposed on Lāna‘i and Moloka‘i, and in mid-October 2009, Sempra Generation announced that it had acquired Auwahi Wind Energy LLC and intends to construct wind generation facilities on Ulupalakua Ranch land on Haleakalā (the latter project was announced several years ago, but little progress was made after the initial announcement).

[80] Because the KWP project will not provide firm power, MECO must still provide fossil fuel-fired capacity for use during periods when there is insufficient wind energy. Hence, the development-related effects of conventional power plant development will remain.

[81] "Renewable energy" means energy generated or produced utilizing the following sources: (1) Wind; (2) The sun; (3) Falling water; (4) Biogas, including landfill and sewage-based digester gas; (5) Geothermal; (6) Ocean water, currents and waves; (7) Biomass, including biomass crops, agricultural and animal residues and wastes, and municipal solid waste; (8) Biofuels; and (9) Hydrogen produced from renewable energy sources (HRS §269-91).

Figure 5.1 Crude Oil Prices 1947-May 2008



Source: http://www.wtrg.com/oil_graphs/oilprice1947.gif

It is possible that one or more of these wind energy projects could eventually, alone or in combination, provide the additional renewable energy that the State and County have targeted for development. It is beyond the scope of this report to analyze each active or hypothetical proposal in detail, and indeed there is no way to know at this stage which if any of the projects that have been proposed might eventually be approved and constructed. None are as far along in the approval process as KWP II, however, and none are located adjacent to an operating wind farm. Hence, any renewable energy project that might be implemented if the KWP II project does not move forward would have to be a "green field" development that lacks the combination of existing transmission, roads, and proximity to an operating wind farm. In short, there is nothing about an alternative location that suggests it would have lesser environmental effects than KWP II. To the extent that an off-island project is considered, the costs and potential impacts of an undersea cable to Maui would have to be considered. There is to our knowledge currently no proposal to make such a connection.

Other renewable energy projects are being discussed that could provide renewable energy to the island of Maui. These include solar, biomass waste-to-energy, biofuels, OTEC, wave energy, and hydroelectric. However, none of these are as advanced as the proposed WTGs that make up the KWP II project, and so none are likely to come to fruition within the same time frame, if at all. Moreover, none of these has the immediate potential to provide the level of energy as the proposed project.

6.0 CONSISTENCY WITH EXISTING POLICIES, CONTROLS, & LAND USE PLANS

In accordance with the requirements of HAR §11-200-17 (h), this chapter discusses the relationship of the proposed action to land use plans, policies, and controls for the area that would be affected by the proposed KWP II project. Table 6.1 lists the permits and approvals required for the project and provides the current status of each. The subsequent discussion identifies the extent to which the proposed action would conform or conflict with objectives and specific terms of approved or proposed land use plans, policies, and controls. The discussion is organized first by the jurisdiction (County, State, or Federal) and then by specific ordinance, regulation, or law.

6.1 REQUIRED PERMITS AND APPROVALS

Table 6.1 lists the potential permits and approvals required for the project. The remainder of the chapter discusses the compliance and compatibility of the proposed improvements with pertinent plans, policies, and regulations at County, State, and Federal levels.

Table 6.1 Status of Required Permits and Approvals

Permit or Approval	*Issuing Agency*	*Status*
Endangered Species Act Section 10 Incidental Take Permit	U.S. Fish and Wildlife Service	Draft HCP/Permit Application Submitted November 2009
"Notice of Proposed Construction or Alteration"	Federal Aviation Administration	In process
State Endangered Species Incidental Take License	Department of Land and Natural Resources	Draft HCP/ITL Application Submitted October 2009
Conservation District Use Permit	Department of Land and Natural Resources	To be submitted concurrent with FEIS
NPDES Construction Permit	Clean Water Branch, State Department of Health (DOH)	In Preparation
PUC Approval	Public Utilities Commission	In Preparation
Source: Compiled by Planning Solutions, Inc. using information provided by KWP II, LLC.		

6.2 MAUI COUNTY

6.2.1 MAUI COUNTY GENERAL PLAN

The Maui County General Plan establishes a vision and a set of long-range guiding principles, goals, objectives, policies and maps to guide the growth and development of the island. The Plan is the principal tool for the County and its citizens to use when evaluating public and private projects and their impacts on land use, the economy, environment, infrastructure, and cultural resources.

The General Plan of the County of Maui (1990) was adopted by Ordinance No. 2039 on September 27, 1991 and was amended on April 23, 1993 by Ordinance No. 2234. In 2002 the County Council adopted Ordinance 3166 (Bill 84 now MCC 2.80B) which revised the process for updating the Maui County General Plan. MCC 2.80B requires that the General Plan identify and describe the major

problems and opportunities regarding the needs and the development of the county as well as the social, economic and environmental effects of development. In addition, MCC 2.80B mandates that the General Plan set forth the desired sequence, patterns and characteristics of future development. 2.80B stipulates that a Countywide Policy Plan be prepared first, followed by a Maui Island Plan and the nine Community Plans.

The *Draft 2030 General Plan* consists of a series of planning documents organized into three tiers:

- ***The Countywide Policy Plan*** acts as an over-arching values statement and is an umbrella policy document for the Island and Community Plans.
- ***The Maui Island Plan*** will function as a regional plan and address the unique problems and needs of the Island of Maui and establish specific policies relating to regional systems such as transportation, utilities, and growth management for the Island of Maui.
- ***The Community Plans*** will reflect the unique characteristics of each Community Plan area and enable residents and stakeholders within those areas to address location specific challenges. A total of nine community plans are in place on Maui.

The following sub-sections discuss the project's consistency with each of these planning documents.

6.2.1.1 Draft Countywide Policy Plan

The Draft Countywide Policy Plan provides the policy framework for the development of the Maui Island Plan and the nine community plans that will address the unique character of each of the islands within the County. It outlines Goals, Objectives, and Policies related to 11 topics:

- *Protect the Natural Environment*
- *Preserve Local Culture and Traditions*
- *Improve Education*
- *Strengthen Social and Health Care Services*
- *Expand Housing Opportunities for Residents*
- *Strengthen the Local Economy*
- *Improve Parks and Public Facilities*
- *Diversify Transportation Options*
- *Improve Physical Infrastructure*
- *Promote Sustainable Land Use & Growth Management*
- *Strive for Good Governance*

The following section lists the topics, goals, and policies most relevant to the proposed project and discusses it's consistency with them. Text from the draft Countywide Policy Plan is reproduced prior to each response.

A. PROTECT THE NATURAL ENVIRONMENT

Goal: Maui County's natural environment and distinctive open spaces will be preserved, managed, and cared for in perpetuity.

Objective 1: Improve the opportunity to experience the natural beauty and native bio-diversity of the islands for present and future generations.

Policies:

a. Perpetuate native Hawaiian bio-diversity by preventing the introduction of invasive species, containing or eliminating existing noxious pests, and protecting critical habitat areas.

g. Identify, preserve, and provide ongoing care for important scenic vistas, view planes, landscapes, and open space resources.

Objective 3: Improve the stewardship of the natural environment.

Policies:

b. Protect flora and fauna communities.

h. Reduce air, noise, light, land, and water pollution and reduce Maui county's contribution to global climate change.

Discussion: As discussed in Section 4.6.2, development of the proposed facilities would occur in areas dominated by non-native species. In selecting the alternative layouts, KWP II LLC specifically ruled out areas to the north with higher concentrations of native plants. Section 4.6.2.1 describes the measures KWP II LLC is proposing to prevent the introduction and spread of invasive species at the project site. These measures will complement and add to the efforts made by KWP I and other resource management groups at the existing facility.

KWP II LLC considered a number of factors in selecting the alternative layouts, including visual impacts. The Preferred Alternative would add to the area from which Kaheawa WTGs would be visible and increase the number that can be seen from some viewpoints on the island's central isthmus. Alternative 2 would also increase the number of WTGs that can be seen from certain locations, but in general fewer people would be able to see the additional pieces of equipment in this Alternative than in the Preferred Alternative. The views that will be most affected are aerial views and views from the ocean, and in either case the character of the proposed facility is not significantly different from the existing KWP I facility.

B. PRESERVE LOCAL CULTURES AND TRADITIONS

Goal: Maui County will foster a spirit of *pono* and protect, perpetuate and reinvigorate its multi-cultural values and traditions to ensure that current and future generations will enjoy the benefits of their rich island heritage.

Objective 1. Perpetuate the Hawaiian culture as a vital force in the lives of residents.

Policies:

b. Foster partnerships to identify and preserve or revitalize historic and cultural sites.

c. Identify and prohibit inappropriate development of cultural lands and sites which are important for traditional Hawaiian cultural practices and establish mandates for the special protection of these lands in perpetuity.

Objective 4. Preserve and restore significant historic architecture, structures, cultural sites, cultural districts and cultural landscapes.

Policies:

a. Support the development of an island-wide historic, archaeological, and cultural resources inventory.

d. Protect and preserve lands that are cultural or historically significance [*sic*].

Discussion: Archaeological inventory and cultural resource surveys were conducted for both the alternative areas. Results of these surveys are discussed in detail in Section 3.9.3 and 3.9.4. None of the features that would be affected by Alternative 2 were recommended for further preservation by the archaeologists, and SHPD concurred with this recommendation. SHPD concurrence with the similar recommendation for the Preferred Alternative has been sought, but no response has been received. Although it is not on either of the alternative sites, KWP II LLC will comply with the preservation plan that is in place for the *heiau* on the KWP I site and will notify contractors of its presence.

F. STRENGTHEN THE LOCAL ECONOMY

Goal: Maui County's economy will be diverse, sustainable, and support community values.

Objective 4: Expand economic sectors that increase living wage job choices and are compatible with community values.

Policies:

a. Support emerging industries, including but not limited to the:

Renewable energy industry.

Discussion: Maui County has identified renewable energy as an important emerging industry. As discussed throughout this document, the project is expected to result in significant environmental, economic, and community benefits by providing a clean renewable energy source, generating tax and lease revenue, and contributing to Maui's energy independence.

I. IMPROVE PHYSICAL INFRASTRUCTURE

Goal: Maui County's physical infrastructure will be maintained in optimum condition and will provide for and effectively serve the needs of the County through clean and sustainable technologies.

Objective 3. Utilize renewable and green technologies to promote energy efficiency and energy self-sufficiency.

Policies:

a. Encourage the use of locally renewable energy sources and reward energy efficiency.

b. Provide tax incentives and credits for the development of sustainable and renewable energy sources.

d. Encourage small scale energy generation which utilizes wind, sun, water, biowaste, and other renewable sources of energy.

e. Expand potential renewable energy production capabilities.

f. Develop public-private partnerships to ensure the use of renewable energy and increase energy efficiency.

k. Reduce Maui County's dependence on fossil fuels and energy imports.

Discussion: The goals and objectives outlined in the Countywide Policy Plan confirm that renewable energy will remain a priority for the County well into the future. KWP II is an example of the type of public-private partnership that the County seeks to encourage in expanding its renewable energy portfolio.

6.2.1.2 Draft Maui Island Plan

The Draft Maui Island Plan provides a guide for the future growth of the island to the year 2030. The Maui Island Plan establishes a vision and a set of long-range guiding principles, goals, objectives, policies and maps to guide the growth and development of the island.

Renewable energy is given significant attention in the Plan's Economic Development section in Volume I, which notes that:

*Renewable energy development will be critical in helping the State of Hawaii and Maui County reduce energy costs, avoid the negative economic effects of volatile oil prices, reduce overdependence on oil, and increase energy security by reducing imports. Renewable energy can grow new local industries, provide jobs and income for the people of Maui County, and protect the environment, which is also the basis of Maui's economy***.**

The Plan also acknowledges KWP I's contribution to renewable energy on Maui and notes that additional wind generating capacity is under consideration at the site.

Challenges and opportunities for wind energy development on Maui are discussed as well:

> *Maui has significant potential for wind energy development. View impacts and physical access present challenges to wind energy development on Maui, since many viable sites lie on high ridges. Wind energy may encounter fewer land use and zoning barriers than other types of renewable energy development. Zoning ordinances allow for wind energy development in State and County Agricultural districts, and barring conflicting land uses, wind energy is likely to be allowable in rural districts.*

Volume II of the Plan outlines specific goals and policies to match the topics covered in Volume I. Those policies most relevant to the proposed KWP II project are reproduced below, followed by a discussion of the project's consistency with each.

ECONOMIC DEVELOPMENT

EMERGING INDUSTRIES – HIGH TECHNOLOGY & RENEWABLE ENERGY GOAL & POLICIES

3.4 Goal: Maui's high technology and renewable energy industries will be contributing significantly to the island's economy.

3.4.3 Increase the economic contribution of the renewable energy industry on Maui, including solar, wind power and biofuel technologies, and include the protection of an adequate supply of land for these industries.

Discussion: The proposed KWP II project will contribute an additional 21MW of renewable energy to Maui's electrical grid. The economic and environmental benefits associated with the project are significant, as discussed elsewhere in this report.

HERITAGE RESOURCES

CULTURAL RESOURCES - GOAL & POLICIES

2.1 Goal: Maui will have preserved a rich inventory of historic and archaeological sites and artifacts that represent living examples of the island's diverse history.

2.1.5 Require development within Heritage Areas to be compatible with and supportive of cultural landscapes, native Hawaiian cultural practices, and resident lifestyle.

Discussion: As discussed in Section 4.9, the project is expected to be compatible with existing historic, cultural, and archaeological resources. It will not impact resources recommended for preservation and will follow all applicable laws and guidelines to ensure the protection of existing significant resources (i.e., the *heiau* on the KWP I site, the Lahaina Pali Trail).

HERITAGE RESOURCES

SCENIC RESOURCES - GOAL & POLICIES

2.2 Goal: Maui County's natural environment and distinctive open spaces will be preserved, managed and cared for in perpetuity.

2.2.3 Protect public views of Haleakalā, Iao Valley, the West Maui Mountains, the Pacific Ocean and other significant water features, ridgelines and landforms.

2.2.4 Promote the siting and design of telecommunication facilities and infrastructure to avoid visual impacts on the landscape.

2.2.5 Establish limits for development on the slopes of the West Maui Mountains.

Discussion: As discussed in Section 4.11, potential visual effects were considered during the site selection process. The wind generating facility will be nearly identical in character to the existing facility, and locating it next to the existing facility will reduce the need for additional road and facility development. The location that KWP II eventually chose as its Preferred Alternative is an extension of the existing line of WTGs; thus it does not extend wind energy development into areas where it is not already present. Finally, it keeps manmade structures away from the forest and other natural

areas present at higher elevations. Alternative 2 is closer to the natural areas located higher on the Kaheawa hillside and in an area that has not already been modified by road construction. However, the WTGs that make up this alternative would be less visible from heavily traveled areas on the isthmus.

6.2.1.3 West Maui Community Plan

The West Maui Community Plan provides specific recommendations to address goals, objectives and policies in the General Plan, while recognizing the values and unique attributes of the West Maui region. The West Maui Plan was last updated in 1996 and identifies planning goals, objectives, policies and implementation considerations to guide decision-making in the region through the year 2010. Several of the opportunities, objectives, and policies identified in the West Maui Community Plan are relevant to the proposed KWP II project. These are reproduced below, followed by discussions of the project's consistency with them.

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. (emphasis added)*

Discussion: The bold portion of the quoted text reiterate's Maui County's commitment to renewable energy development and recognition of the potential economic benefits of renewable energy projects.

Part III - Policy Recommendations, Implementing Actions, & Standards for the West Maui Region, Section B. Goals, Objectives, Policies and Implementing Actions:

Land Use:

> *2. Preserve and enhance the mountain and coastal scenic vistas and the open space areas of the region.*
>
> *5. Preserve the current State Conservation District and the current State Agriculture District boundaries in the planning region, in accordance with this Community Plan and its land use map. Lands north of Kapalua and south of Puamana to the region's district boundaries should ensure the preservation of traditional lifestyles, historic sites, agriculture, recreational activities and open space.*

Discussion: Both the Preferred and Alternative 2 project areas are located in the State Conservation District in an area characterized by open space and sweeping mountain vistas. As noted in the preceding discussion related to the *Maui Island Plan* and discussed in detail in Section 4.11, mountain and coastal vistas and open space were considered during the site selection process. KWP II's Preferred Alternative makes the WTGs an extension of the existing line of WTGs, thereby avoiding areas that have not already been disturbed by road construction. It also keeps manmade structures away from the forest and other natural areas present at higher elevations. However, the WTGs that make up Alternative 2 would be less visible from heavily traveled areas on the isthmus.

The project design also takes into account existing uses and sensitive resources in the area, with attention to avoiding or minimizing adverse impacts. Approval of the project will not affect Conservation District boundaries.

Cultural Resources:

> *6. Ensure that new projects or developments address potential impacts on archaeological, historical, and cultural resources and identify all cultural resources located within the project area as part of initial project studies. Further require that all proposed activity adequately mitigate potential adverse impacts on cultural resources.*

Discussion: The Plan identifies the Lahaina Pali Trail among significant cultural resources to be preserved. None of the other cultural resources mentioned in the Plan are near either of the alternative project sites. Sections 4.9 and 4.11.4.1 discuss the project's potential impacts on the Lahaina Pali Trail and the measures KWP II LLC has proposed in order to minimize or mitigate impacts to users of the trail.

Energy:

> *3. Promote the environmentally sensitive use of renewable energy resources, such as biomass, wind, and solar.*

Discussion: KWP II LLC is working with resource agencies at the State and Federal level to ensure that the proposed facility is constructed and operated with minimal impact to valued environmental resources. Consequently, it is compatible with the intent of this statement.

6.2.1.4 Kīhei-Mākena Community Plan

The Kīhei-Mākena Community Plan was last updated in 1998 and identifies planning goals, objectives, policies and implementation considerations to guide decision-making in the region through the year 2010. The area covered by the Plan includes parts of the lower slopes and foothills of the West Maui Mountains, as well as the community of Mā'alaea. The portions of the plan relevant to the proposed project closely parallel (or are in some cases identical to) those in the West Maui Community Plan discussed above, and points that are similar are not repeated here. The portion of the Plan dealing with social and physical infrastructure calls for the promotion of "environmentally and culturally sensitive use of renewable energy resources like biomass, solar, wind, and hydroelectric energy in all sectors of the community." It also calls for proper site selection, facility construction and monitoring of power generation facilities in order to minimize adverse environmental impacts upon the Kīhei-Makena community. The proposed wind energy generation project is consistent with the desire to increase the use of renewable energy. The site selection process that is being followed is designed to ensure that the proposed KWP II project does not conflict with existing or planned land uses as provided for in the Kīhei-Mākena Community Plan.

6.2.2 COUNTY ZONING

Title 19 of the Maui County Code defines zoning districts and regulates development within them. The proposed KWP II project is within the State Conservation District and is, therefore, exempt from the Maui County zoning code. Consequently, County zoning regulations are not applicable to the proposed facility.

6.3 STATE OF HAWAI'I

6.3.1 HAWAI'I STATE PLAN

The *Hawaii State Plan* is intended to guide the long-range development of the State of Hawai'i by:

- Identifying goals, objectives, and policies for the State and its residents;
- Establishing a basis for determining priorities and allocating resources; and
- Providing a unifying vision to enable coordination between the various counties' plans, programs, policies, projects and regulatory activities to assist them in developing their county plans, programs, and projects and the State's long-range development objectives.

The *Hawai'i State Plan* is a policy document. It depends upon implementing laws and regulations to achieve its goals. The sections of the *State Plan* that are most relevant to the proposed KWP II project are Sections 226-18(a) and (b), which establish objectives and policies for energy facility systems. These sections are reproduced in italics below, and the proposed action's consistency with them is discussed.

> *§226-18 (a) Planning for the State's facility systems with regard to energy shall be directed toward the achievement of the following objectives, giving due consideration to all:*
>
> *(1) Dependable, efficient, and economical statewide energy systems capable of supporting the needs of the people;*

Discussion: As discussed elsewhere in this document, the proposed project is cost-competitive with traditional fossil-fueled electrical generation and has the associated environmental and economic benefits of reduced air pollutant emissions and enhanced energy independence. The proposed battery storage will significantly enhance the facility's reliability as well. Consequently, it is consistent with this objective.

> *(2) Increased energy self-sufficiency where the ratio of indigenous to imported energy use is increased;*

Discussion: The proposed KWP II project would help to increase the ratio of indigenous to imported energy on Maui by harnessing the naturally high winds in the West Maui mountains.

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

Discussion: The proposed facility would reduce Maui's dependence on imported fossil fuels significantly, as discussed in Section 1.2.2.2. The fixed cost of the project will also help buffer the local economy from the fluctuating costs of energy during its lifespan.

> *(4) Reduction, avoidance, or sequestration of greenhouse gas emissions from energy supply and use.*

Discussion: Section 4.2.2 quantifies the reduction in greenhouse gas emissions that is expected to result from the project. Because wind energy generates little to no emissions, these reductions are significant and in accordance with this objective.

> *§226-18 (b) To achieve the energy objectives, it shall be the policy of this State to ensure the provision of adequate, reasonably priced, and dependable energy services to accommodate demand.*

Discussion: As previously discussed, the proposed facility will provide clean, cost-competitive electricity to Maui's consumers, and its reliability will be bolstered by the battery storage technology KWP II LLC is proposing. Consequently, the project is consistent with this objective.

6.3.2 CHAPTER 205, HAWAIʻI REVISED STATUTES - LAND USE LAW

Chapter 205, Hawaii Revised Statutes (HRS), establishes the State Land Use Commission (SLUC) and gives this body the authority to designate all lands in the State as Urban, Rural, Agricultural, or Conservation District lands. The proposed KWP II project site is entirely within the General Subzone of the State Conservation District and is owned by the State of Hawaiʻi. The existing State Land Use District boundaries within the project area are shown in Figure 3.7.

The State Department of Land and Natural Resources (DLNR) is responsible for regulating land uses within the Conservation District. Hawaiʻi Administrative Rules §13-5-22(P-6) identifies *"energy generation facilities utilizing the renewable resources of the area (e.g., hydroelectric or wind farms)"* as a "Public Purpose Use". This type of land use is permitted in the General Subzone with the issuance of a Conservation District Use Permit (CDUP) approved by the Board of Land and Natural Resources (BLNR). This EIS will be submitted in support of KWP II LLC's Conservation District Use Application (CDUA) for the project.

The criteria that DLNR and the Board will use in evaluating the project are outlined in Hawaiʻi Administrative Rules, §13-5-30(c). Each criterion, followed by a discussion of how the proposed lagoon restoration project fulfills it, is reproduced in italics below.

(1) The proposed land use is consistent with the purpose of the conservation district;

Discussion: The purpose of the Conservation District is to conserve, protect, and preserve the important natural resources of the State through appropriate management and use to promote their long-term sustainability and the public's health, safety, and welfare (HAR §13-5-1). As discussed throughout this document, the proposed project will help reduce the Island of Maui's dependence on imported fossil fuels for electricity, thereby contributing to improved air quality and enhanced energy security and independence. Thus, it is in keeping with the purpose of the Conservation District.

(2) The proposed land use is consistent with the objectives of the subzone of the land on which the use will occur;

Discussion: The KWP II project site is in the General (G) subzone of the Conservation District. The objective of this subzone is to designate open space where specific conservation uses may not be defined, but where urban use would be premature (HAR §13-5-14(a)). The proposed wind energy generation facility is compatible with existing land uses in the area, and was designed with sensitivity to visual impacts. It is not significantly different in size or character from the existing KWP I facility, and its construction and operation will not preclude future uses of the site for conservation purposes. Consequently, it is consistent with the intent of the General subzone.

(3) The proposed land use complies with provisions and guidelines contained in chapter 205A, HRS, entitled "Coastal Zone Management," where applicable;

Discussion: The discussion in Section 6.3.4 below confirms the consistency of the project with the Coastal Zone Management Act and the objectives outlined in Chapter 205A, HRS.

(4) The proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community or region;

Discussion: As discussed in Chapter 4, substantial adverse environmental impacts are not expected to result from the proposed project. Unavoidable impacts will be minimized and mitigated through coordination with various resource agencies.

(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;

Discussion: The area adjacent to the project site is already used for wind energy generation, and the facilities being proposed are very similar to the existing ones. Other uses in the area have coexisted

with the existing project and this is expected to continue during construction and operation of KWP II. The existing facility also avoids the need to construct substantial new roads and infrastructure on the generally steep slopes of the West Maui Mountains.

(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;

Discussion: While the facility will have unavoidable visual impacts, these will be minimized by situating it adjacent to an existing wind energy facility, and locating it further west where it will be less visible to populous areas of central and east Maui. In general, wind energy facilities have been shown to be compatible with other open space uses and scenery, and KWP II is expected to be no exception.

(7) Subdivision of land will not be utilized to increase the intensity of land uses in the conservation district;

Discussion: No property subdivision is needed for the proposed project. KWP II LLC is working with DLNR to negotiate a lease for the project site.

(8) The proposed land use will not be materially detrimental to the public health, safety and welfare.

Discussion: The project will not be detrimental to public health, safety, or welfare. It is located well away from residences and other sensitive uses that might be affected by noise or construction-related air pollutants, and once in operation the project will not be a source of emissions. If anything, the project will improve public health and safety by significantly reducing greenhouse gas emissions on Maui.

6.3.3 NA ALA HELE TRAILS & ACCESS PROGRAM

The State of Hawai‘i established the Na Ala Hele Trails and Access Program in 1988 by adopting 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 calls for the State 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 Hawai‘i’s people, and
- Helps to conserve Hawai‘i’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, which is 7.2km (4.5mi) long, starts near the County of Maui’s Ukumehame Beach Park and ends near Pu‘u Hele. It traverses the Kaheawa Pastures below the lower end of the existing KWP I turbines. The trail joins the access road just before the road crosses the Malalowaiaole Gulch at an elevation of about 500m (1,600ft) above sea level.

KWP I LLC consulted with the State’s Na Ala Hele Trails and Access Program in conjunction with the development of the existing KWP I facility and used the input it received to guide the placement of several WTGs so as to reduce the visual impact of the facility to trail users. The proposed KWP II facility at the Alternative 2 site would add 14 additional WTGs to the hillside, 3 of which are closer to the trail than the existing KWP I WTGs. As illustrated by the visual simulation presented in Figure 4.15, this will increase the visual impacts to users of the trail. The additional Alternative 2 WTGs would be virtually the same as the existing ones, and the new turbine closest to the Trail would still be over 900 feet away from it. Siting constraints made it impossible to find locations further from the trail that still met the stringent siting requirements for the WTGs. The Preferred Alternative WTGs

are even closer to the trail than are those in Alternative 2, with the trail passing between WTG #4 and WTG #5. The only other alternative was to reduce the number to below what KWP II LLC considers economically viable. This, combined with the anticipated environmental and economic benefits of the proposed facility has led KWP II LLC to the conclusion that the proposed wind energy generating facility would not compromise the ability of the trail to meet the objectives of the Na Ala Hele Trails and Access program.

6.3.4 COASTAL ZONE MANAGEMENT PROGRAM

Enacted as Chapter 205A, HRS, the Hawai‘i Coastal Zone Management (CZM) Program was promulgated in 1977 in response to the Federal Coastal Zone 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 Hawai‘i Coastal Zone Management Program focuses on ten policy objectives:

- 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.
- 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.
- Scenic and Open Space Resources. To protect, preserve, and where desirable, restore or improve the quality of coastal scenic and open space resources.
- Coastal Ecosystems. To protect valuable coastal ecosystems, including reefs, from disruption and to minimize adverse impacts on all coastal ecosystems.
- 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.
- Coastal Hazards. To reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.
- Managing Development. To improve the development review process, communication, and public participation in the management of coastal resources and hazards.
- 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.
- 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 due to erosion.
- Marine Resources. To implement the state's ocean resources management plan.

Other key areas of the CZM program include: a permit system to control development within a Special Management Area (SMA) managed by the Counties and the Office of Planning; a Shoreline Setback Area which serves as a buffer against coastal hazards and erosion, and protects view-planes; and the Marine and Coastal Affairs. Finally, a Federal Consistency provision requires that federal activities, permits and financial assistance be consistent with the Hawai‘i CZM program.

At its closest, the Preferred Alternative is located more than a half-mile from the coastline; Alternative 2 is even further inland (over one mile). Neither alternative involves the placement, erection, or removal of materials near the coastline. As documented in this EIS, the type and scale of the activities that it involves do not have the potential to affect coastal resources significantly, and thus the project does not require a CZM Federal consistency determination. However, it is consistent with the CZM objectives that are relevant to a project of this sort. A copy of the *Revised DEIS* will be sent to the Office of Coastal Zone Management at the State of Hawai‘i Department of Business, Economic Development, and Tourism.

6.3.5 ARCHEOLOGICAL AND HISTORIC PRESERVATION ACT (16 U.S.C. § 469A-1) & NATIONAL HISTORIC PRESERVATION ACT (16 U.S.C. § 470(F))

Section 4.9 documents the proposed project’s compliance with the provisions of the Archaeological and Historic Preservation Act and National Historic Preservation Act. SHPD will be provided a copy of the *Revised DEIS*, and their comments, if any, will be included in the *Final EIS*.

6.3.6 CLEAN AIR ACT (42 U.S.C. § 7506(C))

Section 4.3 documents that both alternatives would comply with all applicable standards at the county, State, and federal level. Thus, it is compliant with the Clean Air Act.

6.3.7 CLEAN WATER ACT (CWA)

The CWA (Federal Water Pollution Control Act, 33 USC 1251, et seq.) is the principal law governing pollution control and water quality of the nation's waterways. Under Section 401 of the CWA, projects that involve discharge or fill to wetlands or navigable waters must obtain certification of compliance with state water quality standards. The State of Hawai‘i Department of Health implements the Section 401 certification program. Section 404 of the law authorizes a permit program for the disposal of dredged or fill material into navigable waters. The U.S. Army Corps of Engineers (USACE) administers the program. KWP II LLC has consulted with USACE and with the State Department of Health and confirmed that the project will not affect navigable waters. Thus, Section 401 and 404 permits will not be required.

6.3.8 ENDANGERED SPECIES ACT (16 U.S.C. 1536(A)(2) AND (4))

The Endangered Species Act (16 U.S.C. §§ 1531-1544, December 28, 1973, as amended) (ESA) provides broad protection for species of fish, wildlife, and plants that are listed as threatened or endangered in the U.S. or elsewhere. The ESA mandates that federal agencies seek to conserve endangered and threatened species and use their authorities in furtherance of the ESA’s purposes. It provides for listing species, as well as for recovery plans and the designation of critical habitat for listed species. The ESA outlines procedures for federal agencies to follow when taking actions that may jeopardize listed species, and contains exceptions and exemptions.

Section 3.7 of this report discusses existing fauna on and near both the alternative sites. The discussion documents that several threatened and endangered species are known to occur in the alternative areas, including nēnē, Hawaiian Hoary Bats, Hawaiian Petrels, and Newell’s Shearwaters. As discussed in detail in Section 4.7.2, KWP II LLC is working with USFWS to obtain an incidental take permit under ESA Section 10 for any “take” of listed species associated with KWP II. This process includes preparation of a Habitat Conservation Plan (HCP) and execution of an Implementation Agreement with USFWS. Copies of this *Revised DEIS* are being provided to the USFWS, and KWP II anticipates that the USFWS will use some of the information it contains to assist in preparing its own National Environmental Policy Act environmental assessment for the HCP.

6.3.9 RESOURCE CONSERVATION AND RECOVERY ACT (42 U.S.C. 6962)

The Resource Conservation and Recovery Act (RCRA) regulates solid and hazardous waste. Its goals are: (i) to protect human health and the environment from the hazards posed by waste disposal; (ii) to conserve energy and natural resources through waste recycling and recovery; (iii) to reduce or eliminate, as expeditiously as possible, the amount of waste generated, including hazardous waste; and (iv) to ensure that wastes are managed in a manner that is protective of human health and the environment.

As discussed in Section 4.12, the facility will not utilize or generate significant hazardous waste. A RCRA permit is not required.

7.0 OTHER CHAPTER 343 TOPICS

Hawai‘i Administrative Rules §11-200-17 establishes the content requirements for environmental impact statements. Most of these topics have been dealt with in the preceding sections of this report. This chapter addresses the few that do not fit neatly into any of the previously defined categories.

7.1 SECONDARY AND CUMULATIVE IMPACTS

The proposed facility is not directly or indirectly related to other actions planned by KWP II LLC. The proposed project's secondary effects (such as those related to the direct expenditure of construction dollars on Maui) are discussed in the appropriate impact sections of the report. Notwithstanding the environmental and economic benefits associated with increased renewable energy capacity, the project would not lead to significant growth or changes in the character of economic activity on Maui (e.g., the opening of new industries not previously practical) that might have secondary impacts. Likewise, the project will not generate significant new employment opportunities. Hence, it does not have the ability to cause significant secondary impacts.

The additional WTGs would add to the risk to avian fauna transiting the area, and the potential for that cumulative effect (as well as the measures that would be taken to avoid and/or mitigate them) are discussed in Chapter 4 and are being addressed in the HCP that has been submitted to State and Federal agencies. Other arenas in which there could be cumulative effects (such as the job and business activity multiplier that will increase the economic stimulus the direct construction expenditures provide) are discussed in that chapter as well. The only other wind project that is currently proposed is tens of miles away on the slope of Haleakalā, and there is little likelihood that birds affected by the proposed KWP II project would be exposed to the same threats as might affect them. Hence, there is little likelihood of cumulative effect on that front.

7.2 SHORT-TERM USES VS. LONG-TERM PRODUCTIVITY

Constructing and operating the proposed wind energy generation facility would provide renewable energy to Maui's grid, thereby helping to reduce pressures on the existing grid and alleviate some of the island's dependence on imported fossil fuels. The facility would not preclude other uses of the property that might be more productive over the long term, nor does it preclude the use and development of other energy sources.

7.3 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS

The construction of the proposed facility does not irrevocably commit any party to the continued use of the site for wind energy generation or to the continued use of wind energy to add power to MECO's grid.

Construction of the project does require some non-renewable resources (e.g., construction materials, fuel for vehicles, etc.). However, at the end of the estimated project lifetime of 20 years the land lease and power purchase agreements can be renegotiated or be terminated, and upon removal of the facilities the land can be allowed to return largely to its prior state (with the exception of some of the topography affected by grading for access roads and pads).

7.4 UNRESOLVED ISSUES

At present, there are no known unresolved issues. However, several permits and approvals must still be obtained, and it is possible that issues may arise as applications for these are prepared and processed.

7.5 RATIONALE FOR PROCEEDING

Chapter 4 describes the environmental effects that could result from construction and operation of the proposed wind power generating facility on either of two locations neat the existing KWP I wind farm. It has identified a "Preferred Alternative", and intends to continue seeking all of the approvals needed to move forward with that proposal. In doing so, KWP II LLC is committed to avoiding or mitigating adverse effects to the greatest extent practical. KWP II LLC believes that the Preferred Alternative is superior overall to the other alternatives that are available (including "no action"), and it does not believe that there are alternatives which would achieve the same goals with fewer environmental effects. However, if the agencies from which it needs approval conclude otherwise, it has indicated that it would move forward to develop the necessary facilities on the Alternative 2 site discussed in this document.

8.0 GLOSSARY AND LIST OF ACRONYMS

Alien Introduced to Hawai‘i by humans

AOS Adequacy of Supply

ahupua‘a A traditional unit of land in ancient Hawai‘i that usually includes a region between two bounding ridges, from the ocean to the mountain peaks

BMP Best Management Practice

CERCLA Comprehensive Environmental Response, Compensation, & Reliability Act

CFR Code of Federal Regulations

Crepuscular Active at twilight hours (dawn and dusk)

CWRM Commission on Water Resource Management, State of Hawai‘i

Cycling units Generating units that are started up before the morning peak and shut down daily after the evening peak.

CZM Coastal Zone Management

CZMP Coastal Zone Management Program

dB Decibel, the basic, logarithmic unit of sound level measurement

dBA A-weighted sound level: Sound level measurement weighted to be most sensitive to the frequencies audible to the human ear

DBEDT Department of Business, Economic Development and Tourism, State of Hawai‘i

DC Direct Costs

DEM Digital Elevation Model

DLNR Department of Land and Natural Resources, State of Hawai‘i

DNL Day-Night Average Sound Level (also expressed as Ldn)

DOH Department of Health, State of Hawai‘i

Domesticated Feral species, not considered established in the wild on the Island of O‘ahu

DPP Department of Planning and Permitting, City & County of Honolulu

EA Environmental Assessment

EIS Environmental Impact Statement (DEIS = Draft EIS; FEIS = Final EIS)

EISPN Environmental Impact Statement Preparation Notice

Endangered Listed and protected under the Endangered Species Act as an endangered species

Endemic Native and unique to the Hawaiian Islands

EPA Environmental Protection Agency

EPRI Electric Power Research Institute

ESA Endangered Species Act of 1973, as amended

◦F Fahrenheit degrees

FEMA Federal Emergency Management Agency, U.S. Federal Government

FIRM Flood Insurance Rate Map

GIS Geographic Information System

HAR Hawai‘i Administrative Rules

HRS Hawai‘i Revised Statutes

Hz Hertz, the basic unit of frequency, cycles per second

IBC International Building Code

Indigenous Native to the Hawaiian Islands, but also found elsewhere naturally

IPP Independent Power Producer

IRS Interconnection Requirement Study

IRP Integrated Resource Plan

kV Kilovolt

kWh Kilowatt hour

Ldn Day-Night Average Sound Level (also expressed as DNL)

LM Load management

makai Towards the ocean

mauka Inland; towards the mountains

MECO Maui Electric Company

MGD Millions of Gallons per Day flow

moku District; a Hawaiian land division within an *ahupua‘a*

MPH Miles per hour

MPRM Meteorological Processor for Regulatory Models

MSL Mean sea level

MW Megawatt

NAAQS National Ambient Air Quality Standards

NCDC National Climatic Data Center

NE Northeast

NLT No later than

NOAA National Oceanic and Atmospheric Administration, Department of Commerce, U.S. Federal Government

Nocturnal Active at night-time, after dark

NPDES National Pollutant Discharge Elimination System

NPS National Park Service, Department of the Interior, U.S. Federal Government

NW Northwest

OEQC Office of Environmental Quality Control, Department of Health, State of Hawai‘i

OSHA Federal Occupational Safety & Health Administration

pH Measure of acidity; the negative logarithm (Base 10) of the effective molar concentration of hydronium ions in water

PPA Power Purchase Agreement

PUC Public Utilities Commission

ROW Right-of-Way

RPS Renewable Portfolio Standard

S South

SAAQS State Ambient Air Quality Standards

SCS Soil Conservation Service, US Department of Agriculture (now the Natural Resource Conservation Service)

SEC State Energy Corridor, State of Hawai‘i

SHPD State Historical Preservation Division, Department of Land and Natural Resources, State of Hawai‘i

SLUC State Land Use Commission, State of Hawai‘i

SMA Special Management Area

SMP Special Management Area Permit

SPCC Spill Prevention, Countermeasure, and Control

SPL Sound Pressure Level (SPL or Lp)

SWL Sound Power Level (other abbreviations are PWL or L_w).

Threatened Listed and protected under the ESA as a threatened species

TMK Tax Map Key

tpy Tons per year (air pollutant emissions unit)

UBC Uniform Building Code

USCG United States Coast Guard

USFWS United States Fish and Wildlife Service

USGS United States Geological Survey

USN United States Navy

VOC Volatile Organic Compounds

WERC Wind Engineering Research Council

WTA Willingness to Accept

WTG Wind Turbine Generator

WTP Willingness to Pay

µS/cm Micro-Siemens per centimeter, the standard unit for measuring specific conductance (which is generally directly proportional to salinity in natural waters)

z_o Surface roughness length unit

THIS PAGE WAS INTENTIONALLY LEFT BLANK

9.0 BIBLIOGRAPHY

Adams, D.L. & Associates, Ltd. (October 16, 2009). *Environmental Noise Assessment Report Kaheawa Wind Power Phase II Ukumehame, Maui, Hawai'i*. DLAA Project No. 08-55A. Prepared for: First Wind Energy, LLC. Honolulu, Hawai'i.

Adams, D.L. & Associates, Ltd. (March 27, 2009). Environmental Noise Measurement Report: Kaheawa Wind Power Phase II, Ukumehame, Maui, Hawai'i. DLAA Project No. 08-55. Prepared for: First Wind Energy, LLC.

Adams, D.L. & Associates, Ltd. (January 9, 2009). *Environmental Noise Assessment Report Kaheawa Wind Power Phase II Ukumehame, Maui, Hawai'i*. DLAA Project No. 08-55. Prepared for: First Wind Energy, LLC. Honolulu, Hawai'i.

Adams, Josh (2008). "Petrels in the Pacific: Tracking the Far-ranging Movements of Endangered 'Ua'u (Hawaiian Petrel)", US Geological Survey, Western Ecological Research Center. www.microwavetelemetry.com/ newsletters/spring_2007 Page 4.pdf.

Ainley, D.G., L. DeForest, N. Nur, R. Podolsky, G. Spencer, and T.C. Telfer (1995). Status of the threatened Newell's Shearwater on Kaua'i: Will the population soon be endangered?

Ainley, D. G., R. Podolsky, L. DeForest, G. Spencer, and N. Nur (2001). "The status and population trends of Newell's Shearwater on Kaua'i: insights from modeling." *Studies in Avian Biology* No. 22: 108-123.

Ainley, D. G., R. Podolsky, L. DeForest, and G. Spencer (1997a). New insights into the status of the Hawaiian Petrel on Kauai. Colonial Waterbirds 20: 24–30.

Ainley, D. G., T. C. Telfer, and M. H. Reynolds (1997b). Townsend's and Newell's Shearwater (Puffinus auricularis). In A. Poole and F. Gill, eds. The birds of North America, No. 297. Academy of Natural Sciences, Philadelphia, PA, and American Ornithologists' Union, Washington, DC. 20 pp.

American Ornithologists' Union (1998). *Check-list of North American birds*. 7th ed. American Ornithologists' Union, Washington, DC. 829 pp.

Armstrong, R. W. (ed.) (1983). *Atlas of Hawaii*. (2nd. ed.) University of Hawaii Press.

Arnett, Edward B., W. Kent Brown, Wallace P. Erickson, Jenny K. Fiedler, Brenda L. Hamilton, Travis H. Henry, Aaftab Jain, Gregory D. Johnson, Jessica Kerns, Rolf R. Koford, Charles P. Nicholson, Timothy J. O'Connell, Martin D. Piorkowski, Roger D. Tankersley, Jr. (2008). "Patterns of Bat Fatalities at Wind Energy Facilities in North America". *Journal of Wildlife Management* 72(1):61–78.

Arnett, E. B. and M. D. Tuttle (2004). "Cooperative Efforts to assess the impacts of wind turbines on bats." *National Wind Coordinating Committee, Onshore Wildlife Interactions with wind Developments: Research Meeting V*, November 3-4, 2004, Landsdowne, VA. Resolve,Inc., Washington, D.C.

Athens, J. (2004). *Supplemental Archaeological Survey for Access Road, Wind Turbine Project at Kaheawa Pastures, Upland Ukumehame Ahupua'a, Maui* (TMK 4-8-001:001 & 3-6-001:014). International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

____ (2002). *An Upland Heiau Site.* Ukumehame Ahupua'a, Maui. International Archaeological Research Institute, Inc., Honolulu. Prepared for GE Wind Energy, LLC, Tehachapi, California.

Baldwin, P.H. (1950). "Occurrence and behavior of the Hawaiian bat." *J. Mammalogy* 31:455-456.

Banko, P.C. (1992). "Constraints on productivity of wild nēnē or Hawaiian Geese *Branta sandvicensis*." *Wildfowl* 43: 99–106.

____ (1988). Breeding biology and conservation of the nēnē, Hawaiian goose (Nesochen sandvicensis). Ph.D. dissertation, Univ. Washington, Seattle. 255pp.

Banko, P. C., J. M. Black, and W. E. Banko (1999). Hawaiian Goose (nēnē) (Branta sandvicensis). In *The Birds of North America*, No. 434 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Banko, W. E. (1980a). Part I. Population histories—species accounts. Sea birds: Hawaiian Dark-rumped Petrel ('Ua'u). Cooperative National Park Resources Studies Unit, University of Hawaii at Manoa, Honolulu, HI. CPSU/UH Avian History Report 5B: History of Endemic Hawaiian Birds. 42 pp.

Banko, W. E. (1980b). Part I. Population histories—species accounts. Sea birds: Newell Shearwater ('A'o). Cooperative National Park Resources Studies Unit, University of Hawaii at Manoa, Honolulu, HI. CPSU/UH Avian History Report 5B: History of Endemic Hawaiian Birds. 35 pp.

Bellwood, J.J. and J.H. Fullard (1984). "Echolocation and Foraging Behaviour in the Hawaiian Hoary Bat, *Lasiurus cinereus semotus*." *Canadian Journal of Zoology* 62:2113-2120.

Bird Studies Canada (2003). *Wind Turbines and Birds: A Guidance Document for Environmental Assessment, Draft* December 2003. Prepared by Kingsley, A. and B. Whittam, Bird Studies Canada, for Canadian Wildlife Service, Environment Canada, Gatineau, Quebec.

Bonaccorso, F. (2008). Annual Summary Report: Hawaiian Hoary Bat Occupancy in Hakalau Forest National Wildlife Refuge. Special Use Permit: 12516-07008.

−−−, (February 5, 2008). Personal communication regarding Hawaiian hoary bat population on the Island of Hawai‘i.

Brandt, C. A., J. K. Parrish, and C. N. Hodges. (1995). "Predictive approaches to habitat quantification: Dark-rumped Petrels on Haleakalā, Maui." *Auk* 112: 571–579.

CFR (Code of Federal Regulations 1986). Title 36, Part 800: *Protection of Historic Properties*. (Including Part 800.9: Criteria of effect and adverse effect.)

____ (Code of Federal Regulations,1981). Title 36 Part 60: *National Register of Historic Places*. (Including Part 60.4: Criteria for evaluation.)

Clarke, Matthew R. and Robert B. Rechtman. November 2006. *An Archaeological Inventory Survey of 333 Acres for the Proposed Expansion of the Kaheawa Wind Farm* (TMK: 2-4-8-001: por. 001). Ukumehame Ahupua‘a, Lahaina District, Island of Maui. Prepared for Kaheawa Wind Power, LLC, Makawao, Hawai‘i.

Conant, S. (1980). "Recent records of the 'Ua'u (Dark-rumped Petrel) and the 'A'o (Newell's Shearwater) in Hawaii." *'Elepaio* 41: 11–13.

____ (2005). An Archaeological Survey of the Proposed Kaheawa Wind Farm Project Area (Portions of TMK (2) 3-6-001:014 & (2) 4-8-001:001), Ukumehame Ahupua‘a, Lahaina and Wailuku Districts, Island of Maui. Rechtman Consulting LLC Report RC-0328. Prepared for Kaheawa Wind Power LLC, Makawao, HI.

Cooper, Brian A. and Robert H. Day (2009). *Radar and Visual Studies of Seabirds at the Proposed KWP II Down-Road Alternative Wind Energy Facility, Maui Island, Hawaii, Summer 2009*. Prepared by ABR, Inc. for First Wind.

____ (2008). Modeling Annual Seabird Fatality At Wind Turbines At The Proposed KWP II Wind Energy Facility, Maui Island, Hawai‘i. Prepared by ABR, Inc. for First Wind. Author: Fairbanks, AK 99708-0410.

____ (2003). “Movement of Hawaiian Petrels to inland breeding sites on Maui Island, Hawai‘i.” *Waterbirds* 26:62–71.

____ (1998). “Summer behavior and mortality of Dark-rumped Petrels and Newell’s Shearwaters at power lines on Kaua‘i.” *Colonial Waterbirds* 21: 11–19.

Cooper, Brian A. & Robert H. Day, ABR, Inc. (2004a). Results of Endangered Bird and Bat Surveys at the Proposed Kaheawa Pastures Wind Energy Facility on Maui Island, Hawaii. Prepared for Kaheawa Windpower LLC.

____ (2004b). Modeling Annual Seabird Use and Fatality at the Proposed Kaheawa Pastures Wind Energy Facility, Maui Island, Hawaii. Prepared for Kaheawa Wind power LLC.

Cooper, Brian A. and C. Sanzenbacher (In prep.). *Radar and Visual Studies of Seabirds at the Proposed KWP II Down-Road Alternative Wind Energy Facility, Maui Island, Hawaii, Fall 2009.* Prepared by ABR, Inc. for First Wind.

Cowie, R. H., Evenhuis, N. L. & Christensen, C. C. 1995. *Catalog of the Native Land and Freshwater Molluscs of the Hawaiian Islands*, Backhuys Publishers, Leiden, The Netherlands: vi + 248 pp.

Day, Robert H., and Brian A. Cooper. (2008). *Interim Report: Oahu Radar & Audiovisual studies, Fall 2007 and Summer 2008*. ABR, Inc. – Environmental Research & Services.

____, (2002). *Petrel and shearwater surveys near Kalaupapa, Molokai Island, June 2002*. Unpublished report prepared for National Park Service, Hawaii National Park, HI, by ABR, Inc.—Environmental Research & Services, Fairbanks, AK, and Forest Grove, OR. 17 pp.

____ (2001). *Results of petrel and shearwater surveys on Kaua‘i, June 2001*. Unpublished report prepared for U. S. Fish and Wildlife Service, Honolulu, HI, by ABR, Inc., Fairbanks, AK, and Forest Grove, OR. 21 pp.

____ (1999). Results of Endangered Bird and Bat Surveys at the Proposed Kaheawa Pastures Windfarm on Maui Island, Hawai‘i, Summer 1999. Prepared by ABR, Inc., Forest Grove, OR and Fairbanks, AK for Zond Pacific, Wailuku, HI. 26 pp.

____ (1995). “Patterns of movement of Dark-rumped Petrels and Newell’s Shearwaters on Kaua‘i.” *Condor* 97: 1011–1027.

Day, R.H., B.A. Cooper, and T.C. Telfer (2003a). “Decline of Townsend’s (Newell’s) Shearwaters (*Puffinus auricularis newelli*) on Kauai, Hawai‘i.” *Auk* 120:669-679.

Del Hoyo, J., A. Elliott and J. Sargatal (1992). *The Handbook of the Birds of the World, Volume I.* Ostrich to Ducks. Lynx Edicions, Barcelona.

Department of Business, Economic Development and Tourism, State of Hawai‘i (2007). State *of Hawai‘i 2007 Data Book.*

____ (2006a). State *of Hawai‘i 2005 Data Book.*

____ (2006b). 2005 Annual Visitor Research Report.

Devereux, T., I. Masterson, M. Heidel, V. Creed, L. Pyle, H. Hammatt (1999). *Archaeological Inventory Survey and Subsurface Testing of a 440 Acre Parcel*. Ahupua`a of Ukamehame, District of Lahaina, Island of Maui (TMK 4-8-02:09). Cultural Surveys Hawaii. Prepared for Sugar Way Ltd.

Dirksen, S., A. L. Spaans and J. Winden (1998). "Nocturnal collision risks with wind turbines in tidal and semi-offshore areas." *Wind Energy and Landscape. Proceedings of the 2nd European and African Conference on Wind Engineering, 1997.* pp. 99-108.

DOFAW (Hawai'i Division of Forestry and Wildlife). (2005a). http://www.dofaw.net/fbrp/projects.php?id=00064.

____ (2005b). Hawai'i's Species of Greatest Conservation Need (July 27, 2005 Draft). http://www.state.hi.us/dlnr/ dofaw/cwcs/Conservation_ need.htm.

____ (2000). "Survey of the nēnē population on Maui." *'Elepaio* 60:25-28.

DOH (State of Hawai'i Department of Health, Air Quality Branch) (2005). *Hawai'i 2005 Air Quality Data Book.*

Electric Power Monthly (Sept 2006). http://www.eia.doe.gov/cneaf/electricity/epm/epm_sum .html

Erickson, W.P. (2003). "Updated information regarding bird and bat mortality and risk at new generation wind projects in the west and Midwest." *National Wind Coordinating Committee, Wildlife Workgroup Meeting*, November 18, 2003. Resolve, Inc., Washington, D.C. http: //www.nationalwind. org/events/wildlife/2003 -2/presentations/erickson.pdf

Erickson, W. P., G. D. Johnson, D. P. Young, Jr., M. D. Strickland, R. E. Good, M. Bourassa, K. Bay (2002). *Synthesis and Comparison of Baseline Avian and Bat Use, Raptor Nesting and Mortality Information from Proposed and Existing Wind Developments*. Technical Report prepared for Bonneville Power Administration, Portland, Oregon.

Erickson, W.P., G. D. Johnson, M. D. Strickland, D. P. Young, Jr., K. J. Sernka and R.E. Good (2001). *Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to Other Sources of Avian Collision Mortality in the United States.* National Wind Coordinating Committee Publication. http://www.nationalwind.org/pubs/default.htm

Evans, W. R. (2003). "An assessment of the potential hazard to migrant birds from a wind farm proposed by Equinox Wind Partners, LLC on Little Equinox Mountain, Manchester, VT." Prepared for Vermont Fish and Wildlife Department. In *Bird Studies Canada 2003. Wind Turbines and Birds: A Guidance Document for Environmental Assessment*, Draft. Prepared by Kingsley, A. and B. Whittam, Bird Studies Canada, for Canadian Wildlife Service, Environment Canada, Gatineau, Quebec.

Federal Register (1999a). Department of the Interior, Fish and Wildlife Service, *Endangered and Threatened Wildlife and Plants*. 50CFR 17:11 and 17:12 – December 3, 1999

____ (1999b). Department of the Interior, Fish and Wildlife Service, 50 CFR 17. Endangered and Threatened Wildlife and Plants; Review of Plant and Animal Taxa that are Candidates or Proposed for Listing as Endangered or Threatened. Annual Notice of Findings on Recycled Petitions, and Annual Description of Progress on Listing Actions. Federal Register, 64 No. 205 (Monday, October 25, (1999): 57534-57547.

Foote, Donald E., Elmer L. Hill, Sakuichi Nakamura, and Floyd Stephens (August 1972). *Soil Survey of Islands of Kaua'i, O'ahu, Maui, Molokai, and Lāna'i, State of Hawai'i.* U.S. Department of Agriculture Soil Conservation Service in cooperation with the University of Hawai'i Agricultural Experiment Station. US Government Printing Office, Washington, DC. 233 p.

Fraser, Heather R., Vanessa Parker-Geisman, and George R. Parish, IV (April 2007). *Hawaiian Hoary Bat Inventory in National Parks on Hawai'i, Maui and Mōloka'i*. Technical Report 140. Pacific Cooperative Studies Unit, University of Hawai'i at Mānoa, Dr. David C. Duffy, Unit Leader, Department of Botany.

Fujioka, K. K., and S. M. Gon III (1988). "Observations of the Hawaiian Bat (Lasiurus cinereus semotus) in the districts of Ka‘u and South Kona, island of Hawai‘i." *Journal of Mammalogy* 69: 369–371.

Fullard, J.H. (2001). "Auditory Sensitivity of Hawaiian Moths (Lepidoptera: Noctuidae) and Selective Predation by the Hawaiian Hoary Bat (*Chiroptera: Lasiurus cinereus semotus*)." *Proceedings of the Royal Society of London B.* 268:1375-1380.

Gill, J.P., M. Townsley, and G.P. Mudge (1996). "Review of the impacts of wind farms and other aerial structures upon birds." *Scottish Natural Heritage Review*. No. 21.

Gon, S. M., III (1988). Observations of the 'Ua'u (Hawaiian Petrel) in the Hono O Pali Natural Area Reserve, Island of Kauai. 'Elepaio 48: 113.

Gorresen, P. Marcos, Adam C. Miles, Christopher M. Todd, Frank J. Bonaccorso, and Theodore J.Weller (2008). "Assessing Bat Detectability and Occupancy with Multiple Automated Echolocation Detectors." *Journal of Mammalogy*, 89(1):11–17, 2008.

Guillemette, M., J. Larsen, and I. Clausager. 1999. Assessing the impact of the Tunø Knob wind park on sea ducks: the influence of food resources. NERI Technical Report No. 263.

____ (1998). *Impact assessment of an offshore wind park on sea ducks*. NERI Technical Report 227. National Environmental Research Institute, Kalø.

Hammatt, H., I. Masterson and T. Devereaux. (1996). *Archaeological Inventory Survey of Access Roads Adjacent to the Maalaea-Lahaina Third 69kV Transmission Line Corridor.* Cultural Surveys Hawaii. Prepared for Dames and Moore and Maui Electric Co.

Handy, E.S.C., E.G. Handy and M. Pukui (1991). *Archaeological Inventory Survey of Access Roads Adjacent to the Maalaea-Lahaina Third 69V Transmission Line Corridor.* Cultural Surveys Hawaii. Prepared for Dames and Moore and Maui Electric. Co.

Harrison, C. (1990). *Seabirds of Hawaii*. Natural History and Conservation. Cornell University Press, Ithaca.

Hawai‘i Natural Heritage Program (1999). *Natural Diversity Database.* December 16, 1999.

Hays, W.S.T. and S. Conant (2007). "Biology and Impacts of Pacific Island Invasive Species. 1. A Worldwide Review of Effects of the Small Indian Mongoose, *Herpestes javanicus* (*Carnivora: Herpestidae*)." *Pacific Science* 61(1):3-16.

Hirai, L. T. (1978a). "Native birds of Lanai, Hawaii." *Western Birds* 9: 71–77.

Hirai, L.T. (1978b). "Possible dark-rumped petrel colony on Lana‘i, Hawai‘i." *‘Elepaio* 38:71-72.

Hobdy, Robert W. Environmental Consultant (2009). *Botanical Resources Survey for the Kaheawa Pastures Energy Project Ukumehame, Maui, Hawaii*. Prepared for First Wind Energy, LLC.

____(2006). Botanical Resources Survey For The Kaheawa Pastures Wind Energy Project II Ukumehame, Maui, Hawai‘i. Prepared for Kaheawa Windpower, LLC.

____(2004a). Botanical Resources Survey for the Kaheawa Pastures Wind Energy Project Access Road – Primary Route. Ukumehame, Maui, Hawaii. Prepared for Kaheawa Wind Power, LLC. 18 pp.

____ (2004b). Botanical Resources Survey for the Kaheawa Pastures Wind Energy Project Access Road – Alternate Route Section. Ukumehame, Maui, Hawaii. Prepared for Kaheawa Windpower, LLC.

Hodges, C. S. (1994). Effects of introduced predators on the survival and fledging success of the endangered Hawaiian Dark-rumped Petrel (Pterodroma phaeo -pygia sandwichensis). M.S. thesis, Univ. of Washington, Seattle.

Hodges, C.S.N. and R.J. Nagata (2001). "Effects of Predator Control on the Survival and Breeding Success of the Endangered Hawaiian Dark-rumped Petrel." *Studies in Avian Biology* 22: 308-318.

Horn, J.W., E.B. Arnett, and T.H. Kunz (2008). "Behavioral Responses of Bats to Operating Wind Turbines." *Journal of Wildlife Management* 72(1):123-132.

Hoshide, H.M., A. J. Price, L. Katahira (1990). "A progress report on nēnē Branta sandvicensis in Hawai'i Volcanoes National Park from 1974-89." *Wildfowl* 41: 152–155.

Hu, D. E. (1998). *Causes of endangerment and extinction in Hawaiian birds.* Ph.D. diss., Univ. of California, Davis.

Hu, D., C. Glidden, J. S. Lippert, L. Schnell, J. S. MacIvor, and J. Meisler (2001). "Habitat use and limiting factors in a population of Hawaiian Dark-rumped Petrels on Mauna Loa, Hawai'i." Pages 234-242 in J. M. Scott, S. Conant, and C. van Riper III, eds. *Ecology, conservation, and management of endemic Hawaiian birds: A vanishing avifauna. Studies in Avian Biology* volume 22.

International Standard ISO 9613-2:1996, Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of Calculation.

Jacobs, D.S. (1994). "Distribution and abundance of the endangered Hawaiian Hoary Bat, Lasiurus cinereus simotus." *Pacific Science* 48:193-200.

____ (1993). *Character release in the endangered Hawaiian Hoary Bat, Lasiurus cinereus simotus*. Final report to U.S. Fish and Wildlife Services (Grant 14-48- 0001-92570). 6pp.

James, R.D. (2003). "Bird observations at the Pickering wind turbine." *Ontario Birds*, August 2003.

Johnson, G. D. (2005). "A review of bat mortality at wind-energy developments in the United States." *Bat Research News* 46:45–49.

Johnson, G.D., W.P. Erickson, M.D Strickland (2003a). Mortality of Bats at a Large-scale Wind Power Development at Buffalo Ridge, Minnesota. American Midland Naturalist 150(2):332-342. Johnson, G.D., W.P. Erickson, and M.D. Strickland. 2003b.

Johnson, G. D., W. P. Erickson, and M. D. Strickland (2003b). "What is known and not known about bat collision mortality at windplants?" In R. L. Carlton (ed.), *Proc. Workshop on Avian Interactions at Wind Turbines*, 16-17 October, 2002, Jackson Hole, WY. Electric Power Research Inst., Palo Alto, CA.

Johnson, G. D., W. P. Erickson, M. D. Strickland, M. F. Shepherd and D. A. Shepherd (2000). *Final report, avian monitoring studies at the Buffalo Ridge, Minnesota wind resource area: results of a 4-year study*. Prepared for Northern States Power Company, Minneapolis, by Western Ecosystems Technology, Inc.

Johnson, G. D., W. P. Erickson, M. D. Strickland, M. F. Shepherd, D. A. Shepherd, and S. A. Sarappo (2002). "Collision mortality of local and migrant birds at a large-scale wind-power development on Buffalo Ridge, Minnesota." *Wildlife Society Bulletin* 30:879-887.

Kaheawa Wind Power (2008). *Kaheawa Pastures Wind Energy Generation Facility Habitat Conservation Plan Year 2 HCP Implementation*. Prepared for submittal to the State of Hawai'i Department of Land and Natural Resources. 82pp.

____, (2008a). *KWP I and KWP II Acoustic Monitoring of Bat Activity*. Unpublished report.

____, (2008b). *Kaheawa Pastures Wind Energy Generation Facility, Habitat Conservation Plan: Year 1 Annual Report (Part II)*. First Wind Energy, LLC, Environmental Affairs, Newton, MA. 23 pp.

____, (2008c). *Kaheawa Pastures Wind Energy Generation Facility, Habitat Conservation Plan: Year 2 Annual Report*. First Wind Energy, LLC, Environmental Affairs, Newton, MA. 26 pp.

____ (2007a). *Kaheawa Pastures Wind Energy Generation Facility Habitat Conservation Plan 2006 Annual Report Part 1*. Prepared for submittal to the State of Hawai‘i Department of Land and Natural Resources. 43pp.

____ (2007b). *Kaheawa Pastures Wind Energy Generation Facility Habitat Conservation Plan 2006 Annual Report: Part 2*. Prepared for submittal to the State of Hawai‘i Department of Land and Natural Resources. 52pp.

____, (2006). Kaheawa Pastures Wind Energy Generation Facility Habitat Conservation Plan (TMK Nos. 4-8-001:001 and 3-6-001:014), Ukumehame, Maui, Hawai‘i.

____ (2004). *Kaheawa Pastures Wind Energy Generation Facility Final Environmental Assessment*.

Kanoelehua, Wilson Ah Sam and Robert B. Rechtman. October 2009. *A Cultural Impact Assessment for the Proposed Kaheawa Wind Power (KWP) Phase 2 Project Area ((TMK: 2-3-6-001: Por. 014 and 2-4-8-001: por. 001)*. Prepared for First Wind Energy LLC, Honolulu, Hawai‘i.

Kear, J. and A. J. Berger 1980. *The Hawaiian goose: an experiment in conservation*. Buteo Books, vermillion, SD.

Kepler, C. B., and J. M. Scott. 1990. “Notes on distribution and behavior of the endangered Hawaiian Hoary Bat (Lasiurus cinereus semotus), 1964–1983.” *‘Elepaio* 50: 59–64.

Kerlinger, P. 2005. Bird studies: what we know and what has been done? 2nd Wind Power Siting Workshop: Siting Wind Power Projects in the Eastern U. S. Sponsored by the American Wind Energy Association, www.awea.org.

Kerns, J., W. P. Erickson, and E. B. Arnett. 2005. Bat and Bird Fatality at Wind Energy Facilities in Pennsylvania and West Virginia. Pages 24–95 In: Arnett, E.B., editor. Relationships Between Bats and Wind Turbines in Pennsylvania and West Virginia: An Assessment of Bat Fatality Search Protocols, Patterns of Fatality, and Behavioral Interactions with Wind Turbines. A Final Report Submitted to the Bats and Wind Energy Cooperative. Bat Conservation International, Austin, Texas, USA. http://www.batcon.org/windliterature.. Accessed 1 Sep 2007.

Kingsley, A., and B. Whittam. (2007). *Wind Turbines and Birds: A Background Review for Environmental Assessment, Draft*. Canadian Wildlife Service, Environment Canada, Gatineau, Quebec.

Kramer, R. J. (1971). *Hawaiian Land Mammals*. Charles E. Tuttle, Rutland, VT. 347 pp.

Kunz, T.H., E.B. Arnett, B.M. Cooper, W.P. Erickson, R.P. Larkin, T. Mabee, M.L. Morrison, M.D. Strickland, and J.M. Szewczak (2007). “Assessing Impacts of Wind-energy Development on Nocturnally Active Birds and Bats: A Guidance Document.” *Journal of Wildlife Management* 71: 2449–2486.

Kushlan, J.A., M.J. Steinkamp, K.C. Parsons, J. Capp, M.A. Cruz, M. Coulter, I. Davidson, L.Dickson, N. Edelson, R. Elliot, R.M. Erwin, S. Hatch, S. Kress, R. Milko, S. Miller, K. Mills, R. Paul, R. Phillips, J. E. Saliva, B. Sydeman, J. Trapp, J. Wheeler, and K. Wohl (2002). *Waterbird Conservation for the Americas: The North American Waterbird Conservation Plan, Version 1. Waterbird Conservation for the Americas*, Washington, DC.

Larsen, J. K., and J. Madsen (2000). "Effects of wind turbines and other physical elements on field utilization by pink-footed geese (*Anser brachyrhynchus*): A landscape perspective." *Landscape Ecology* 15: 755-764.

Larsson, A. K. 1994. "The environmental impact from an offshore plant." *Wind Engineering* 18: 213-219.

Macdonald, G.A., A.T. Abbott, and F.L. Peterson. (1983). *Volcanoes in the Sea: The Geology of Hawai'i.* 2nd Edition. Honolulu: University Press, 517 p.

Magnuson, C.M. (2003). *Supplemental archaeological survey of turbine pad alignments, Kaheawa Pastures, Upland Ukumehame Ahupua'a, Maui.* Prepared for Hawaii Wind Energy, LLC, Honolulu. International Archaeological Research Institute, Inc., Honolulu.

Malama Environmental, LLC (2007). Phase 1 Environmental Site Assessment. Preliminary Summary for the Property Located at the Kaheawa Wind Farm, West Maui Mountains, Maui, HI. TMK(2) 4-8-01:001 (portion), MEV Project No. 0708-0066.

MECO, 1994. As cited in WSB-Hawai'i, Final Kaheawa Pastures 20 MW Windfarm, Maui, Hawai'i Environmental Impact Statement, August 26, 1999.

Medeiros, Arthur C. (1998). Botanical Survey of Proposed Road Construction Corridor, SE West Maui. Prepared for Zond Energy Systems, Inc.

____ (1996). A botanical survey of six proposed wind testing sites on leeward West Maui. Prepared for Zond Pacific, Inc.

Menard, T. (2001). Activity Patterns of the Hawaiian Hoary Bat (Lasiurus cinereus semotus) in Relation to Reproductive Time Periods. Masters thesis, Univ. of Hawai'i, Hawai'i.

Miller, A. H. (1937). "Structural modifications in the Hawaiian goose (*Nesochen sandvicensis*): a study in adaptive evolution." *University of California Publications in Zoology* 42(1):1-80.

Mitchell, C., C. Ogura, D.W. Meadows, A. Kane, L. Strommer, S. Fretz, D. Leonard, and A. McClung (2005). *Hawaii's Comprehensive Wildlife Conservation Strategy*. Department of Land and Natural Resources. Honolulu, HI. Available at: http://www.state.hi.us/dlnr/dofaw/cwcs/index.html. Accessed August 21, 2008.

Mossop, D. H. (1998). *Five years of monitoring bird strike potential at a mountain-top wind turbine, Yukon Territory*. Prepared for CANMET Energy Technology Centre, Natural Resources Canada.

Nishibayashi, E. (1998). *Native bird activity at proposed access road*. Prepared for Zond Pacific, Inc., Wailuku, HI, by Eric Nishibayashi Biological Consulting, Kahului, HI.

____ (1997). *Downed wildlife survey at six leeward West Maui wind monitoring towers*. Prepared for Zond Pacific, Inc., Wailuku, HI, by Eric Nishibayashi Biological Consulting, Kahului, HI.

OEQC (Office of Environmental Quality Control, State of Hawai'i 1997). *Guidelines for Assessing Cultural Impacts*. Adopted by the Environmental Council; November 19, 1997.

Parker, P.L., and T.F. King (1990). "Guidelines for Evaluating and Documenting Traditional Cultural Properties." *National Register Bulletin No. 38*. Washington, D.C.: U.S. Dept. Interior, National Park Service.

Percival, S. M. (2001). *Assessment of the effects of offshore wind farms on birds*. Report ETSU W/13/00565/REP, DTI/Pub URN 01/1434.

Pitman, R. L. (1986). *Atlas of Seabird Distribution and Relative Abundance in the Eastern Tropical Pacific*. La Jolla, California: NOAA, NMFS, Southwest Fisheries Center Administrative Report LJ-86-02C.

Podolsky, R. (2005). *Peer Review and Avian Risk of Collision Model, Kaheawa Pastures Wind Farm, Maui, HI*. Prepared by The Louis Berger Groyup, Rockport, ME for UPC Wind Management, LLC.

____ (2004). Avian Risk of Collision (ARC) model. National Wind Coordinating .....Committee, Onshore Wildlife Interactions with Wind Developments: Research Meeting V, November 3-4, 2004, Landsdowne, VA. Resolve, Inc., Washington, D.C.

Podolsky, R., D. G. Ainley, G. Spencer, L. DeForest, and N. Nur. (1998). "Mortality of Newell's Shearwaters caused by collisions with urban structures on Kaua'i." *Colonial Waterbirds* 21: 20–34.

Pratt, T. K. (1988). "Recent observations, March–May 1988." *'Elepaio* 48: 65–66.

Pratt, H.D., P.L. Bruner, and D.G. Berrett (1987). *The Birds of Hawaii and the Tropical Pacific*. Princeton University Press, Princeton, NJ.

Pukui, M. K., S. H. Elbert, and E. T. Mookini (1976). *Place Names of Hawai'i*. University of Hawai'i Press. Honolulu, Hawai'i. 289 pp.

Pyle, R. L. (1983). "Hawaiian Islands Region (1 June–31 July 1983)." *American Birds* 37: 1028–1029.

Rasmussen, C. (2005a). Supplemental Archaeological Reconnaissance Survey of the Southern Portion of the New Low Impact Road for the Wind Turbine Project at Kaheawa Pastures, Upland Ukumehame Ahupua'a, Maui (TMK 3-6-001:014). International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

____ (2005b). *Supplemental Archaeological Reconnaissance Survey within the SMA Zone for the Wind Turbine Project at Kaheawa Pastures, Upland Ukumehame Ahupua'a, Maui (TMK 3-6-001:014). Draft.* International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

Rechtman, Robert B., Johnny R. Dudoit, and Ashton K. Dircks Ah Sam. October 2009. *An Archaeological Inventory Survey for the Kaheawa Wind Power (KWP) Phase 2 Project Area ((TMK: 2-3-6-001: Por. 014 and 2-4-8-001: por. 001)*. Prepared for First Wind Energy LLC, Honolulu, Hawai'i.

RESOLVE, Inc. (September 2004). Susan Savitt Schwartz, ed., *Proceedings of the Wind Energy and Birds/Bats Workshop: Understanding and Resolving Bird and Bat Impacts*. Washington, DC. May 18-19, 2004.

Reynolds, M. H., B. A. Cooper, and R. H. Day. 1997. "Radar study of seabirds and bats on windward Hawai'i." *Pacific Science* 51:97–106.

Reynolds, M.H. and G.L. Ritchotte (1997). "Evidence of Newell's Shearwater Breeding in Puna District, Hawaii." *Journal of Field Ornithology* 68(10): 26-32

Richardson, F. and D.H. Woodside. 1954. "Rediscovery of the nesting of the Dark-rumped Petrel in the Hawaiian Islands." *Condor* 56: 323-327.

Ridge Energy Storage & Grid Services L.P. (June 27, 2005). *The Economic Impact of CAES on Wind in TX, OK, and NM: Final Report*. Prepared for the Texas State Energy Conservation Office. Houston, Texas.

Robins, J., W. Folk, & H. Hammatt (1994). An Archaeological Inventory Survey of an Approximately 14.7 Mile Proposed Transmission Line from Mā'alaea to Lahaina, Maui, Hawai'i, Cultural Surveys Hawaii, Kailua, HI. Original 1991, Revised 1994.

Sanzenbacher P.M. and B.A. Cooper. (2009) Radar and Visual Studies of Seabirds at the Proposed KWP II Wind Energy Facility, Maui Island, Hawaii: Use of 2008 Data to Model Annual Collision Fatalities at Proposed Wind Turbines. Prepared for First Wind, Newton Massachusetts, 28 pp.

____, (2008). *Radar and Visual Studies of Seabirds at the KWP I and KWP II Wind Energy Facilities, Maui Island, Hawaii: Use of 2008 Data to Model Annual Collision Fatalities at Meteorological Towers*. Unpublished report prepared for FirstWind, Newton, MA, by ABR, Inc.-Environmental Research & Services, Forest Grove, OR. 21 pp.

Severns, Mike R. (September 2009b). *An Assessment of Hawaiian Native Molluscan Fauna of the lower Kaheawa Pasture, West Maui, Hawai'i*. Prepared for First Wind.

____,(January 2009a). An Assessment of Hawaiian Native Molluscan Fauna Kaheawa Pastures, West Maui, Hawai'i. Prepared for First Wind. Kihei, Hawai'i.

Severns, Mike R. (In press). *An illustrated Catalog of the Shelled Molluscan Fauna of the Hawaiian Islands, Marine, Freshwater and Land*, Conchbooks Publishers. Maizer Str. 25, D-55546, Hackenheim, Germany. Estimated 800 pp.

Shallenberger, R. J. (1974). Field notes. *'Elepaio* 35: 18–20.

Simons, T. R. (1985). "Biology and behavior of the endangered Hawaiian Dark-rumped Petrel." *Condor* 87: 229-245.

____ (1984). "A population model of the endangered Hawaiian dark-rumped petrel." *J. Wildl. Mgmt.* 48(4) 1065-1076.

Simons, T. R., and C. N. Hodges. 1998. Dark-rumped Petrel (Pterodroma phaeopygia). In The Birds of North America, No. 345 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Sincock, J. L., and G. E. Swedberg (1969), "Rediscovery of the nesting grounds of Newell's Manx Shearwater (Puffinus puffinus newelli), with initial observations." *Condor* 71:69–71.

Spear, L.B., Ainley, D.G., Nur, N., and Howell, S.N.G.. 1995. "Population size and factors affecting at-sea distributions of four endangered procellariids in the tropical Pacific." *Condor* 97:613-638.

Spencer, Greg (2009). Personal communication regarding results of acoustical bat monitoring at West Maui Mountains, Kaheawa Pastures.

−−−, (2008). Personal communication regarding nēnē nesting activity in and around KWP I project area.

State of Hawai'i (2002). *Hawai'i Statewide GIS Program*. Hazard Layer. URL: http://www.state.hi.us/dbedt/gis/hazard.htm

Still, D., B. Little and S. Lawrence (1995). *The Effect of Wind Turbines on the Bird Population at Blyth*. ETSU Report W/13/00394.

Strickland, M. D., G. D. Johnson and W. P. Erickson (2000). Avian use, flight behaviour, and mortality on the Buffalo Ridge, Minnesota, wind resource area. In Proceedings of National Avian - Wind Power Planning Meeting III, San Diego, California, May 1998. Prepared for the Avian Subcommittee of the National Wind Coordinating Committee by LGL Ltd., King City, Ontario. 202 pp.

SWCA (October 2009). *Draft Kaheawa Wind Power II Wind Energy Generation Facility Habitat Conservation Plan*. Prepared for First Wind, October 2009.

SWCA (March 2009). *Draft Kaheawa Wind Power II Wind Energy Generation Facility Habitat Conservation Plan*. Prepared for First Wind, January 2009.

Telfer, T. C. (1986). Newell's Shearwater nesting colony establishment study on the island of Kaua'i. Final Report, Statewide Pittman-Robertson Program. Department of Lands and Natural Resources, State of Hawai'i, Honolulu, HI.

Telfer, T. C., J. L. Sincock, G. V. Byrd, and J. R. Reed (1987). "Attraction of Hawaiian seabirds to lights: conservation efforts and effects of moon phase." *Wildlife Society Bulletin* 15: 406–413.

Tetra Tech EC, Inc. (2008a). Draft Environmental Assessment For Issuance of an Endangered Species Act Section 10 (a)(1)(B) Permit for the Incidental Take of Listed Species for the Lanai Meteorological Towers Project. Castle & Cooke Resorts, LLC. Prepared for U.S. Fish & Wildlife Service.

____ (2008b). DRAFT Habitat Conservation Plan for the construction and operation of Lanai met towers, Lanai, Hawaii (Revised February 8, 2008, TTEC-PTLD-2008-080). Unpubl. report by Tetratech EC, Honolulu, HI for Castle and Cooke Resorts LLC, Lanai City, HI. 52 pp. + appendices. Available at: http:// www.state.hi.us/dlnr/dofaw/pubs/Lana'i_MetTowers_HCP.pdf.

Tomich, P. Q. (1986). "Mammals in Hawai'i: A synopsis and notational bibliography." Rev. ed. B.P. Museum, Honolulu, HI. Spec. Pub. 76.384 pp.

____ (1969). "Mammals in Hawaii: A Synopsis and Notational Bibliography." *B.P. Bishop Museum, Honolulu, HI*. Spec. Pub. 57. 238 pp.

Tomonari-Tuggle, M.J. (1998). *An Archaeological Reconnaissance Survey for 27 Wind Turbines in the Ukumehame Uplands, Island of Maui.* Prepared for Warren S. Bollmeier, II, WSB Hawai'i, Kaneohe, Hawai'i. International Archaeological Research Institute, Inc., Honolulu.

____ (1995). *A Cultural Resource Management Plan for the Lahaina Pali Trail.* International Archaeological Research Institute, Inc., Honolulu. Prepared for Na Ala Hele Program, DOFAW and Tri-Isles RC&D Council, Inc., Wailuku.

Tomonari Tuggle, M.J., and C. Rasmussen. (2005). *Preservation plan for Site 50-50-09-5232, an upland heiau in Ukumehame Ahupua'a, Island of Maui. TMK 4-8-01:1.* International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

Tomonari-Tuggle, M.J., and H. Tuggle. (1991). Archaeological Survey of Two Deomonstration Trails of the Hawai'i Statewide Trail and Access System: Lahaina Pali Trail, Island of Maui and Kaiolohia-Kahue Trail, Island of Lana'i. International Archaeological Research Institute, Inc., Honolulu. Prepared for Na Ala Hele Program, DOFAW.

Tulp, I., H. Schekkerman, J. K. Larsen, J. van der Winden, R. J. W. van de Haterd, P. van Horssen, S. Dirksen and A. L. Spaans. 1999. *Nocturnal flight activity of sea ducks near the windfarm Tunø Knob in the Kattegat*. IBN-DLO Report No. 99.30. (As cited in Percival 2001.)

USDA (United States Department of Agriculture) (1972). *Soil survey of the islands of Kaua'i, Oahu, Maui, Moloka'i, and Lana'i, State of Hawai'i.* Prepared by Donald E. Foote, Elmer L. Hill, Sakuichi Nakamura, and Floyd Stephens, USDA Soil Conservation Service.

USFWS (United States Fish and Wildlife Service). (2006). Final Environmental Assessment for the Issuance of an Endangered Species Act Section 10(a)(1)(B) Incidental Take Permit for the Hawaiian Petrel, Newell's (Townsend) Shearwater, Hawaiian Goose or nēnē, and Hawaiian Hoary Bat to the Kaheawa Pastures Wind Energy Generation Facility.

USFWS. (2005). *Regional Seabird Conservation Plan, Pacific Region.* U.S. Fish and Wildlife Service, Migratory Birds and Habitat Programs, Pacific Region, Portland, OR.

USFWS. (2004a). Draft revised recovery plan for the nēnē or Hawaiian Goose (Branta sandvicensis). U. S. Fish and Wildlife Service, Portland, OR. 148 + xi pp.

USFWS. (2004b). *Interim Guidelines To Avoid and Minimize Wildlife Impacts From Wind Turbines*. www.fws.gov. USFWS. 2005. http://pacificislands.fws.gov/wesa/hawanimalsindex.html

USFWS. (1999). Endangered and Threatened Wildlife and Plants. 50 CFR 17.11 & 17.12

USFWS. (1998). *Recovery Plan for the Hawaiian Hoary Bat (Lasiurus cinereus semotus)*. U.S. Fish and Wildlife Service, Portland, OR. 50 pp.

USFWS. (1983). Hawaiian *Dark-rumped Petrel and Newell's Manx Shearwater Recovery Plan.* U. S. Fish and Wildlife Service, Portland, OR. 57 pp.

U.S. Environmental Protection Agency and U.S. Department of Energy (July 2000). *Carbon Dioxide Emissions from the Generation of Electric Power in the United States*. (http://www.eia.doe.gov/cneaf/electricity/page/co2_report/co2report.html). Washington, D.C.

U.S. Geological Survey (2000). Water Resources Data, Hawai‘i and Other Pacific Areas, Water Years, 1999 and 2000.

____ (1999). Groundwater Atlas of the United States: Alaska, Hawai‘i, Puerto Rico and the U. S. Virgin Islands. HA 730-N O‘ahu Regional Aquifer System

____ (1997). *Hawai‘i Seismic Zone Assignments, 1988 and 1997.* URL: http://hvo.wr.usgs.gov/earthquakes/hazards/

Valenzuela, H. and J. Smith. (2002). *Green Manure Crops: Annual Ryegrass*. College of Tropical Agriculture and Human Resources (CTAHR).

Vuich Environmental Consultants (VEC) (2005). *Environmental Site Assessment: Phase I Investigation. Kaheawa Pastures Proposed Windfarm, West Maui Mountains.* Prepared for Kaheawa Wind Power LLC. Wailuku, HI.

Walker, W. (1931). *Archaeology of Maui.* Manuscript, Department of Anthropology, B.P. Bishop Museum, Honolulu.

Warham, J. (1996). The Behaviour, Population Biology and Physiology of the Petrels. Academic Press, San Diego, CA.

Whitaker, J.O. and P.Q. Tomich (1983). Food Habits of the Hoary Bat Lasiurus cinereus, from Hawaii. *Journal of Mammalogy* 64:151-52.

Wilson, K. Lehua, and R. Rechtman (2009). Cultural Impact Assessment of the Kaheawa Wind Power II Project Area, Ukumehame Ahupua‘a, Lahaina District, Island of Maui. Rechtman Consulting, LLC Report RC-0590. Prepared for First Wind, Maui.

Woog, F. and J. M. Black (2001). "Foraging behavior and the temporal use of grasslands by nēnē: implications for management." *Studies in Avian Biology* 22:319-328.

WSB Hawaii (1999). *Final Environmental Impact Statement, Kaheawa Pastures 20 MW Windfarm, Maui, Hawaii*. Prepared for Zond Pacific.

10.0 PARTIES CONSULTED

10.1 EISPN CONSULTATION & DISTRIBUTION

10.1.1 CONSULTATION

KWP II LLC consulted the State Department of Land and Natural Resources Office of Conservation and Coastal Lands, Division of Forestry and Wildlife, Land Division, State Historic Preservation Division, and the U.S. Fish and Wildlife Service during the preparation of the EISPN.

10.1.2 EA/EISPN DISTRIBUTION

KWP II LLC distributed the EISPN to the individuals and organizations listed in Table 10.1 and requested their comments on the proposed scope of the analysis and on the completeness of the alternatives that it proposed to evaluate. It provided a limited number of loan copies to libraries.

Table 10.1 EISPN Distribution List

Maui County	**Libraries and Depositories**
Department of Water Supply	DBEDT Library
Department of Public Works & Environmental Mgmt.	Hawai‘i State Library Hawai‘i Documents Center
Department of Parks and Recreation	Legislative Reference Bureau
Department of Planning	Maui Community College Library
Department of Transportation Services	UH Hamilton Library
Department of Fire Control	Lahaina Public Library
Police Department	Kahului Regional Library
State Agencies	**Elected Officials**
Commission on Water Resource Management	Governor Linda Lingle
Department of Defense	U.S. Representative Mazie Hirono
Department of Hawaiian Homelands	U.S. Senator Daniel K. Inouye
Hawai‘i State Civil Defense	U.S. Senator Daniel Akaka
Office of Environmental Quality Control	State Representative Angus McKelvey
Office of Hawaiian Affairs	State Senator Rosalyn Baker
Department of Accounting and General Services	Mayor Charmaine Tavares
Department of Agriculture	Councilmember Jo Anne Johnson
Department of Business, Economic Development, and Tourism (DBEDT) Office of Planning	
DBEDT Energy, Resources & Technology Division	**Local Utilities**
Department of Health, Environ. Planning Office	Hawaiian Telcom
Department of Land and Natural Resources (5 copies)	Maui Electric Company
Department of Transportation	
DLNR Historic Preservation Division	**Other Parties**
UH Environmental Center	Sierra Club, Maui Group
	Maui Tomorrow
Federal Agencies	
Environmental Protection Agency (PICO)	**News & Media**
National Marine Fisheries Service	Honolulu Advertiser
US Army Engineer Division	Honolulu Star-Bulletin
US Fish and Wildlife Service	Maui News
US Federal Aviation Administration	
US Natural Resources Conservation Service	
US Geological Survey	
Source: Compiled by Planning Solutions, Inc.	

10.1.3 WRITTEN COMMENTS RECEIVED ON THE EISPN

KWP II LLC received written comments on the EISPN from the individuals and organizations listed in Table 10.2 below. The comment letters and KWP II LLC's responses to them are reproduced in Appendix G.

Table 10.2 Written Comments Received on the EISPN

Number	Name & Title of Commenter	Organizational Affiliation
1	Thomas M. Phillips, Chief of Police	Maui Police Department
2	Ernest Y.W. Lau, Public Works Administrator	Department of Accounting and General Services, State of Hawai‘i
3	Tamara Horcajo, Director	Department of Parks and Recreation, Maui County
4	Edward T. Teixeira, Vice Director	Civil Defense, State of Hawai‘i
5	Irene Bowie, Executive Director	Maui Tomorrow Foundation, Inc.
6	Lawrence T. Yamamoto, Director	Natural Resources Conservation Service, Pacific Islands
7	Abbey Seth Mayer, Interim Director	Department of Business, Economic Development, & Tourism, State of Hawai‘i
8	Brennon T. Morioka, Interim Director	Department of Transportation, State of Hawai‘i
9	Clyde W. Nāmu‘o, Administrator	Office of Hawaiian Affairs, State of Hawai‘i
10	Paul J. Conry, Administrator	Division of Forestry & Wildlife, Department of Land & Natural Resources, State of Hawai‘i
11	Ken C. Kawahara, Deputy Director	Commission on Water Resource Management, State of Hawai‘i
12	Jeffrey S. Hunt, Planning Director	Maui County Planning Department
13	Kelvin H. Sunada, Manager	Environmental Planning Office, Department of Health, State of Hawai‘i
14	Gary Moniz, Chief	Division of Conservation & Resource Enforcement, Dept. of Land & Natural Resources, State of Hawai‘i
15	Morris Atta, Acting Administrator	Land Division, Department of Land & Natural Resources, State of Hawai‘i
Source: Compiled by Planning Solutions, Inc.		

10.2 DRAFT EIS PREPARATION & DISTRIBUTION

10.2.1 COMMUNITY OUTREACH & SCOPING

KWP II LLC began meeting with Maui community organizations, elected officials serving at the federal, state, and county government, various agency representatives, and individuals in 2006 to discuss its plans for adding additional wind generating capacity at Kaheawa Pastures. Outreach efforts also included educational tours of the existing KWP I facility with community organizations, elected officials, representatives from public agencies, and students of all ages from a number of educational institutions on Maui, including students who participate in home-school programs. Community outreach, consultation, and tours are important facets of KWP II's commitment to joining the Maui community as a long-term partner and will continue throughout the life of the project. This ongoing dialogue provides KWP II with the opportunity to incorporate feedback into the project design and mitigation measures.

First Wind's business model is to develop, construct, own and operate its wind farms. From the outset, First Wind seeks to become a long-term, contributing member of the communities that it joins. As the senior owner of KWP II, LLC, First Wind appreciates the fact that it will be held accountable to the communities that it joins for the life of the project, and recognizes its credibility and demonstrated stewardship of natural resources is vital to continued success.

Throughout the past three years, KWP II, LLC has been engaged in community outreach with Maui residents regarding the benefits of clean, renewable energy generated on the island of Maui. Since its commissioning, Kaheawa Wind Power has been an educational resource for students, community members and organizations, and policymakers. KWP has hosted all ages at the wind farm – from Cub Scouts to college students and has responded to the many requests to visit the wind farm. KWP has also hosted extended educational sessions with Native Hawaiian organizations such as Na Pua Noeau, where students learn about the cultural history of the site, the technology and economics that make wind energy a viable solution on Maui, the importance of sustainability in Hawaii's future and also provided an opportunity to participate in KWP's native plant replanting program.

First Wind has conducted presentations at various Maui schools to discuss the importance of clean energy and Maui's sustainable future. First Wind has joined organizations such as the Maui Chamber of Commerce and the Maui Economic Development Board and has sponsored and participated in Maui community events such as the Maui County Fair, Maui County Energy Expo, and the Kula Sustainability Fair. First Wind has also developed a positive working relationship with Maui Electric Company which is an important part of its success in integrating additional renewable energy into Maui's grid.

Over the past three years, First Wind has discussed both the downwind and downroad options for KWP II with Maui residents, organizations and policymaker and has sought ways to incorporate community suggestions into the development of the KWP II project. Feedback on the options has been positive and has focused on the need to continue the demonstrated stewardship of natural resources associated with Kaheawa Wind Power I.

Examples of organizations and individuals participating in the ongoing consultation:

- Assistant Secretary of Energy Efficiency & Renewable Energy, USDOE, Andy Karsner & Staff
- Staff from the U.S. Senate Committees on Appropriations and Commerce, Science and Telecommunications
- Staff from the offices of Hawaii's Congressional Delegation
- Governor Linda Lingle & Staff
- Lieutenant Governor Duke Aiona & Staff
- Members of the Hawaii House of Representatives Committee on Finance
- Members of the Hawaii State Senate Committee on Ways and Means

- Senator Kalani English
- Senator Roz Baker
- Senator Mike Gabbard
- Representative Hermina Morita
- Representative Mele Carroll
- Representative Calvin Say
- Representative Cynthia Thielen
- Members of the Hawaiian Homes Commission
- Mayor Charmaine Tavares & Staff
- Participants in the 2008 Hawaii Congress of Planners Conference
- Participants in the 2007 Maui Energy Expo
- Participants in the 2008 Conference sponsored by the Maui County Board of Water Supply
- Students from Maui Community College Sustainability program
- Students from the Na Pua Noeau program
- Students from the Kamehameha Scholars Program
- Kilohana Ridge Home Owners Association
- American Institute of Architects
- Maui Sierra Club
- Kiwanis Club of Maui
- Maui Tomorrow
- Hokulani Holt Padilla
- Paolo Fujishiro

In addition, KWP II LLC has been working with representatives of USFWS and DOFAW regarding the Habitat Conservation Plan (HCP) for the project. Over the past 6 months, First Wind has met with the agencies to conduct site inspections with the agencies, provide regular updates on project developments, and coordinate baseline wildlife and natural resources studies. Contacts have included John Medeiros (District Wildlife Biologist at the DOFAW office in Kahului), Paula Hartzell (DLNR/DOFAW Conservation Initiatives Coordinator), and James Kwon (USFWS). Finally, KWP II LLC has also briefed the State of Hawai‘i Endangered Species Recovery Committee about the KWP II project and HCP.

The public also had an opportunity to review and comment on the DEIS published in February 2009 in accordance with HRS Chapter 343.

10.2.2 LIST OF PREPARERS

The Kaheawa Wind Power II EIS was prepared by Planning Solutions, Inc. The respective contributions of the individuals and organizations are listed in Table 10.3.

Table 10.3 List of Preparers

Planning Solutions, Inc.	
Perry J. White	Principal Author
Julia Ham Tashima	Contributing Author
Melissa M. White	Contributing Author
Charles Morgan	Contributing Author
Makena B. White	Maps, Graphic Design, and Contributing Author
Technical Consultants	
AECOM Water	Civil Engineering
ABR, Inc.	Avian Surveys/Modeling
D. L. Adams Associates, Inc.	Noise Impact Analysis
Electrical Consultants, Inc.	Electrical Engineering & Interconnection
Robert Hobdy	Botanical Survey
Rechtman Consulting	Archaeological/Cultural Impact Assessment
SSFM International	Civil Engineering
SWCA Environmental Consultants	Habitat Conservation Plan
First Wind	
Dave Cowan	Vice President, Environmental Affairs
Greg Spencer	Senior Biologist
Mike Goodwin	Project Manager, Construction
Noe Kalipi	Director, Government and Community Relations
Mike Gresham	Vice President, Hawaii Development
Kelly Bronson	Business Development Manager
Steve Jiran	Construction Project Manager
Donna McClay	Director, Western Permitting and Compliance

10.2.3 FEBRUARY 2009 DRAFT EIS DISTRIBUTION

KWP II LLC distributed the February 2009 Draft EIS to the individuals and organizations listed in Table 10.3 and requested their comments. It also provided a limited number of loan copies to libraries.

Table 10.4 February 2009 Draft and Revised Draft EIS Distribution List

Maui County	**Libraries and Depositories**
Department of Water Supply	Hawai‘i State Library Hawai‘i Documents Center
Department of Public Works & Environmental Mgmt.	Legislative Reference Bureau
Department of Parks and Recreation	Maui Community College Library
Department of Planning	UH Hamilton Library
Department of Transportation Services	Lahaina Public Library
Department of Fire Control	Kahului Regional Library
Police Department	
Dept. of Housing & Human Concerns	
State Agencies	**Elected Officials**
Commission on Water Resource Management	Governor Linda Lingle
Department of Defense	U.S. Representative Mazie Hirono
Department of Hawaiian Homelands	U.S. Senator Daniel K. Inouye
Hawai‘i State Civil Defense	U.S. Senator Daniel Akaka
Office of Environmental Quality Control	State Representative Angus McKelvey
Office of Hawaiian Affairs	State Senator Rosalyn Baker
Department of Accounting and General Services	State Senator Mike Gabbard
Department of Agriculture	State Senator Kalani English
Department of Business, Economic Development, and Tourism (DBEDT)	State Representative Hermina Morita
Department of Business, Economic Development, and Tourism (DBEDT) Office of Planning	State Representative Denny Coffman
DBEDT Energy, Resources & Technology Division	Mayor Charmaine Tavares
Department of Health, Environ. Planning Office	Councilmember Jo Anne Johnson
Department of Land and Natural Resources (5 copies)	
Department of Transportation	**Local Utilities**
DLNR Historic Preservation Division	Hawaiian Telcom
UH Environmental Center	Maui Electric Company
Hawaii Housing Finance & Development Corp.	
Department of Labor & Industrial Relations	**Other Parties**
Department of Education	Blue Planet Foundation
Water Resources Research Center	Kihei Community Association
	Sovereign Council of Hawaiian Homestead Assembly
Federal Agencies	Sierra Club, Maui Group
US EPA – Pacific Island Office	Maui Contractors Association
US National Marine Fisheries Service	Maui Chamber of Commerce
US Army Engineer Division	Maui Tomorrow
US Fish and Wildlife Service	
US Federal Aviation Administration	**News & Media**
US Natural Resources Conservation Service	Honolulu Advertiser
US Geological Survey	Honolulu Star-Bulletin
	Maui News
Source: Compiled by Planning Solutions, Inc.	

10.2.4 DRAFT EIS WRITTEN COMMENTS AND RESPONSES

KWP II LLC received written comments on the DEIS from the individuals and organizations listed in Table 10.5 below. The comment letters and KWP II LLC's responses to them are reproduced in Appendix G.

Table 10.5 Written Comments Received on the DEIS

No.	*Name & Title of Commenter*	*Organizational Affiliation*
1	Ernest Y.W. Lau, Public Works Administrator	Department of Accounting and General Services, State of Hawai‘i
2	Thomas M. Phillips, Chief of Police	Maui Police Department
3	Tamara Horcajo, Director	Department of Parks and Recreation, Maui County
4	Milton M. Arakawa, Director	Department of Public Works and Environmental Management, Maui County
5	George P. Young, Chief	Department of the Army, U.S. Army Corps of Engineers
6	Cheryl K. Okuma, Director	Department of Environmental Management, Maui County
7	Edward T. Teixeira, Vice Director	Civil Defense, State of Hawai‘i
8	Kelvin H. Sunada, Manager	Environmental Planning Office, Department of Health, State of Hawai‘i
9	Abbey Seth Mayer, Director	Department of Business, Economic Development, & Tourism, State of Hawai‘i
10	Andy Herrera, Manager	Transmission & Distribution Department, Maui Electric Company, Ltd.
11	Jacqueline Haraguchi, Executive Director	Maui Contractors Association
12	Brennon T. Morioka, Director	Department of Transportation, State of Hawai‘i
13	Peter Rappa, Environmental Review Coordinator	University of Hawai‘i-Manoa, Environmental Center
14	Jon Miller, President	Kihei Community Association
15	Julie Rogers, Community Relations Director	Blue Planet Foundation
16	Jeffrey S. Hunt, Director	Department of Planning, Maui County
17	Senator Rosalyn H. Baker, Chair of Commerce and Consumer Protection	Senate - 5th District – South and West Maui
18	Pamela Tumpap, President	Maui Chamber of Commerce
19	Samuel J. Lemmo, Administrator	Office of Conservation and Coastal Lands, Department of Land & Natural Resources, State of Hawai‘i
20	Clyde W. Nāmu‘o, Administrator	Office of Hawaiian Affairs, State of Hawai‘i
Source: Compiled by Planning Solutions, Inc.		

APPENDIX A. BOTANICAL SURVEY REPORTS

BOTANICAL RESOURCES SURVEY

for the

KAHEAWA PASTURES WIND ENERGY PROJECT II

UKUMEHAME, MAUI, HAWAII

by

ROBERT W. HOBDY
ENVIRONMENTAL CONSULTANT
Kokomo, Maui
October 2006

Prepared for:
Kaheawa Windpower, LLC

INTRODUCTION

The Kaheawa Pastures Wind Energy Project II consists of an array of 18 wind turbines that is to be situated on a remote ridgetop above the southern tip of West Maui between the elevations of 1,440 ft. and 2,880 ft. It is to be located alongside an existing array of 20 wind turbines that came on line in June, 2006. This survey is being conducted in fulfillment of environmental requirements in pursuance of permits for this project.

SITE DESCRIPTION

The project area lies on the edge of a grassy ridge above Papalaua Gulch. The ridgetop is smooth and even in its upper portion with an average slope of about 16% but grades into rough rocky terrain at the bottom below 2,200 ft. Soils consist of Naiwa Silty Clay Loam (NAC) and OLi Silt Loam (OMB) in the upper portions. These soils are deep, dusky-red, moderately acid and highly erodible and are developed from igneous volcanic rock. The lower portion of the project area is characterized as Rock Land (rRK). It is rougher in terrain with abundant surface rock and rocky outcrops (Foote et al, 1972). Rainfall averages 15 in./yr. at the lowest elevation and increases to 40 in./yr. at the top, with the bulk falling between November and March (Armstrong, 1983).

BIOLOGICAL HISTORY

In pre-contact times this mountain slope was entirely covered with native vegetation of low stature with dry grass and shrublands below and mesic to wet windblown forests above. The Hawaiians made some uses of forest resources here and had a cross-island trail cresting the ridge at 1600 ft. elevation. This trail was upgraded during the mid-1800s and used as a horse trail to Lahaina. It was resurrected to use in recent years and is the present Lahaina Pali Trail.

Cattle ranching began in the late 1800s and continued for over 100 years. During this time the grazing animals consumed most of the native vegetation which was gradually replaced by hardy weed species.

During the 1950s Maui Electric Co. installed high voltage powerlines along with access roads through this area. Increased traffic brought more disturbances and weeds. Fires became more frequent, further eliminating remnant native vegetation.

With the cessation of cattle grazing a number of grass and weed species have proliferated, creating a heightened fire hazard. A large fire swept across the mountain in 1999 consuming more than 2500 acres including most of the project area. About a

month prior to this survey another fire burned the same area scorching about 80% of the 333 acre project area, leaving only about 67 acres untouched.

DESCRIPTION OF THE VEGETATION

The vegetation within the project area is a diverse array of grasses and low shrubs with a scattering of small trees. The most abundant species is molasses grass (*Melinis minutiflora*) which is taking over following the 1999 fire. Also common are broomsedge (*Andropogon virginicus*), Natal redtop (*Melinis repens*), hairy horseweed (*Conyza bonariensis*), kilau (*Pteridium aquilinum* var. *decompositum*), fire weed (*Senecio madagascariensis*), narrow-leaved plantain (*Plantago lanceolata*) and ʼūlei (*Osteomeles anthyllidifolia*). A total of 57 plant species were recorded during the course of the survey.

Eighteen native plant species are found scattered within the grassland/shrubland. Ten species are endemic only to the Hawaiian Islands: kilau, (*Carex wahuensis* subsp. *Wahuensis*) no common name, koʼokoʼolau (*Bidens micrantha*), nehe (*Melanthera lavarum*), ʻakoko (*Chamaesyce celastroides* var. *amplectens*), naio (*Myoporum sandwicense*), ʻōhiʼa (*Metrosideros polymorpha* var. *glaberrima*), ʻiliahi aloʼe (*Santalum ellipticum*), ʻakia (*Wikstroemia oahuensis*) and orange-flowered naupaka (*Scaevola gaudichaudii*). An additional eight species are indigenous to Hawaii as well as to other countries: pili (*Heteropogon contortus*), koali awahia (*Ipomoea indica*), pukiawe (*Leptecophylla tameiameiae*), ʻilima (*Sida fallax*), huehue (*Cocculus orbiculatus*), ʻūlei, ʻaʼaliʼi (*Dodonaea viscosa*) and ʻuhaloa (*Waltheria indica*). The remaining 39 species are non-native plants.

The 80% of the project area that burned has only bare, blackened ground with a few charred stumps. The vegetation here was similar to what has been recorded in this report and no additional species native or otherwise probably occurred.

SURVEY OBJECTIVES

This report summarizes the findings of a botanical survey of the proposed Kaheawa Pastures Wind Energy Project II which was conducted in October, 2006.
The objectives of the survey were to:

1. Document what plant species occur on the property or may likely occur in the

existing habitat.
2. Document the status and abundance of each species.
3. Determine the presence or likely occurrence of any native plant species, particularly any that are Federally listed as Threatened or Endangered. If such occur, identify what features of the habitat may be essential for these species.
4. Determine if the project area contains any special habitats which if lost or altered might result in a significant negative impact on the flora in this part of the island.
5. Note which aspects of the proposed development pose significant concerns for plants and recommend measures that would mitigate or avoid these problems.

SURVEY METHODS

The entire project area was surveyed on foot, with the greatest intensity of effort focused on existing vegetation. There was scant remains of anything within the burned area by which the former vegetation could be identified. Only the author's recollections of what formerly occurred here could be used as a rough guide. Areas more likely to harbor native or rare plants were most carefully examined. Notes were made on plant species, distribution and abundance as well as on terrain and substrate.

PLANT SPECIES LIST

Following is a checklist of all those vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within three groups: Ferns, Monocots and Dicots. Taxonomy and nomenclature of the ferns are in accordance with Palmer (2003) and the flowering plants are in accordance with Wagner et al. (1999) and Staples and Herbst (2005).

For each species, the following information is provided:

1. Scientific name with author citation

2. Common English or Hawaiian name.

3. Bio-geographical status. The following symbols are used:

   endemic = native only to the Hawaiian Islands; not naturally occurring anywhere else in the world.
   indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).
   polynesian introduction = plants introduced to Hawai'i in the course of Polynesian migrations and prior to western contact.
   non-native = all those plants brought to the islands intentionally or accidentally after western contact.

4. Abundance of each species within the project area:

   abundant = forming a major part of the vegetation within the project area.
   common = widely scattered throughout the area or locally abundant within a portion of it.
   uncommon = scattered sparsely throughout the area or occurring in a few small patches.
   rare = only a few isolated individuals within the project area.

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
FERNS			
DENNSTAEDTIACEAE (Bracken Family)			
Pteridium aquilinum (L.) Kuhn. var. *decompositum* (Gaudich.) R.M. Tryon	*kilau*	endemic	common
MONOCOTS			
CYPERACEAE (Sedge Family)			
Carex wahuensis C.A. Mey. subsp. *wahuensis*	----------	endemic	rare
POACEAE (Grass Family)			

Andropogon virginicus L.	broomsedge	non-native	common
Axonopus fissifolius (Raddi) Kuhlm.	narrow-leaved carpetgrass	non-native	rare
Cynodon dactylon (L.) Pers.	Bermuda grass	non-native	uncommon
Digitaria ciliaris (Retz.) Koeler	Henry's crabgrass	non-native	rare
Heteropogon contortus (L.) P.Beauv. ex Roem.&Schult.	*pili*	indigenous	rare
Melinis minutiflora P. Beauv.	molasses grass	non-native	abundant
Melinis repens (Willd.) Zizka	Natal redtop	non-native	common
Panicum maximum Jacq.	Guinea grass	non-native	rare
Paspalum conjugatum Bergius	Hilo grass	non-native	rare
Paspalum dilatatum Poir.	Dallis grass	non-native	rare
Pennisetum clandestinum Chiov.	Kikuyu grass	non-native	uncommon
Rhytidosperma pilosum (R.Br.) Connor & Edgar	hairy oatgrass	non-native	rare
Sporobolus africanus (Poir.) Robyns & Tournay	smutgrass	non-native	rare
Stenotaphrum secundatum (Walter) Kuntze	St.Augustine grass	non-native	rare

DICOTS

ANACARDIACEAE (Mango Family)

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Schinus terebinthifolius Raddi	Christmas berry	non-native	rare

ASTERACEAE (Sun Flower Family)

Bidens micrantha Gaud.	*ko'oko'olau*	endemic	rare
Conyza bonariensis L. Cronq.	hairy horseweed	non-native	common
Conyza canadensis (L.) Cronq. var. pusilla (Nutt.) Cronq.	little horseweed	non-native	rare
Erigeron karvinskianus DC.	daisy fleabane	non-native	rare
Heterotheca grandiflora Nutt.	telegraph weed	non-native	uncommon
Hypochoeris radicata L.	gosmore	non-native	rare
Melanthera lavarum (Gaud.) Wagner & Rob.	*nehe*	endemic	rare

Pluchea carolinensis (Jacq.) G. Don.	sourbush	non-native	rare
Senecio madagascariensis Poir.	fireweed	non-native	common
CACTACEAE (Cactus Family)			
Opuntia ficus-indica (L.) Mill.	*panini*	non-native	rare
CASUARINACEAE (She-oak Family)			
Casuarina equisetifolia L.	common ironwood	non-native	uncommon
Casuarina glauca Siebold ex Spreng.	longleaf ironwood	non-native	rare
CONVOLVULACEAE (Morning Glory Family)			
Ipomoea indica (J. Burm.) Merr.	*koali awahia*	indigenous	rare
EPACRIDACEAE (Epacris Family)			
Leptecophylla tameiameiae (Cham.& Schlectend.) C.M. Weiller	*pukiawe*	indigenous	uncommon
EUPHORBIACEAE (Spurge Family)			
Chamaesyce celastroides (Boiss.) Croizat&Degener var. amplectens (Sherff) Degener&I.Degener	*'akoko*	endemic	rare
FABACEAE (Pea Family)			
Acacia farnesiana (L.) Willd.	klu	non-native	uncommon

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Chamaecrista nictitans (L.) Moench	partridge pea	non-native	uncommon
Desmodium sandwicense E. Mey.	Spanish clover	non-native	rare
Indigofera suffruticosa Mill.	*iniko*	non-native	uncommon
Leucaena leucocephala (Lam.) de Wit	*koa haole*	non-native	uncommon
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	*kiawe*	non-native	rare
GENTIANACEAE (Gentian Family)			
Centaurium erythraea Raf.	bitter herb	non-native	rare
GOODENIACEAE (Goodenia Family)			
Scaevola gaudichaudii Hook. & Arnott	orange naupaka	endemic	rare
LAMIACEAE (Mint Family)			
Salvia coccinea B. Juss. ex Murray	scarlet sage	non-native	rare

MALVACEAE (Mallow Family)			
Sida fallax Walp.	*'ilima*	indigenous	uncommon
MENISPERMACEAE (Moonseed Family)			
Cocculus orbiculatus (L.) DC.	*huehue*	indigenous	rare
MYOPORACEAE (Myoporum Family)			
Myoporum sandwicense A. Gray	*naio*	endemic	rare
MYRTACEAE (Myrtle Family)			
Metrosideros polymorpha Gaud. var. *incana* (H. Lev.) St. John	*'ohi'a*	endemic	rare
Psidium guajava L.	guava	non-native	rare
PLANTAGINACEAE (Plantain Family)			
Plantago lanceolata L.	narrow-leaved plantain	non-native	common
POLYGALACEAE (Milkwort Family)			
Polygala paniculata L.	----------	non-native	rare
PRIMULACEAE (Primrose Family)			

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Anagallis arvensis L.	scarlet pimpernel	non-native	rare
PROTEACEAE (Protea Family)			
Grevillea robusta A. Cunn. ex R.Br.	silk oak	non-native	rare
ROSACEAE (Rose Family)			
Osteomeles anthyllidifolia (Sm.) Lindl.	*'ulei*	indigenous	common
SANTALACEAE (Sandalwood Family)			
Santalum ellipticum Gaud.	*'iliahi alo'e*	endemic	rare
SAPINDACEAE (Soapberry Family)			
Dodonaea viscosa Jacq.	*'a'ali'i*	indigenous	uncommon
STERCULIACEAE (Cacao Family)			
Waltheria indica L.	*'uhaloa*	indigenous	uncommon
THYMELAEACEAE (‘Akia Family)			
Wikstroemia oahuensis (A.Gray) Rock.	*'akia*	endemic	rare

VERBENACEAE (Verbena Family)

Lantana camara L.	lantana	non-native	uncommon
Verbena littoralis Kunth.	*'owi*	non-native	rare

DISCUSSION

The construction of 18 additional wind turbines will require the development of additional access roads and the clearing and leveling of 18 construction pads within the 333 acre project site. This will result in the loss of vegetation where these occur. The area in general has experienced a dramatic loss of native plant communities over the last century and there is concern that further losses of rare species and special habitats be avoided. The proposed project was analyzed with these concerns in mind.

Of the 18 native plants identified on the property none were found to be Federally listed Threatened or Endangered species (USFWS, 1999) nor were any that are candidates for such status. None were even found to be rare in any way (Species of Concern). All are widespread and fairly common in Hawaii. While some native plants will be lost in the course of the development, it should be noted that probably 15 or 16 of the 18 proposed turbine sites and most of the access roads will occur on areas that have completely burned twice during the past eight years.

With respect to fire it is likely that periodic fires will continue to be a problem into the foreseeable future. The area is being increasingly invaded by fire-prone species that are quick to reproduce following each fire. Each fire also results in fewer and fewer of even the common native plants. Unless land management practices change dramatically across this dry mountain slope, little improvement in this prognosis is

likely. One month since the area burned it was noted that seven plant species are beginning to sprout from stumps or underground rhizomes. Only one of these, the fire adapted kilau fern, is native.

Previous botanical surveys identified a few Endangered plant species growing within a mile of the first wind turbine project, most notably in the Manawainui Plant Sanctuary and upper Papalaua Gulch. This project is further from these protected resources than the first project was.

Due to the general condition of the habitat and the specific lack of any environmentally sensitive native plant species on the project area, the proposed development work is not expected to result in any significant negative impact on the botanical resources in this part of Maui.

RECOMMENDATIONS

The quality of the roads created will have a long term effect on surrounding habitat. Poorly engineered roads in this entire project area quickly erode causing downslope disturbances from moving water and road materials. They have the added effect of necessitating frequent maintenance work resulting in further disturbances. It is recommended that the road surfaces be crowned and rolled with stable material, and that swales, drains and culverts be engineered to channel water from the roadway quickly and effectively.

It is desirable that the incidence of wildfires be minimized because of their devastating long term effects on native plant resources. Fuels in this area are highly flammable. One way to minimize fire here is to limit human access along the road corridor to only those with management or other legitimate functions.

Literature Cited

Armstrong, R. W. (ed.) 1983. Atlas of Hawaii. (2nd. ed.) University of Hawaii Press.

Foote, D.E. , E.L. Hill, S. Nakamura, and F. Stephens. 1972. Soil survey of the islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii. U.S. Dept. of Agriculture, Soil Conservation Service. Washington, D.C.

Palmer, D.D. 2003 Hawai'i's Ferns and Fern Allies. University of Hawaii Press, Honolulu.

Staples, G.W. and D.R. Herbst. 2005. A Tropical Garden Flora, Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press.

U.S. Fish and Wildlife Service. 1999. Endangered and threatened wildlife and Plants. 50 CFR 17.11 & 17.12

Wagner, W. L., D.R. Herbst, and S. H. Sohmer. 1999. Manual of the flowering plants of Hawai'i. Univ. of Hawai'i Press and Bishop Museum Press. Honolulu.

POST – FIRE BOTANICAL SURVEY AND ASSESSMENT

for

KAHEAWA WIND POWER II

UKUMEHAME, MAUI, HAWAII

by

ROBERT W. HOBDY
ENVIRONMENTAL CONSULTANT
Kokomo, Maui
January 2009

Prepared for:
Kaheawa Windpower, LLC

POST - FIRE BOTANICAL SURVEY AND ASSESSEMENT
Kaheawa Wind Power II Project

INTRODUCTION

The Kaheawa Wind Power II Project is situated about ¼ mile west of an existing line of functioning wind turbines in Kaheawa Pasture, Ukumehame, West Maui TMK (2) 4-8-01:01 por. (see attached map). The work consists of a botanical followup survey of a proposed wind turbine project area with a special focus on assessing changes in the vegetation resulting from a wild fire that burned the area in 2006. Field work was conducted in January, 2009.

SITE DESCRIPTION

The project area lies on approximately 450 acres of sloping ridge land that is between 1,500 feet and 3,100 feet elevation. Ridge tops are smooth with relatively deep soil. Small to moderate sized gullies cut through the south and western sides of the ridge and are rough and rocky as they run down slope. Vegetation mostly consists of low wind blown grasses and shrubs with occasional patches of small trees. Annual rainfall ranges from about 20 inches at the bottom up to 50 inches at the top with the bulk falling during the winter months (Armstrong, 1983).

SURVEY OBJECTIVES

This report summarizes a botanical survey of the Kaheawa Wind Power II project area which was completed in January, 2009. The objectives of the survey were to:

1. Document what plant species occur within the project area.
2. Document the status and abundance of each species.
3. Determine the presence of any native plant species and particularly any that are Federally listed as Threatened or Endangered under the Endangered Species Act (USFWS,1999). If such occur, identify what features of the habitat may be essential for these species.
4. Assess the changes in the vegetation that may have occurred since a wild fire swept through this area in 2006.

SURVEY METHODS

The botanical survey consisted of a series of sweeps across the different elevations of the property that ensured complete coverage of the area. Areas most likely to harbor

native species such as rocky outcrops and gulch slopes were more intensively examined. Binoculars were used to scan less accessible locations. Notes were made on plant species, distribution, abundance, terrain and substrate.

DESCRIPTION OF THE VEGETATION

The vegetation was predominantly a grassland both in character and in number of species. Most abundant was molasses grass (*Melinis minutiflora*). Also common were Natal redtop (*Melinis repens*), pitted beardgrass (*Bothriochloa pertusa*) and buffelgrass (*Cenchrus ciliaris*). Interspersed within the grass land were a number of common shrubs, herbs, one fern and one tree species. They include: inikö (*Indigofera suffruticosa*), ‘ilima (*Sida fallax*), ‘uhaloa (*Waltheria indica*), ‘ūlei (*Osteomeles anthyllidifolia*), fireweed (*Senecio madagascariensis*), partridge pea (*Chamaecrista nictitans*), narrow-leaved plantain (*Plantago lanceolata*), kilau fern (*Pteridium aquilinum* var. *decompositum*) and common ironwood (*Casuarina equisetifolia*). The remaining 73 plant species were uncommon or rare of occurrence.

Twenty native Hawaiian species were found in the project area. They include: kilau fern, ‘ilima, ‘uhaloa, ‘ūlei, (*Carex wahuensis*) no common name, (*Trisetum inaequale*) no common name, ko’oko’olau (*Bidens mauiensis*), ko’oko’olau (*Bidens micrantha*), nehe (*Melanthera lavarum*), Hawaiian moonflower (*Ipomoea tuboides*), ‘akoko (*Chamaesyce celastroides* var *amplectens*), ‘öhi’a (*Metrosideros polymorpha*), ‘iliahi alo’e (*Santalum ellipticum*), ‘akia (*Wikstroemia oahuensis*), pili grass (*Heteropogon contortus*), koali awahia (*Ipomoea indica*), pukiawe (*Leptecophylla tameiameiae*), huehue (*Cocculus orbiculatus*), naio (*Myoporum sandwicense*) and ‘a’ali’i (*Dodonaea viscosa*). The native plant species are spread throughout the project area, mixed among the grasses, but are less prevalent at the lower, drier parts of the property. There is, however, one pocket of predominantly native shrubland on the western edge of the project area on an eroded rocky ridge between 2,000 ft. and 2,400 ft. elevation.

DISCUSSION AND RECOMMENDATIONS

At the time of the first botanical survey of this project area in October of 2006, the vegetation was just beginning to recover from a fire that had burned 80% of the area. What we are seeing today is the regrowth of just over two years on an area that was basically bare, blackened ground. Only about 40 acres at the top of the present project area escaped the 2006 burn and is representative of unburned vegetation.

What is growing at the top of the project in the unburned area is basically the same as what it was before 2006, a diverse native shrubland mixed with grass. There has been a noticeable increase in molasses grass, but it is in small scattered clumps. Molasses grass along with the other grass species occupies about 20% of the vegetation cover.

The burned area between 2,300 feet and 2,900 feet elevation was regrown with a dramatically noticeable increase in grass species and a decrease in native shrubs. Molasses grass forms a dense, nearly monotypic growth over most of this area with an estimated frequency of 80% cover.

The burned area between 1,900 feet and 2,300 feet elevation has regrown with a similarly dramatic increase in grass species. This grassland is a mixture of molasses grass and Natal redtop in fairly even proportions with an estimated frequency of 80% cover. The eroded ridge with native shrubland sustained only a light burn due to the scarcity of fuels and has recovered with little loss of species or cover.

The lowest part of the project area between 1,500 feet and 1,900 feet elevation has been an open grassland for a long time. Since the 2006 fir it has come back in essentially the same condition. Dominant grasses are pitted beardgrass and buffelgrass with an estimated frequency of nearly 90% cover.

The Ukumehame lands, of which the Kaheawa Wind Power II project area is a small part, had been grazed by cattle for well over 100 years. During this period much of the native vegetation had been converted to non-native grasslands. Cattle grazing, has been discontinued in this area for over ten years now and this has had a profound effect on the vegetation. First, without cattle grazing, the grasses have grown up creating a dense fuel load. During this period there have been three large and devastating fires unlike any that have been experienced in recent memory. Following each fire, regrowth has been with increasing amounts of grass. This encourages a perpetuating cycle of fires as long as there are risks of fire starts. The two grass species which contribute most to fuel loading are molasses grass in the damper areas above 2,000 feet, and buffelgrass in the drier areas below 2,000 feet. Both of these species are considered to be fire adapted grasses that thrive and multiply with periodic burning because they replace or outcompete species that suffer from the effects of burning. This cycle will likely continue unless fuel hazards can be reduced or risks of fire starts can be minimized, or both.

A total of 86 plant species were recorded during the course of the botanical survey. Of these 20 were endemic or indigenous to the Hawaiian Islands. None of these were Federally listed as Threatened or Endangered under the Endangered Species Act. None were candidates for such status either. Only one, (*Trisetum inaequale*) is somewhat rare, having a limited distribution on West Maui and Lana'i. All of the rest of the native species occur on more than one or on several islands.

The Endangered species in this region on southern West Maui occur in remnant forests in the gulches of Papalaua, Manawainui and Pohakea and on ridge top shrub forests, all mauka of the present project. These species were addressed during the first Kaheawa project. The present project is further from these resources. Concerns would be similar, as the planned wind turbines and their placement would be nearly the same.

PLANT SPECIES LIST

Following is a checklist of all those vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within three groups: Ferns, Monocots and Dicots. Taxonomy and nomenclature of the ferns are in accordance with Palmer (2003) and the flowering plants are in accordance with Wagner et al. (1999) and Staples and Herbst (2005).

For each species, the following information is provided:

1. Scientific name with author citation.

2. Common English or Hawaiian name.

3. Bio-geographical status. The following symbols are used:

   endemic = native only to the Hawaiian Islands; not naturally occurring anywhere else in the world.
   indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).
   Polynesian introduction = plants introduced to Hawai'i in the course of Polynesian migrations and prior to western contact.
   non-native = all those plants brought to the islands intentionally or accidentally after western contact.

4. Abundance of each species within the project area:

   abundant = forming a major part of the vegetation within the project area.
   common = widely scattered throughout the area or locally abundant within a portion of it.
   uncommon = scattered sparsely throughout the area or occurring in a few small patches.
   rare = only a few isolated individuals within the project area.

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
FERNS			
DENNSTAEDTIACEAE (Bracken Family)			
Pteridium aquilinum (L.) Kuhn. var. *decompositum* (Gaudich.) R.M. Tryon	*kilau*	endemic	common
PTERIDACEAE (Brake Fern Family)			
Pityrogramma austroamericana Domin.	gold fern	non-native	rare
MONOCOTS			
CYPERACEAE (Sedge Family)			
Carex wahuensis C.A. Mey. subsp. *wahuensis*	----------	endemic	uncommon
POACEAE (Grass Family)			

Andropogon virginicus L.	broomsedge	non-native	uncommon
Bothriochloa barbinodis (Lag.) Herter	fuzzy top	non-native	rare
Bothriochloa pertusa (L.) A. Camus	pitted beardgrass	non-native	common
*Cenchrus ciliaris*L.	buffelgrass	non-native	common
Cynodon dactylon (L.) Pers.	Bermuda grass	non-native	rare
Digitaria ciliaris (Retz.) Koeler	Henry's crabgrass	non-native	rare
Digitaria insularis (L.) Mez ex Ekman	sourgrass	non-native	rare
Heteropogon contortus (L.) P. Beauv. ex Roem.&Schult.	pili grass	indigenous	rare
Hyparrhenia rufa (Nees.) Stapf	thatching grass	non-native	rare
Melinis minutiflora P. Beauv.	molasses grass	non-native	abundant
Melinis repens (Willd.) Zizka	Natal redtop	non-native	common
*Panicum maximum*Jacq.	Guinea grass	non-native	rare
Paspalum conjugatum Bergius	Hilo grass	non-native	rare
*Paspalum dilatatum*Poir.	Dallis grass	non-native	rare
Pennisetum clandestinum Chiov.	Kikuyu grass	non-native	uncommon
Rhytidosperma pilosum (R.Br.) Connor & Edgar	hairy oatgrass	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Setaria parviflora (Poir.) Kerguelen	yellow foxtail	non-native	rare
Setaria verticillata(L.) P. Beauv.	bristly foxtail	non-native	rare
Sporobolus africanus (Poir.) Robyns & Tournay	smutgrass	non-native	uncommon
*Trisetum inaequale*Whitney	----------	endemic	rare

DICOTS

ANACARDIACEAE (Mango Family)

Schinus terebinthifolius Raddi	Christmas berry	non-native	uncommon

APOCYNACEAE (Dogbane Family)

Stapelia gigantea N.E. Brown	Zulu giant	non-native	rare

ASTERACEAE (Sunflower Family)

Acanthospermum australe (Loefl.) Kuntze	spiny bur	non-native	rare
Ageratina adenophora (Spreng.) R.King & H.Robinson	Maui pamakani	non-native	rare

*Bidens cynapiifolia*Kunth	----------	non-native	rare
Bidens mauiensis (A.Gray) Sherff	ko'oko'olau	endemic	rare
*Bidens micrantha*Gaud.subsp. *micrantha*	ko'oko'olau	endemic	uncommon
Bidens pilosa L.	Spanish needle	non-native	rare
Conyza bonariensis (L.) Cronq.	hairy horseweed	non-native	uncommon
Conyza canadensis (L.) Cronq.	horseweed	non-native	rare
*Emilia fosbergii*Nicolson	red pualele	non-native	rare
Erigeron karvinskianus DC.	daisy fleabane	non-native	uncommon
*Galinsoga parviflora*Cav.	----------	non-native	rare
Heterotheca grandiflora Nutt.	telegraph weed	non-native	rare
*Hypochoeris radicata*L.	gosmore	non-native	rare
Melanthera lavarum (Gaud.) Wagner & Rob.	nehe	endemic	rare
Senecio madagascariensis Poir.	fire weed	non-native	common
Sonchus oleraceus L.	pualele	non-native	uncommon

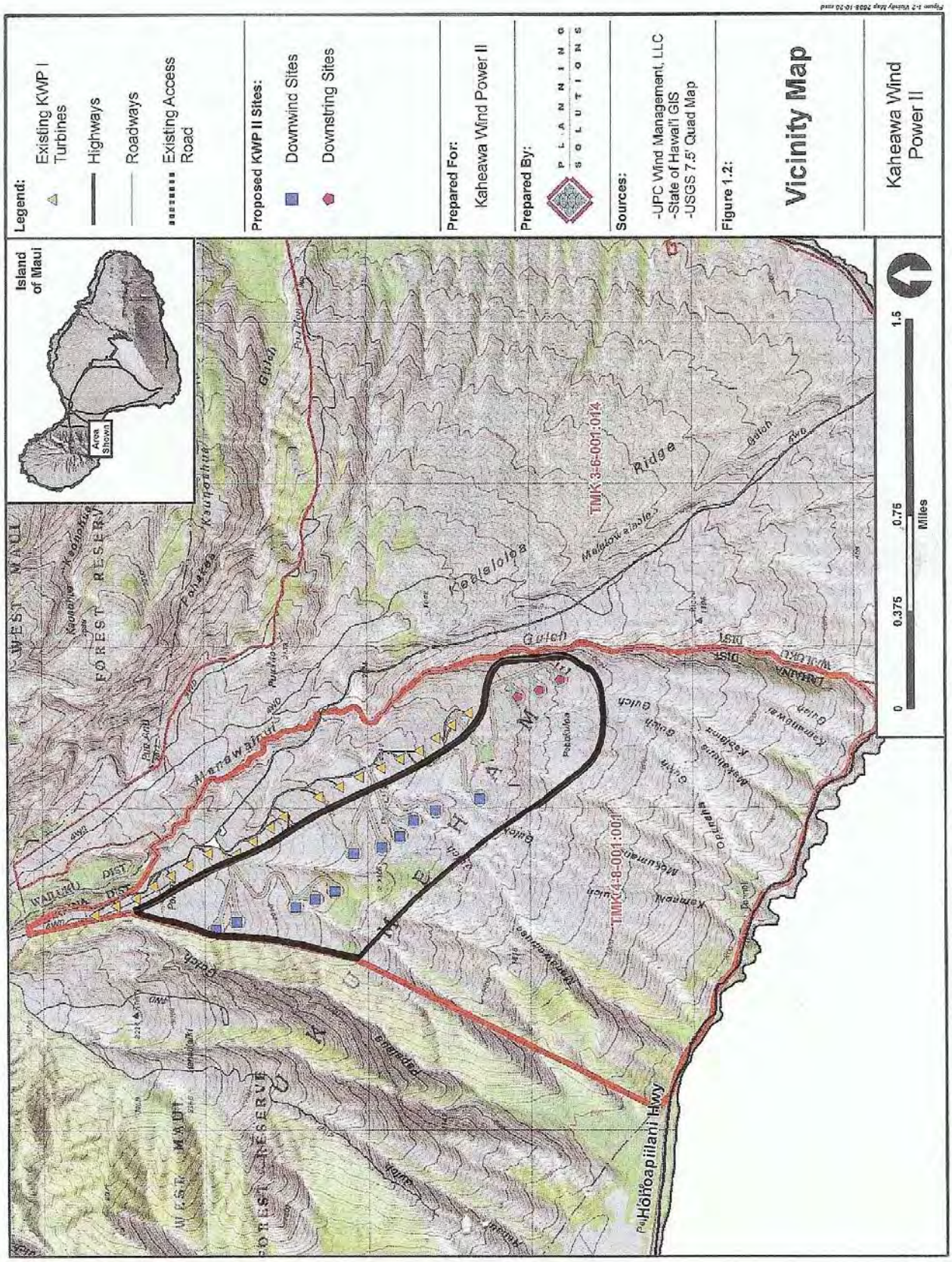
SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
*Tridax procumbens*L.	coat buttons	non-native	rare
Zinnia peruviana (L.) L.	zinnia	non-native	rare
BRASSICACEAE (Mustard Family)			
Sisymbrium officinale (L.) Scop.	hedge mustard	non-native	rare
CACTACEAE (Cactus Family)			
Opuntia ficus-indica (L.) Mill	panini	non-native	rare
CASUARINACEAE (She-oak Family)			
Casuarina equisetifolia L.	common ironwood	non-native	common
Casuarina glauca Siebold ex Spreng.	longleaf ironwood	non-native	rare
CONVOLVULACEAE (Morning Glory Family)			
Ipomoea indica (J. Burm.) Merr.	koali awahia	indigenous	uncommon
Ipomoea tuboides Degener & Ooststr.	Hawaiian moon flower	endemic	rare
ERICACEAE (Heath Family)			
Leptecophylla tameiameiae (Cham. & Schlect.) C.M. Weiller	pukiawe	indigenous	uncommon

EUPHORBIACEAE (Spurge Family)			
Chamaesyce celastroides (Boiss.) Croizat & Degener var. amplectens (Sherff) Degener & I.Degener	'akoko	endemic	rare
FABACEAE (Pea Family)			
Acacia farnesiana(L.) Willd.	klu	non-native	uncommon
Chamaecrista nictitans (L.) Moench	partridge pea	non-native	common
*Crotalaria pallida*Aiton	smooth rattlepod	non-native	rare
Crotalaria retusa L.	----------	non-native	rare
Desmanthus pernambucanus (L.) Thellung	slender mimosa	non-native	uncommon
Desmanthus incanum DC.	kaimi clover	non-native	rare
*Desmodium sandwicense*E. Mey.	Spanish clover	non-native	rare
Indigofera suffruticosa Mill.	inikö	non-native	common
Leucaena leucocephala(Lam.) de Wit	koa haole	non-native	uncommon

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Macroptilium lathyroides (L.) Urb	wild bean	non-native	rare
Prosopis pallida(Humb.&Bonpl. ex Willd.) Kunth	kiawe	non-native	rare
LAMIACEAE (Mint Family)			
Salvia coccinea B. Juss. ex Murray	scarlet sage	non-native	rare
MALVACEAE (Mallow Family)			
Abutilon grandifolium(Willd.) Sw.	hairy abutilon	non-native	rare
*Malva parviflora*L.	cheese weed	non-native	rare
Malvastrum coromandelianum(L.) Garcke	false mallow	non-native	rare
Sida fallax Walp	'ilima	indigenous	common
Triumfetta semitriloba Jacq.	Sacramento bur	non-native	rare
Waltheria indica L.	'uhaloa	indigenous	common
MENISPERMACEAE (Moonseed Family)			
Cocculus orbiculatus (L.) DC.	huehue	indigenous	uncommon
MYOPORACEAE (Myoporum Family)			
Myoporum sandwicense A. Gray	naio	indigenous	rare
MYRTACEAE (Myrtle Family)			

Metrosideros polymorpha Gaud.	'öhi'a	endemic	rare
Psidium guajava L.	guava	non-native	rare
OXALIDACEAE (Wood Sorrel Family)			
Oxalis corniculata L.	'ihi	Polynesian	rare
PLANTAGINACEAE (Plantain Family)			
Plantago lanceolata L.	narrow-leaved plantain	non-native	common
POLYGALACEAE (Milkwort Family)			
Polygala paniculata L.	----------	non-native	uncommon
PORTULACACEAE (Purslane Family)			

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Portulaca oleracea L.	pigweed	non-native	rare
PRIMULACEAE (Primrose Family)			
Anagallis arvensis L.	scarlet pimpernel	non-native	rare
PROTEACEAE (Protea Family)			
Grevillea robusta A. Cunn. ex R. Br.	silk oak	non-native	rare
ROSACEAE (Rose Family)			
Osteomeles anthyllidifolia (Sm.) Lindl.	'ülei	indigenous	common
SANTALACEAE (Sandalwood Family)			
*Santalum ellipticum*Gaud.	'iliahi alo'e	endemic	uncommon
SAPINDACEAE (Soapberry Family)			
Dodonaea viscosa Jacq.	'a'ali'i	indigenous	uncommon
SOLANACEAE (Nightshade Family)			
Solanum lycopersicum L.	cherry tomato	non-native	rare
THYMELAEACEAE ('Akia Family)			
Wikstroemia oahuensis(A.Gray) Rock	'akia	endemic	uncommon
VERBENACEAE (Verbena Family)			
Lantana camara L.	lantana	non-native	rare
Stachytarpheta jamaicensis (L.) Vahl	Jamaica vervain	non-native	uncommon



January 2009 Project area
Post-Fire Botanical Survey and Assessment

Literature Cited

Armstrong, R. W. (ed.) 1983. Atlas of Hawaii. (2nd. ed.) University of Hawaii Press.

Palmer, D.D. 2003 Hawai'i's Ferns and Fern Allies. University of Hawaii Press, Honolulu.

U.S. Fish and Wildlife Service. 1999. Endangered and threatened wildlife and Plants. 50 CFR 17.11 & 17.12

Wagner, W. L., D.R. Herbst, and S. H. Sohmer. 1999. Manual of the flowering plants of Hawai'i. Univ. of Hawai'i Press and Bishop Museum Press. Honolulu.

BOTANICAL RESOURCES SURVEY

for the

KAHEAWA PASTURES ENERGY PROJECT

UKUMEHAME, MAUI, HAWAII

by

ROBERT W. HOBDY
ENVIRONMENTAL CONSULTANT
Kokomo, Maui
August 2009

Prepared for:
First Wind Energy, LLC

BOTANICAL RESOURCES SURVEY
Kaheawa Pastures Wind Energy Project

INTRODUCTION

The Kaheawa Pastures Wind Energy Project area lies on lower Kealaloloa Ridge on the southern tip of West Maui between Manawainui Gulch on the west and Malalowaia'ole Gulch on the east. The project area is approximately 276 acres in size TMK (2) 3-6-01:14 (por.). This study has been initiated by First Wind Energy LLC to assess the botanical resources in the area in fulfillment of environmental requirements of the planning process.

SITE DESCRIPTION

Kealaloloa Ridge is a very evenly sloping ridge descending from Hanaula Peak to the sea at a 16% grade. Vegetation is mostly open windblown grasslands with scattered shrubs and trees in gullies. Soils are exclusively characterized as Rocklands (rRK) by the National Resource Conservation Service (Foote et al, 1972). This substrate consists of thin soils formed from gray trachyte lavas of the Honolua Series which overlay the foundational lavas of the West Maui volcano. These lavas weather to platy gray blocks that extend across the entire ridge. This area is quite arid with annual rainfall totaling only about 12 to 20 inches per year (Armstrong, 1983).

BIOLOGICAL HISTORY

In pre-contact times this part of the mountain slope was entirely covered with native vegetation of low stature with dry grass and shrub lands and with a few trees in the gullies. The Hawaiians made some uses of forest resources here and had a cross-island trail cresting the ridge at 1600 ft. elevation. This trail was upgraded during the mid-1800s and used as a horse trail to Lahaina. It was resurrected to use in recent years and is the present Lahaina Pali Trail.

Cattle ranching began in the late 1800s and continued for over 100 years. During this time the grazing animals consumed most of the native vegetation which was gradually replaced by hardy weed species.

During the 1950s high voltage power lines were installed across the mountain along with access roads through this area. Increased traffic brought more disturbances and weeds. Fires became more frequent, further eliminating remnant native vegetation.

With the cessation of cattle grazing a number of grass and weed species have proliferated, creating a heightened fire hazard. Large fires have swept across the mountain consuming thousands of acres including the entire project area several times.

DESCRIPTION OF THE VEGETATION

The vegetation within the project area is a diverse array of grasses and low shrubs with a scattering of small trees in gullies. The most abundant species is buffelgrass (*Cenchrus ciliaris*) which has proliferated following the fires. Also common are Natal redtop (*Melinis repens*), ‘ilima (*Sida fallax*), ‘uhaloa (*Waltheria indica*), lesser snapdragon (*Antirrhinum orontium*) and Jamaica vervain (*Stachytarpheta jamaicensis*). A total of 62 species were recorded during the survey.

Fifteen species of native plants were found on the project area: kumuniu (*Doryopteris decipiens*), (*Cyperus phleoides* var *phleoides*) no common name, kalamalö (*Eragrostis deflexa*), ‘äheahea (*Chenopodium oahuense*), nehe (*Lipochaeta lobata* var. *lobata*), nehe (*Melanthera lavarum*), puakala (*Argemone glauca*), ‘akia (*Wikstroemia oahuensis*), pili grass (*Heteropogon contortus*), koali awahia (*Ipomoea indica*), ‘ilima, ‘uhaloa, naio (*Myoporum sandwicense*), ‘ulei (*Osteomeles anthyllidifoli*a) and ‘a’ali’i (*Dodonaea viscosa*). The remaining 47 plant species were non-native grasses, shrubs and trees.

SURVEY OBJECTIVES

This report summarizes the findings of a botanical survey of the Kaheawa Pastures Wind Energy Project which was conducted in August, 2009.
The objectives of the survey were to:

1. Document what plant species occur on the property or may likely occur in the existing habitat.

2. Document the status and abundance of each species.

3. Determine the presence or likely occurrence of any native plant species, particularly any that are federally listed as Threatened or Endangered. If such occur, identify what features of the habitat may be essential for these species.

4. Determine if the project area contains any special habitats which if lost or altered might result in a significant negative impact on the flora in this part of the island.

5. Note which aspects of the proposed development pose significant concerns for plants and recommend measures that would mitigate or avoid these problems.

SURVEY METHODS

The entire project area was surveyed on foot. Areas on rocky gully slopes and the steep cliffs at the edges of the two large bordering gulches were examined more intensively as these were the places where the most native plants survived both the grazing of cattle and the effects of wildfires. Notes were made on plant species, distribution and abundance as well as on terrain and substrate.

PLANT SPECIES LIST

Following is a checklist of all those vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within three groups: Ferns, Monocots and Dicots. Taxonomy and nomenclature of the ferns are in accordance with Palmer (2003) and the flowering plants are in accordance with Wagner et al. (1999) and Staples and Herbst (2005).

For each species, the following information is provided:

1. Scientific name with author citation

2. Common English or Hawaiian name.

3. Bio-geographical status. The following symbols are used:

   endemic = native only to the Hawaiian Islands; not naturally occurring anywhere else in the world.
   indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).
   Polynesian introduction = plants introduced to Hawai'i in the course of Polynesian migrations and prior to western contact.
   non-native = all those plants brought to the islands intentionally or accidentally after western contact.

4. Abundance of each species within the project area:

   abundant = forming a major part of the vegetation within the project area.
   common = widely scattered throughout the area or locally abundant within a portion of it.
   uncommon = scattered sparsely throughout the area or occurring in a few small patches.
   rare = only a few isolated individuals within the project area.

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
FERNS			
NEPHROLEPIDACEAE (Sword Fern Family)			
Nephrolepis brownii (Desv.) Hovencamp & Miyam.	Asian sword fern	non-native	rare
PTERIDACEAE (Brake Fern Family)			
Doryopteris decipiens (Hook.) J.Sm.	kumuniu	endemic	rare
Pityrogramma austroamericana Domin	gold fern	non-native	rare
MONOCOTS			
CYPERACEAE (Sedge Family)			
Cyperus phleoides Nees ex Kunth subsp. *phleoides*	----------	endemic	rare
POACEAE (Grass Family)			
Andropogon virginicus L.	broomsedge	non-native	rare
Cenchrus ciliaris L.	buffelgrass	non-native	abundant
Cynodon dactylon (L.) Pers.	Bermuda grass	non-native	rare
Eragrostis deflexa Hitchc.	kalamalö	endemic	rare
Heteropogon contortus (L.) P. Beauv. ex Roem & Schult.	pili grass	indigenous	uncommon
Melinis minutiflora P. Beauv.	molasses grass	non-native	rare
Melinis repens (Willd.) Zizka	Natal red-top	non-native	common
Panicum maximum Jacq.	Guinea grass	non-native	rare
Sporobolus africanus (Poir.) Robyns & Tournay	smutgrass	non-native	rare
DICOTS			
AMARANTHACEAE (Amaranth Family)			
Amaranthus spinosus L.	spiny amaranth	non-native	rare
Amaranthus viridis L.	slender amaranth	non-native	rare
Atriplex semibaccata R. Br.	Australian saltbush	non-native	rare
Chenopodium murale L.	'äheahea	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Chenopodium oahuense (Meyen) Aellen	'äheahea	endemic	rare
APOCYNACEAE (Dogbane Family)			
Calotropis procera (Aiton) W.T. Aiton	small crown flower	non-native	rare
ASTERACEAE (Sunflower Family)			
Conyza bonariensis (L.) Cronq.	hairy horseweed	non-native	uncommon
Emilia fosbergii Nicolson	red pualele	non-native	uncommon
Lactuca sativa L.	prickly lettuce	non-native	rare
Lipochaeta lobata (Gaud.) DC. var. lobata	nehe	endemic	rare
Melanthera lavarum (Gaud.) Wagner & Rob.	nehe	endemic	uncommon
Senecio madagascariensis Poir.	fireweed	non-native	rare
Sonchus oleraceus L.	pualele	non-native	rare
Tridax procumbens L.	coat buttons	non-native	uncommon
Xanthium strumarium L.	kikania	non-native	rare
Zinnia peruviana L.	zinnia	non-native	rare
BRASSICACEAE (Mustard Family)			
Sisymbrium altissimum L.	tumble mustard	non-native	uncommon
CACTACEAE (Cactus Family)			
Opuntia ficus-indica (L.) Mill.	panini	non-native	rare
CONVOLVULACAE (Morning Glory Family)			
Ipomoea indica (J. Burm.) Merr.	koali awahia	indigenous	rare
EUPHORBIACEAE (Spurge Family)			
Chamaesyce hirta (L.) Millsp.	hairy spurge	non-native	rare
FABACEAE (Pea Family)			
Acacia farnesiana (L.) Willd.	klu	non-native	rare
Chamaecrista nictitans (L.) Moench	partridge pea	non-native	uncommon
Crotalaria incana L.	fuzzy rattlepod	non-native	uncommon

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Desmanthus pernambucanus (L.) Thellung	slender mimosa	non-native	uncommon
Desmodium incanum DC.	kaimi clover	non-native	rare
Desmodium tortuosum (Sw.) DC.	Florida beggarweed	non-native	rare
Indigofera suffruticosa Mill.	'inikö	non-native	uncommon
Leucaena leucocephala (Lam.) de Wit	koa haole	non-native	uncommon
Macroptilium lathryroides (L.) Urb.	wild bean	non-native	uncommon
Pithecellobium dulce (Roxb.) Benth.	'opiuma	non-native	rare
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe	non-native	uncommon
GENTIANACEAE (Gentian Family)			
Centaurium erythraea Raf.	bitter herb	non-native	rare
LAMIACEAE (Mint Family)			
Leonotis nepetifolia (L.) R. Br.	lion's ear	non-native	rare
MALVACEAE (Mallow Family)			
Abutilon incanum (Link) Sweet	hoary abutilon	non-native	rare
Sida fallax Walp.	'ilima	indigenous	common
Waltheria indica L.	'uhaloa	indigenous	common
MYOPORACEAE (Myoporum Family)			
Myoporum sandwicense A. Gray	naio	indigenous	rare
PAPAVERACEAE (Poppy Family)			
Argemone glauca (Nutt. ex Prain) Pope	puakala	endemic	rare
PLANTAGINACEAE (Plantain Family)			
Antirrhinum orontium L.	lesser snapdragon	non-native	common
Plantago lanceolata L.	narrow-leaved plantain	non-native	uncommon
PORTULACACEAE (Purslane Family)			
Portulaca oleracea L.	pigweed	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Portulaca pilosa L.	----------	non-native	rare
PROTEACEAE (Protea Family)			
Grevillea robusta A. Cunn. ex R. Br.	silk oak	non-native	rare
ROSACEAE (Rose Family)			
Osteomeles anthyllidifolia	ūlei	indigenous	uncommon
SAPINDACEAE (Soapberry Family)			
Dodonaea viscosa Jacq.	'a'ali'i	indigenous	uncommon
SOLANACEAE (Nightshade Family)			
Solanum lycopersicum L.	cherry tomato	non-native	rare
THYMELAEACEAE ('Akia Family)			
Wikstroemia oahuensis (A. Gray) Rock	'akia	endemic	rare
VERBENACEAE (Verbena Family)			
Lantana camara L.	lantana	non-native	uncommon
Stachytarpheta jamaicensis (L.) Vahl.	Jamaica vervain	non-native	common

DISCUSSION

The construction of additional wind turbines will require the development of additional access roads and the clearing and leveling of construction pads within the 276 acre project area. This will result in the loss of vegetation where these occur. The area in general has experienced a dramatic loss of native plant communities over the last century and there is concern that further losses of rare species and special habitats be avoided. The proposed project was analyzed with these concerns in mind.

Of the 15 native plant species identified on the property none were found to be federally listed as Threatened or Endangered species (USFWS, 2009), nor were any found that are candidates for such status. All but two are widespread and fairly common in Hawaii. (*Lipocheata lobata*) has one Endangered variety from Oahu and one commoner variety (L.I. *var lobata*) known from Niihau, O'ahu and West Maui. The one found in the project area is the commoner variety that has no federal status. (*Eragrostis deflexa*) is a native grass that was presumed to be extinct in the early 1990s. Recent collections, some quite extensive, from West Maui, Lana'i and Kaho'olawe, however, have been identified as (*Eragrostis deflexa*) and this species is not likely to be listed as Endangered. Six populations of this grass were found within the project area along the rocky edges of the two large gulches.

Of the 15 native plant species found in the project area were most prevalent in the rocky habitat bordering Manawainui and Malalowaia'ole Gulches. This is due to the fact that these area were less accessible to grazing cattle over the years, and to the fact that these rather barren, rocky area are less susceptible to the effects of fires. The three hardiest native species 'ilima, 'uhaloa and 'a'ali'i that are more prevalent on the flatter grassy ridge tops, are the most likely to be impacted by road construction and the leveling of tower pads. These are three of the commonest native dryland plants in all of Hawaii.

It is likely that periodic fires will continue to be a problem into the forseeable future. The area has been nearly completely overtaken by buffelgrass, a highly flammable, fire-adapted species that is quick to recover following wildfires. Meanwhile, each fire destroys more and more of even the hardiest native plants. Unless land management practices change dramatically across this dry mountain slope, little improvement in this prognosis is likely.

Previous botanical surveys on this southern tip for West Maui have identified a few Endangered species growing in gulches about two miles upslope of this project area. This area is remote from these populations and is in a habitat completely unsuitable for their growth and survival. This project is not expected to negatively impact any of these species.

Due to the general condition of the habitat and the specific lack of any environmentally sensitive native plant species or habitats on or near the project area, the proposed development work is not expected to result in any significant negative impact on the botanical resources in this part of Maui.

RECOMMENDATIONS

The quality of the roads created will have a long term effect on surrounding habitat. Poorly engineered roads in this entire project area quickly erode causing downslope disturbances from moving water and road materials. They have the added effect of necessitating frequent maintenance work resulting in further disturbances. It is recommended that the road surfaces be crowned and rolled with stable material, and that swales, drains and culverts be engineered to channel water from the roadway quickly and effectively.

It is desirable that the incidence of wildfires be minimized because of their devastating long term effects on native plant resources. Fuels in this area are highly flammable. One way to minimize fire here is to limit human access along the road corridor to only those with management or other legitimate functions.

Literature Cited

Armstrong, R. W. (ed.) 1983. Atlas of Hawaii. (2nd. ed.) University of Hawaii Press.

Foote, D.E. , E.L. Hill, S. Nakamura, and F. Stephens. 1972. Soil survey of the islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii. U.S. Dept. of Agriculture, Soil Conservation Service. Washington, D.C.

Palmer, D.D. 2003 Hawai'i's Ferns and Fern Allies. University of Hawaii Press, Honolulu.

Staples, G.W. and D.R. Herbst. 2005. A Tropical Garden Flora, Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press.

U.S. Fish and Wildlife Service. 1999. Endangered and threatened wildlife and Plants. 50 CFR 17.11 & 17.12

Wagner, W. L., D.R. Herbst, and S. H. Sohmer. 1999. Manual of the flowering plants of Hawai'i. Univ. of Hawai'i Press and Bishop Museum Press. Honolulu.

APPENDIX B. KWP II ARCHAEOLOGICAL SURVEY FOR PREFERRED ALTERNATIVE AND ALTERNATIVE 2

RC-0438B

An Archaeological Inventory Survey for the Kaheawa Wind Power (KWP) Phase 2 Project Area

(TMK:2-3-6-001:por. 014 and 2-4-8-001: por. 001)

Ukumehame Ahupuaʻa
Wailuku and Lahaina Districts
Island of Maui

DRAFT VERSION

PREPARED BY:

Robert B. Rechtman, Ph.D.
Johnny R. Dudoit, B.A.,
and
Ashton K. Dircks Ah Sam, B.A.

PREPARED FOR:

Kelly Bronson
First Wind Energy, LLC
810 Richards Street, Suite 650
Honolulu, HI 96813

October 2009

RECHTMAN CONSULTING, LLC
507-A E. Lanikaula St. Hilo, Hawaii 96720
phone: (808) 969-6066 fax: (808) 443-0065
e-mail: bob@rechtmanconsulting.com
ARCHAEOLOGICAL, CULTURAL, AND HISTORICAL STUDIES

An Archaeological Inventory Survey for the Kaheawa Wind Power (KWP) Phase 2 Project Area

(TMK: 2-3-6-001:por. 014 and 2-4-8-01:por. 001)

Ukumehame Ahupua‘a
Wailuku and Lahaina Districts
Island of Maui

RECHTMAN CONSULTING

EXECUTIVE SUMMARY

At the request of Kelly Bronson of First Wind, Rechtman Consulting, LLC conducted an archaeological inventory survey of a roughly 175-acre project area in Ukumehame Ahupuaʻa, Wailuku and Lahaina Districts, Island of Maui (TMK:2-3-6-001:por. 014 and TMK:2-4-8-001:por. 001). The objective of the survey was to record the locations of all archaeological sites and features present within the study area and to provide preliminary significance evaluations for any recorded sites. First Wind would like to expand their existing wind farm operation (KWP Phase 1) by erecting fourteen new power generating wind turbines (KWP Phase 2) within the current study area. The current project was undertaken in support of all necessary permit approvals and in compliance with both the historic preservation review process requirements (HAR 13§13-275-5) of the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD) and the County of Maui Planning Department.

The current project area is located on the southern slopes of the West Maui Mountains and stretches from an elevation of approximately 400 feet above sea level to a maximum elevation of approximately 2,000 feet above sea level. The project area is accessed through a gate along the northern edge of Honoapiliʻilani Highway that leads to the existing access road that runs to the upper portions of the area, commonly referred to a Kaheawa Pastures. The land encompassed by the current project area is owned by the State of Hawaiʻi and is administered through the Department of Land and Natural Resources; it is designated as conservation land, and aside from the access road is currently not being used. Cattle were formerly grazed on the property, but a lease to Perreira Ranch was cancelled in the mid-1990s (Tomonari-Tuggle 1998:1). The project area terrain consists of what is commonly referred to as tableland. Typical of the south rift of the West Maui volcano, this land consists of high, inter-valley ridges separated by steep-sided, dry gulches that descend the steep, southwest facing slope to the ocean (Tomonari-Tuggle 1998:1). The two largest gulches that cross the current project area are Malalowaiaole Gulch and Manawainui Gulch; the latter marks the boundary between the Lahaina and Wailuku Districts. Owing to the former use as ranch land, grass is the dominant vegetation over most of the project area.

Nine previous archaeological studies were conducted for the KWP Phase 1 project area. These studies included a reconnaissance survey of twenty-seven wind turbine locations (Tomonari-Tuggle 1998), a study of an upland *heiau* site (Site 5232; Athens 2002) and a preservation plan for that *heiau* (Tomonari-Tuggle and Rasmussen 2005), a supplemental survey of the wind turbine pad alignments (Magnuson 2003), a supplemental survey for a proposed access road (Athens 2004), a reconnaissance survey of the southern portion of a new low impact road (Rasmussen 2005a), a supplemental reconnaissance survey within the SMA zone for a proposed staging area (Rasmussen 2005b), and an inventory survey of the entire proposed development area (Clark and Rechtman 2005). Three of these studies included portions of the current project area (Clark and Rechtman 2005; Rasmussen 2005a; Tomonari-Tuggle 1998). In addition to these studies, an archaeological survey report (Tomonari-Tuggle and Tuggle 1991) and a cultural resource management plan (Tomonari-Tuggle 1995) were prepared for the Lahaina Pali Trail, a portion of which crosses through the current project area; an inventory survey was conducted for MECO transmission lines that mark the *mauka* terminus of the *makai* portion of the current project area (Hammatt et al. 1996; Robins et al. 1994); and an inventory survey of 333 acres for the alternative proposed location for KWP Phase 2 (Clark and Rechtman 2006).

As a result of the current inventory survey the Lahaina Pali Trail and a possible remnant section of its Māʻalaea branch were identified as was the previously recorded Site 5648, along with a concrete water trough (Site 6665). The Lahaina Pali Trail and the Māʻalaea branch of this trail were constructed in 1841 and remained in use until 1891. It seems reasonable to assume that during earlier times other trails accessed this area; however, the physical evidence of such trails is no longer observable on the surface having been superseded by either the historic trails or the Jeep roads. At Site 5648, twenty new features were documented; bringing the total number of features at this site to thirty. The features are indicative of temporary habitation and may represent recurrent use shelters associated with trail routes. The use of these features likely dates from both Precontact and Historic times. The most intensive habitation may have occurred between 1841 and 1891 when the Lahaina Pali Trail and its Māʻalaea branch were still in use. Site 6665 is a concrete water trough that was built on December 14, 1943. This water trough is part of a water system developed by Honoula Ranch in Ukumehame in the 1940s. This system provided drinking water for cattle in the once extensive, but arid pastures of this upland area. Cattle ranching continued within the project area until the 1990s.

The Lahaina Pali Trail and the remnant of the Mā‘alaea branch of this trail are considered significant under Criterion D for the information yielded relative to middle and late nineteenth century transportation patterns and evolving modes of transportation. The main trail branch is already governed by a management plan (Tomonari-Tuggle 1995) and it will not be directly impacted as a result of the current proposed expansion of the wind power project. The newly discovered remnant portion of the Mā‘alaea branch of this trail should be preserved although it does not currently provide a continuous link to the main branch of the Lahaina Pali Trail or to Mā‘alaea. A preservation plan for this site should be prepared and submitted to DLNR-SHPD for review and approval. Site 5648 is considered significant under Criterion D for both the information it has yielded and the potential information it is likely to yield if future work were to be conducted. The locations of the proposed wind generating towers and the associated infrastructure are being designed to avoid all of the features of this site. While it is possible that data recovery might enhance our knowledge relative to the age and specific function of the various features of Site 5648, such mitigation work is not necessary given the current proposed project layout. Therefore a preservation plan for this site should be prepared and submitted to DLNR-SHPD for review and approval. If in the future, it is necessary to impact one or more of the site’s features, DLNR-SHPD should be contacted to address possible mitigation of impacts through data recovery. Site 6665 is considered significant under Criterion D for information it has yielded relative to the middle twentieth century ranching practices in the area. As it is not exceptional, nor is it likely to yield further important information, no further work in the recommended treatment for Site 6665.

Contents

Figures

Tables

INTRODUCTION

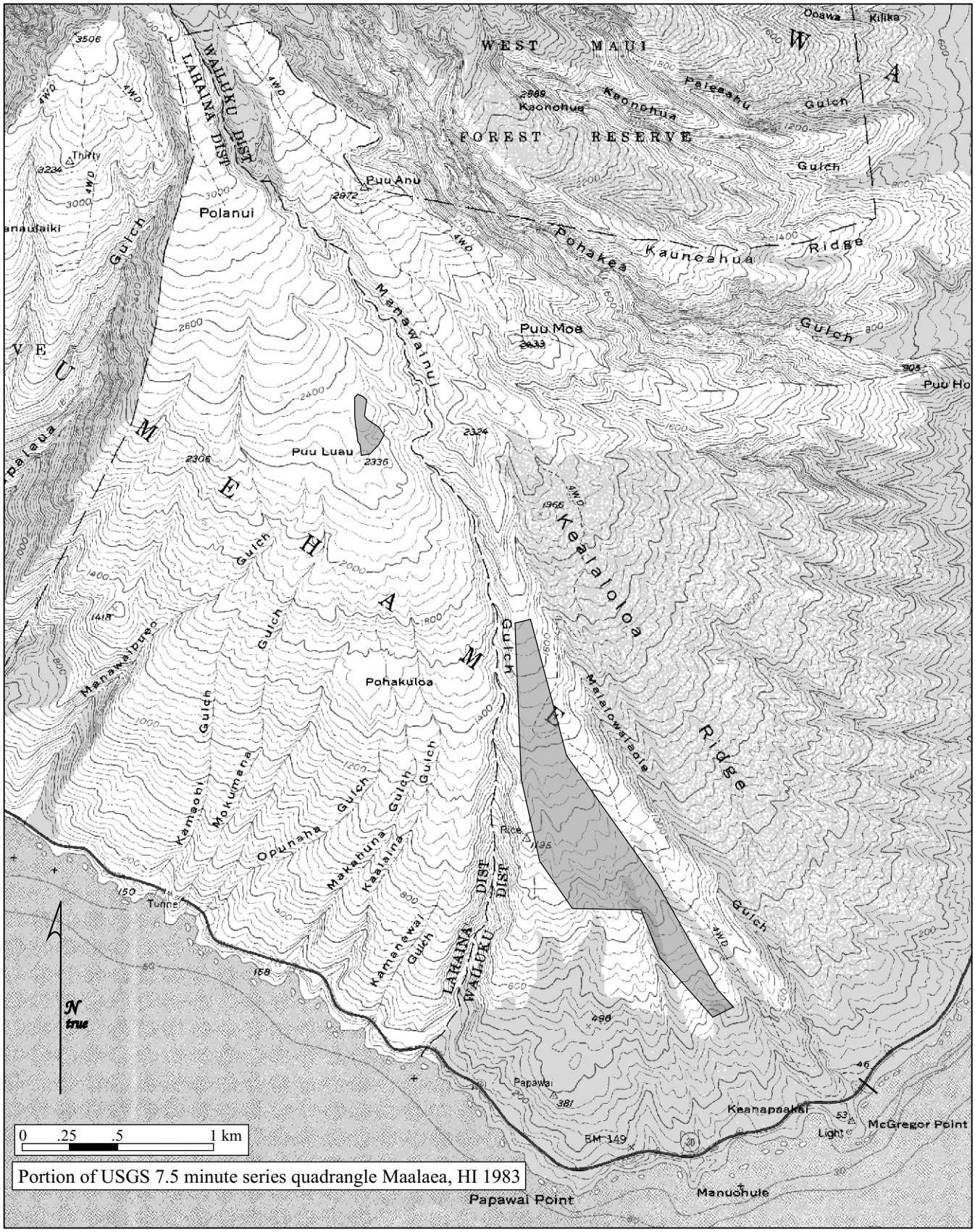
At the request of Kelly Bronson of First Wind, Rechtman Consulting, LLC conducted an archaeological inventory survey of a roughly 175-acre project area in Ukumehame Ahupuaʻa, Wailuku and Lahaina Districts, Island of Maui (TMK:2-3-6-001:por. 014 and TMK:2-4-8-001:por. 001) (Figure 1). The land encompassed by the current project area is owned by the State of Hawaiʻi and is administered through the Department of Land and Natural Resources (DLNR); it is designated as conservation land. The objective of the survey was to record the locations of all archaeological sites and features present within the study area and to provide preliminary significance evaluations for any recorded sites. First Wind would like to expand their existing wind farm operation (KWP Phase 1) by erecting fourteen new power generating wind turbines (KWP Phase 2) within the current study area (Figure 2). Rechtman Consulting, LLC previously conducted an archaeological inventory survey of an adjacent 200 acres for the construction of the existing wind farm (Clark and Rechtman 2005), and more recently an inventory survey of 333-acres as an alternative site for the current proposed expansion of the wind farm (Clark and Rechtman 2006). The current project was undertaken in support of all necessary permit approvals and in compliance with both the historic preservation review process requirements (HAR 13§13-275-5) of the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD) and the County of Maui Planning Department.

This report contains background information outlining the project area's physical and cultural contexts, a presentation of previous archaeological work in the immediate vicinity of the parcel, and current survey expectations based on that previous work. Also presented is an explanation of the project's methods, detailed description of the archaeological resources encountered, interpretation and evaluation of those resources, and treatment recommendations for all of the documented sites.

Project Area Description

The current project area is located on the southern slopes of the West Maui Mountains and stretches from an elevation of approximately 400 feet above sea level to a maximum elevation of approximately 2,000 feet above sea level. The project area is accessed through a gate along the northern edge of Honoapiliʻilani Highway that leads to the existing access road, servicing KWP Phase 1, and that runs all the way to the upper portions of the area, commonly referred to a Kaheawa Pastures. This land is designated as conservation land, and aside from the access road is currently not being used. Cattle were formerly grazed on the property, but a lease to Perreira Ranch was cancelled in the mid-1990s; cattle are currently grazed to the east of the project area on Wailuku Agribusiness lease lands (Tomonari-Tuggle 1998:1). The project area terrain consists of what is commonly referred to as tableland. Typical of the south rift of the West Maui volcano, this land consists of high, inter-valley ridges separated by steep-sided, dry gulches that descend the steep, southwest facing slope to the ocean (Tomonari-Tuggle 1998:1). The two largest gulches that cross the current project area are Malalowaiaole Gulch and Manawainui Gulch; the latter marks the boundary between the Lahaina and Wailuku Districts. Owing to the former use as ranch land, grass is the dominant vegetation over most of the project area.

The current study covers two discontinuous project areas: (1) the main (*makai*), approximately 165-acre area for the placement of the fourteen proposed wind turbines extends *makai* from the lower MECO transmission corridor; and (2) a smaller (*mauka*) area, approximately ten acres, for the proposed KWP Phase 2 substation is immediate adjacent to the earlier (Clark and Rechtman 2006) study area (see Figures 1 and 2). Each of these specific study areas is discussed in detail below.



Portion of USGS 7.5 minute series quadrangle Maalaea, HI 1983

Figure 1. Project area location (shaded).

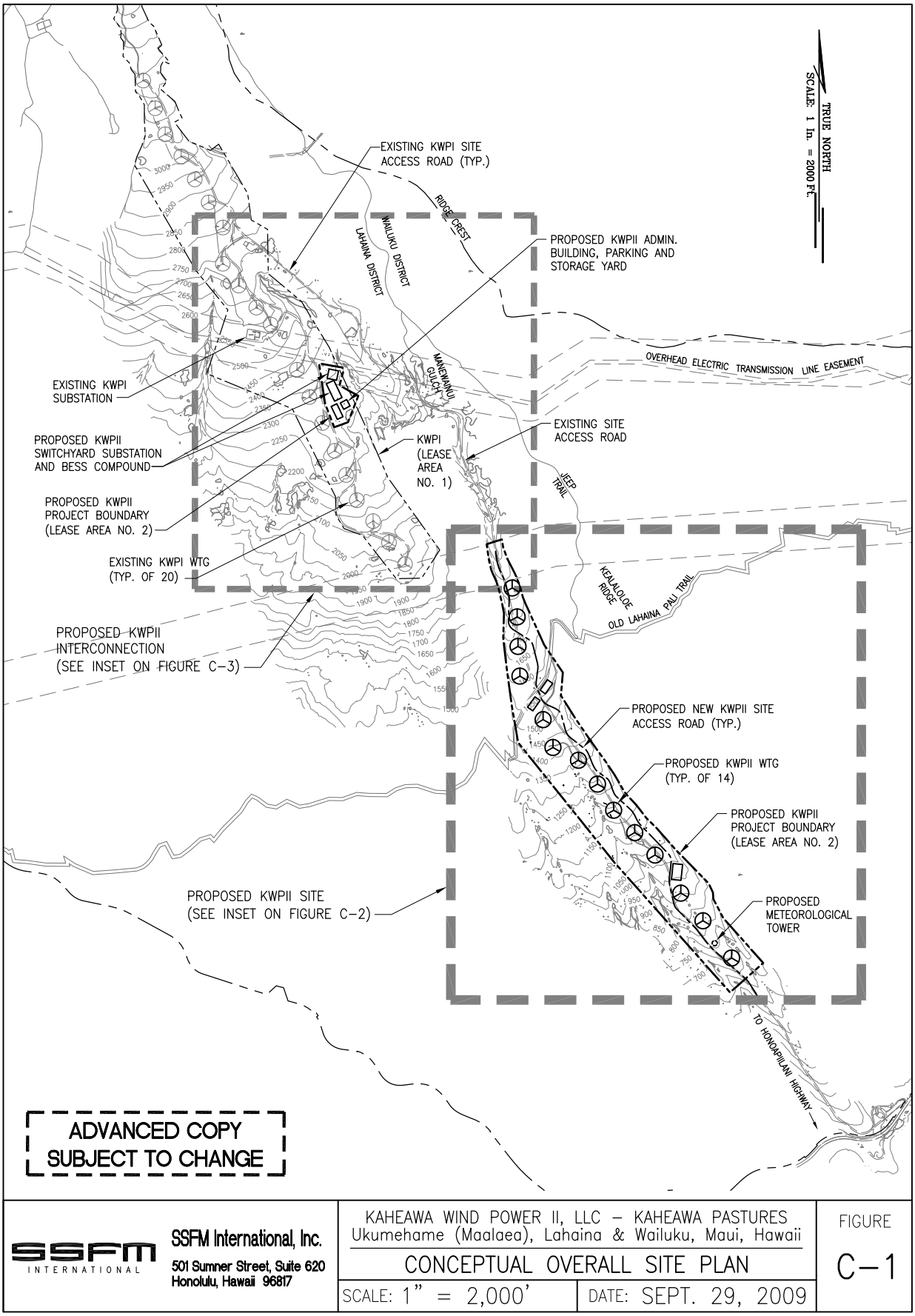


Figure 2. Conceptual development plan for KWP Phase 2.

The *makai* survey area ranges in elevation from about 1,800 feet to 400 feet above sea level and encompasses the narrow ridge between Malalowaiaole Gulch (to the east) and Manawainui Gulch (to the west) (Figure 3). Within this area is the existing KWP Phase 1 roadway (Figure 4), a portion of the original 4WD road that traversed this ridge (Figure 5), and a portion of the Lahaina Pali Trail (Figure 6). This lower survey area is located just *makai* of the unnamed *pu'u* near the head of Malalowaiaole Gulch. Rasmussen, who previously surveyed this portion of the project area, described the environment thusly:

> The soil consists of Oli silty loam, part of a soil series consisting of well-drained, moderately deep to deep soils that are developed in volcanic ash and weathered igneous rock (Foote et al. 1972:97). The lower elevations are characterized by exposed bedrock with uplifted or tilted rock outcroppings along the ridge. Grasses and weeds are short and sparse. . . Native plants such as *pūkiawe* (*Syphelia* sp.), *'a'ali'i* (*Dodonaea viscosa*), *'ūlei* (*Osteomeles anthyllidifolia*), and *'ōhi'a lehua* (*Metrosideros polymorpha*), grow on the sides of the *pu'u*. (Rasmussen 2005a:1)

During the current field investigation ground visibility within the main, *makai*, survey area was excellent with buffelgrass (*Pennisetum ciliare*) dominant and a few burned *kiawe* trees also present (Figure 7).

Figure 3. Manawainui Gulch along the western project area boundary, view to southwest.

Figure 4. Existing access road through the lower study area, view to northeast.

Figure 5. Portion of the original 4WD road in the lower study area, view to south.

Figure 6. Portion of Lahaina Pali Trail in the lower study area, view to southwest.

Figure 7. Typical vegetation cover in the *makai* portion of project area, view to northeast.

The *mauka* survey area, along the western edge of Manawainui Gulch is located at an elevation of 2,000 feet above sea level, just below Puʻu Lūʻau. The western edge of this survey area is bound by the existing access road. Tomonari-Tuggle, who previously surveyed this portion of the current survey area, described the environment thusly:

> 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 Puʻu Luʻau. The terrain is slightly undulating 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 Puʻu Luʻau separates the head of Mokumanu gulch on the west from Manawainui gulch. The area below the puʻu is steep, rocky, and punctured 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 well-drained upland soil formed in "material derived from basic igneous rock" and occurring on narrow to broad ridge tops (Foote et al. 1972:101). The central portion of the project area, inland of Puʻu Luʻau, consists of Maiwa silty clay loam, which is a well-drained upland soil developed in volcanic ash and weathered 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 as rock land where exposed rock covers 25 to 90 percent of the surface.
>
> The top of Puʻu Luʻau and scattered areas along the upper edge of Manawainui gulch are deflated, with exposed dirt and boulders and cobbles.
>
> 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, with scattered Christmas berry (*Schinus terebinthifolius*) and scrub *ʻōhiʻa* (*Metrosideros polymorpha*) in the upper portion and lantana (*Lantana camara*), *ʻilima* (*Sida fallax*), *koa haole* (*Leucaena leucocephala*), and klu (*Acacia farnesiana*) in the lower portion. The vegetation below Puʻu Luʻau is largely dense, tall scrub lantana. There are scattered small groves of ironwood trees (*Casuarina equisitfolia*) on the grass-covered slopes. Above the uppermost anemometer tower, the vegetation changes from grassland to increasingly larger and denser stands of *ʻōhiʻa* and Christmas berry. Taller vegetation in the project area clearly shows the sculpting effect of the near constant winds. (Tomonari-Tuggle 1998:3)

During the current study, ground visibility in this area was good, and the vegetation was a mix of thick grasses and shrubs with stands of ironwood (Figure 8).

Figure 8. Typical vegetation cover in the *mauka* portion of the project area, view to southeast.

BACKGROUND

To generate a set of expectations regarding the nature of archaeological resources that might be encountered within the current study area, and to establish an environment within which to assess the significance of any such resources, previous archaeological studies relative to the project area and a general historical context for the region are presented.

Previous Archaeological Research

Nine previous archaeological studies were conducted for the KWP Phase 1 project area. These studies included a reconnaissance survey of twenty-seven wind turbine locations (Tomonari-Tuggle 1998), a study of an upland *heiau* site (Site 5232; Athens 2002) and a preservation plan for that *heiau* (Tomonari-Tuggle and Rasmussen 2005), a supplemental survey of the wind turbine pad alignments (Magnuson 2003), a supplemental survey for a proposed access road (Athens 2004), a reconnaissance survey of the southern portion of a new low impact road (Rasmussen 2005a), a supplemental reconnaissance survey within the SMA zone for a proposed staging area (Rasmussen 2005b, 2005c), and an inventory survey of the entire proposed development area (Clark and Rechtman 2005). Three of these studies included portions of the current project area (Clark and Rechtman 2005; Rasmussen 2005a; Tomonari-Tuggle 1998). In addition to these studies, an archaeological survey report (Tomonari-Tuggle and Tuggle 1991) and a cultural resource management plan (Tomonari-Tuggle 1995) were prepared for the Lahaina Pali Trail, a portion of which crosses through the current project area; an inventory survey was conducted for MECO transmission lines that mark the *mauka* terminus of the *makai* portion of the current project area (Hammatt et al. 1996; Robins et al. 1994); and an inventory survey of 333 acres for the alternative proposed location for KWP Phase 2 (Clark and Rechtman 2006). The findings of the previous archaeological studies are summarized below and their locations are shown in Figure 9.

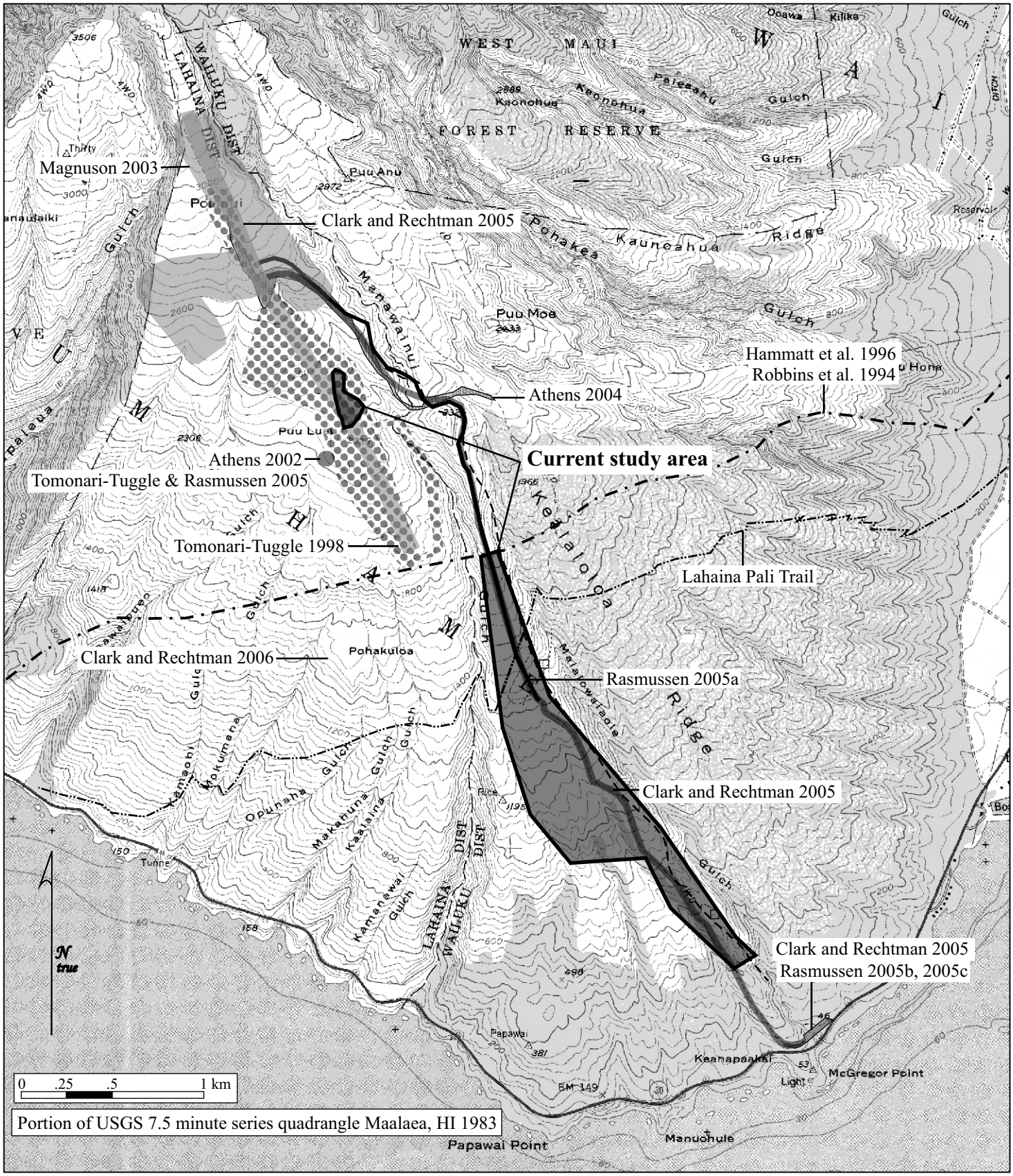


Figure 9. Previous archaeological studies.

Tomonari-Tuggle and Tuggle (1991) conducted an archaeological survey of two demonstration trails for the Hawai‘i statewide trail and access system. One of the demonstration trails was the Historic Lahaina Pali trail, a portion of which runs *makai* of the current project area. This trail was constructed around 1841 to accommodate horse traffic between the towns of Lahaina and Wailuku. Tomonari-Tuggle (1995) later prepared a cultural resource management plan for the trail as well. The trail is currently open to the public as part of the Na Ala Hele Statewide Trail and Access System. Tomonari-Tuggle and Tuggle describe the trail thusly:

> The Lahaina Pali trail extends 4.5 miles across the lower southern slopes of West Maui Mountains. At its west end, the trail is anchored inland of the Honoapili‘ilani Highway just east of Ukumehame State Beach Park. Its east end is located just inland of the pineapple fields near Ma‘alaea Harbor. The trail covers an elevation range from about 100 feet to 1600 feat above sea level. (1991:5)

During the survey of the Lahaina Pali Trail Tomonari-Tuggle and Tuggle (1991) recorded eighteen archaeological sites (Sites 2816 to 2833) along its route, but they did not assign a Site number to the trail itself. Sixteen of the sites were related to the construction and use of the trail or the old coastal road. These sites included alignments, enclosures, walls, petroglyphs, terraces, and C-shaped structures. The two sites not related to the trail included a midden scatter (Site 2816) and a rock shelter (Site 2833). Both of these sites were determined to be of likely Precontact Hawaiian origins. One of the recorded sites (Site 2825) is located *mauka* of trail within Manawainui Gulch along the western edge of the current project area. Tomonari-Tuggle describes Site 2825 as a:

> …complex of petroglyphs and retaining walls; petroglyphs are historic names scratched into boulder outcrop adjacent to trail and about 8 m above trail; one inscription in upper set is the date “1874”; stacked boulder retaining walls up to 1.5 m high, built into natural outcropping on E side of gulch; possible cupboard in outcrop, 1x.50m, top of cliff overhang is 1 m above cupboard surface; stacked boulder wall continues discontinuously upstream about 70 m to an old fencepost. (1995:44)

Robins et al. (1994) conducted an archaeological inventory survey of a then proposed 14.7-mile long transmission line corridor from Mā‘alaea to Lahaina. The alignment of the transmission lines crosses the general project area at an elevation of approximately 1,880 feet above sea level. A later survey for access roads leading to the transmission lines was conducted by Hammatt et al. (1996). While these two surveys did locate a number of sites including Historic irrigation ditches, a Historic dam, Historic cattle walls, and Precontact temporary shelters, wind breaks, enclosures, and agricultural features, no archaeological resources were encountered in the vicinity of the current project area.

Archaeological studies of the previously developed portion of the Kaheawa Wind Power project area began in 1998 with a reconnaissance survey of twenty-seven proposed wind turbine locations (Tomonari-Tuggle 1998). This survey took place at elevations ranging from roughly 2,000 to 2,900 feet above sea level. The survey area included a 200-foot wide by roughly 1.5-mile long corridor following a line of five anemometer towers and a potion of Manawainui Gulch extending inland from the MECO transmission line inland approximately 3,000 feet. The only cultural sites observed during the reconnaissance survey were a concrete water trough and a metal waterline. Tomonari-Tuggle concludes that:

> 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 the pipeline, there are no remains of cattle ranching, the only identified use of this area in historic and modern times. (1998:15)

In 1999 a brush fire burned a portion of the wind farm project area, removing some dense brush from the southwestern edge of Puʻu Lūʻau, and revealing the presence of an upland *heiau* in Ukumehame Ahupuaʻa (Site 50-50-09-5232). The location of the *heiau* places it slightly to the west of the area studied by Tomonari-Tuggle (1998). Mr. Ed Lindsey, a cultural monitor for the wind farm project, discovered the site in late 1999 and notified Dr. Melissa Kirkendall, staff archaeologist at the Maui Branch office of the SHPD (Athens 2002:1). After a field visit by SHPD staff members, it was recommended that a qualified archaeologist document the *heiau* in detail. In 2002 IARII conducted archaeological investigations at the *heiau* that included site mapping, photographs, and subsurface testing (Athens 2002).

According to Athens (2002), the *heiau* consists of two adjacent stone enclosures joined by a massive central wall, with one of the enclosures displaying a notch on one side. Excavation inside the notched enclosure revealed a dense deposit of charcoal associated with use of the *heiau*. An AMS radiocarbon determination on charcoal from a short-lived wood taxon (*Chamaesyce* sp.) indicated that the *heiau* likely dated to AD 1670-1770. Several pieces of branch coral were also recovered from the *heiau*, further confirming the religious nature of the site. No food (marine shell or animal bone) or tool (basalt or volcanic glass flake debris, abraders) remains were found either in the excavation or on the surface of the site.

Tomonari-Tuggle and Rasmussen (2005) prepared a preservation plan for the *heiau* (on behalf of the Michael Gresham of Makani Nui Associates, LLC). The plan calls for several short-term preservation measures including a temporary buffer of 100 to 200 feet around the entire site (this buffer was to be marked by 4 to 6 foot high construction fencing prior to any construction activities), monitoring by a qualified archaeologist during any construction activities that take place within 500 feet of the *heiau*, for a pre-construction briefing to be conducted by a qualified archaeologist with the project manager, construction supervisors, and crews prior to any ground alteration activity, and that a report be prepared detailing these short-term preservation measures and submitted to SHPD (Tomonari-Tuggle and Rasmussen 2005:11-14). Long-term preservation measures called for in the plan include the creation of permanent signage and markers around the site, education for individuals and organizations having access to the project area, and community involvement in the maintenance and protection of the site (Tomonari-Tuggle and Rasmussen 2005:14-15). The long-term preservation of this site would be the responsibility of the State. All of the short-term preservation measures proposed by Tomonari-Tuggle and Rasmussen (2005) were followed during the construction of the existing wind farm, but the long-term preservation measures have not yet been implemented.

In 2003, IARII conducted a supplemental archaeological survey of a revised alignment for wind turbine pad locations (Magnuson 2003). This supplemental survey included three 200-foot wide corridors for two possible turbine rows and an access road connecting them. The survey corridor extended a total distance of 2,130 meters from elevations of 2,400 to 3,100 feet above sea level. As a result of the survey one site, a watering trough previously noted by Tomonari-Tuggle (1998), was relocated, mapped in detail, photographed, and assigned an SIHP site number (Site 50-50-09-5402). Inscriptions in the concrete of the trough indicate that Site 5402 was built in 1943 (Magnuson 2003).

In 2004, IARII conducted a supplemental archaeological survey for a portion of an access road leading to the existing wind farm (Athens 2004). The survey area consisted of a 75-meter wide corridor stretching 2.5 kilometers northwest from an existing jeep road across Manawainui Gulch to the previously surveyed wind farm area. As a result of the survey two small rock piles that probably served as cairns (Sites 50-50-09-5625 and 50-50-09-5626) were located and recorded. Site 5625 was located on a natural bench immediately upslope of a small unnamed cinder cone within a dense growth of ironwood samplings, and Site 5626 was situated on the edge of a small ridge descending into Manawainui Gulch from its western edge (Athens 2004:2). Athens (2004:3) concluded that the two stacked rock piles, probably cairns, were fully documented, and no further archaeological documentation was needed. In addition to these sites, a single brass 45-70 cartridge casing manufactured by Winchester Repeating Arms Company between 1866 and 1932 was also discovered along the western edge of Manawainui Gulch (Athens 2004:3).

In 2005, IARII conducted a supplemental archaeological reconnaissance survey of a new proposed low impact road leading to the existing wind farm that passed through the current project area (Rasmussen 2005a). This survey area consisted of a corridor approximately 75 meters wide that extended from roughly 1,400 to 2,300 feet above sea level (Rasmussen 2005a:6). The corridor commenced at an existing access road, followed a narrow ridge to the northwest, and eventually crossed Manawainui Gulch and joined up with the wind turbine locations. As a result of the reconnaissance survey three previously unrecorded archaeological sites thought to be of traditional Hawaiian origins were discovered (Sites 5648, 5649, and 5650). Two of the recorded sites (Sites 5648 and 5650) were located outside (to the west of) the actual road survey corridor. Site 5648 falls within the boundaries of the current survey area.

Site 50-50-09-5648, located between ca. 1,280 and 1,420 feet above sea level, consisted of six C-shaped rock shelters (Features 1, 2, 5, 6, 7, and 9), a possible C-shaped rock structure (Feature 4), one modified outcrop (Feature 10), and a cupboard (Feature 3). Marine shell was observed near Feature 4. Based on the presence of the shell and the formal attributes of the features, Site 5648 was interpreted as being used for habitation, perhaps related to the Lahaina Pali Trail, or an earlier trail (Rasmussen 2005a:7). Site 50-50-09-5649, located between ca. 1,880 and 1,980 feet above sea level, consisted of a rock cairn (Feature 11) and modified outcrop (Feature 12). Site 50-50-5650, located at the top of an unnamed cinder cone at an elevation of ca. 2,300 feet above sea level, consisted of four rock cairns (Features 13 to 16). Rasmussen concluded that, "the location (on top of a *pu'u*) and type of features present (cairn with linear stones that may be fallen upright stones) suggest that this site may have a ceremonial function" (2005a:8).

Later in 2005, IARII conducted a supplemental archaeological reconnaissance survey of a roughly 1.75-acre SMA area located along the northern (*mauka*) edge of Honoapili'ilani Highway (Rasmussen 2005b). As a result of that survey three archaeological sites were recorded. In the Rasmussen (2005b) report the sites are referred to with temporary site numbers, but in a letter dated February 11, 2005 the sites are referred to with SIHP site numbers (Rasmussen 2005c). The three recorded sites included a Historic road remnant (Site 50-50-09-5652), a traditional Hawaiian habitation area comprised of several rough features on a small knoll north of the staging area (Site 50-50-09-5654), and set of concrete steps with the date 1908 inscribed into one of the steps (Site 50-50-09-5654). According to Rasmussen (2005b) only Site 5652 was located within the SMA project area, and according to Rasmussen (2005c) all three sites were located outside of the project area. Nevertheless, Rasmussen (2005c:2) suggests that measures be taken to protect the sites during any construction activities in the area, and recommended that a full archaeological inventory survey be conducted of the access road leading to the proposed wind farm area prior to any development.

Following all of the preliminary work conducted by IARII, Rechtman Consulting, LLC conducted an archaeological inventory survey of the entire existing wind farm project area (Clark and Rechtman 2005). As a result of the inventory survey seven previously identified archaeological sites and two newly identified sites were recorded. The previously identified sites included the Historic Lahaina Pali Trail, a section of Historic highway (Site 4696), a concrete watering trough (Site 5402), a lone cairn (Site 5625), a cairn and a modified outcrop located next to one another (Site 5649), a terraced section of old road (Site 5652), and the remains of a Historic structure (Site 5654). The newly identified sites included a possible privy (Site 5714) and a Historic hoist location (Site 5715). Two isolated finds, consisting of marine shell fragments and an adze fragment, were also discovered. Five other archaeological sites previously recorded by IARII outside the boundaries of the current project area were also relocated. These sites included an upland *heiau* (Site 5352), a lone cairn (Site 5626), a Precontact habitation complex located between 1,280 and 1,420 feet above sea level (Site 5648), a grouping of four cairns on top of an unnamed *pu'u* (Site 5650), and a Precontact habitation complex located at approximately 70 feet above sea level (Site 5653). Clark and Rechtman summarized the findings within the KWP Phase 1 project area thusly:

> A review of archival resources and previous archaeological studies, combined with the findings of the current inventory survey, indicates that Precontact use of the project area centered around coastal habitation and the exploitation of marine resources, as indicated by Site 5653. A network of trails may have connected the coastal habitation

> area with inland resource areas (Devereux et al. 1999). Site 5648 may have been a Precontact habitation area located along one of these trails, or perhaps an early Historic site related to the use of the Lahaina Pali trail (Rasmussen 2005a). If a Precontact *mauka/makai* trail route traversed the current project area, then it likely accessed inland resource areas, and may have connected to trails leading to other areas of West Maui. No evidence of a Precontact trail was observed during the current survey, and it is likely that if one did exist, it was destroyed by the McGregor Point jeep road (Devereux et al. 1999). In late Precontact times trails likely ran to Site 5352, an inland *heiau* located on Puʻu Lūʻau (Athens 2002). Isolated marine shell fragments and an adze fragment observed within the wind turbine survey corridor may have been dropped along such a trail route leading to or from the *heiau*.
>
> Sites related to Historic use of the current project area are far more numerous than Precontact ones. Recorded Historic sites indicate that the area along the old Highway alignment (Site 4696) was the primary focus of Historic use. The date "1908" within the concrete stairs at Site 5654, indicates that a Historic structure was in use on the ridge to the west of Malalowaiole Gulch around that time period. Site 5652, a terraced roadbed may have run from Site 4696 to the structure. A possible privy (Site 5714) and a Hoist location (Site 5715) were also located in the area. All of these sites may relate to the use of the current project area for cattle ranching purposes. The land in the vicinity of the current project area was leased for ranching purposes and used as pasture from the late 1850s to the early 1990s (Tomonari-Tuggle 1998). The only site recorded in the extreme inland portions of the current project area was a concrete watering trough constructed in 1943 (Site 5402).
>
> In addition to these sites the Lahaina Pali trail crosses the current project area. This Historic trail was constructed around 1841 for horse travel between Wailuku and Lahaina. The trail fell into disuse approximately fifty years later with the construction of a carriage road (Site 4696) along the coast in Ukumehame Ahupuaʻa (Tomonari-Tuggle and Tuggle 1991). The trail brought numerous Historic travelers across the lower slopes of the West Maui Mountains, and it continues to bring modern day visitors to the area as part of the *Nā Ala Hele* Statewide Trail and Access System. [2005:40]

As the alternative proposed location for KWP Phase 2, in 2006 Rechtman Consulting, LLC conducted an archaeological inventory survey of a roughly 333-acre project area located north and west of the current study area (Clark and Rechtman 2006). As a result of their survey Site 5232, an upland *heiau* previously recorded by Athens (2002) was relocated, and five new sites including a windbreak shelter (Site 6218), three cairn (Sites 6219, 6220, and 6221), and a Historic ranching area containing the remains of a concrete trough and two recently burned wooden structures (possible troughs; Site 6222) were recorded within the project area. Two segments of an old metal waterline associated with Site 6222 also crossed the project area from north to south. With the exception of the previously identified *heiau*, all of the newly recorded archaeological sites were present within the southern portion of the project area *makai* of the existing wind farm. The *heiau* (Site 5232) is located along the southwestern flank of Puʻu Lūʻau near the western boundary of the existing wind farm. This site has a previously approved and partially implemented preservation plan (Tomonari-Tuggle and Rasmussen 2005). The site was examined and photographed during the Clark and Rechtman (2006) survey, but no new work was conducted at it, and no new features were discovered in its vicinity. In addition to the recorded archaeological sites a single, isolated piece of branch coral was found on the ground surface to the west of Site 6218 and the old metal waterline.

Cultural-Historical Context

A generalized Cultural-Historical model for the Hawaiian Islands, with specific reference to Maui Island, and Ukumehame Ahupuaʻa, is presented in order to better understand the current survey area within its regional context.

A Generalized Model of Hawaiian Prehistory

The generalized cultural sequence that follows is based on Kirch's (1985) model. The Settlement or Colonization Period is believed to have occurred in Hawaiʻi between A.D. 300–600 from the southern Marquesas Islands. This was a period of great exploitation and environmental modification, when early Hawaiian farmers developed new subsistence strategies by adapting their familiar patterns and traditional tools to their new environment (Kirch 1985; Pogue 1978). Their ancient and ingrained philosophy of life tied them to their environment and kept order. Order was further assured by the conical clan principle of genealogical seniority (Kirch 1984). According to Fornander (1969), the Hawaiians brought from their homeland certain universal Polynesian customs: the major gods *Kane, Ku*, and *Lono*; the *kapu* system of law and order; cities of refuge; the ʻ*aumakua* concept; various superstitions; and the concept of *mana*.

The Development Period (A.D. 600–1100) brought about a uniquely Hawaiian culture. The portable artifacts found in archaeological sites of this period reflect not only an evolution of the traditional tools, but some distinctly Hawaiian inventions. The adze (*koʻi*) evolved from the typical Polynesian variations of plano-convex, trapezoidal, and reverse-triangular cross-section to a very standard Hawaiian rectangular quadrangular tanged adze. The two-piece fishhook and the octopus-lure breadloaf sinker are Hawaiian inventions of this period, as are ʻ*ulu maika* stones and *lei niho palaoa*. The later was a status item worn by those of high rank, indicating a trend toward greater status differentiation (Kirch 1985).

The Expansion Period (A.D. 1100–1650) is characterized by the greatest social stratification, major socioeconomic changes, and intensive land modification. Most of the ecologically favorable zones of the windward and coastal regions of all major islands were settled and the more marginal leeward areas were being developed. The greatest population growth occurred during the Expansion Period. Subsistence patterns intensified as crop farming evolved into large irrigated field systems and expanded into the marginal dryland areas. The *loko* or fishpond aquaculture flourished during this period (Bellwood 1978; Kirch 1985). It was during the Expansion Period that a second major migration settled in Hawaiʻi, this time from Tahiti in the Society Islands (Kamakau 1976).

The *ahupuaʻa* concept was established during the A.D. 1400s (Kirch 1985), adding another component to a then well-stratified society. This land unit became the equivalent of a local community, with its own social, economic, and political significance. *Ahupua'a* were ruled by *aliʻi ʻai ahupuaʻa* or lesser chiefs; who, for the most part, had complete autonomy over this generally economically self-supporting piece of land, which was managed by a *konohiki*. *Ahupuaʻa* were usually wedge or pie-shaped, incorporating all of the eco-zones from the mountains to the sea and for several hundred yards beyond the shore, assuring a diverse subsistence resource base (Hommon 1986). The *aliʻi* and the *makaʻāinana* (commoners) were not confined to the boundaries of the *ahupuaʻa*; when there was a perceived need, they also shared with their neighbor *ahupuaʻa ohana* (Hono-ko-hou 1974).

Handy et al. relate that, "Maui was the only island that had a paved way that ran all the way around both its east and west ends" (1991:489). This road was known as the *Alaloa* (long road). Martha Foss Fleming (1933:3-9 in Handy et al. 1991) writes that:

> …This road was built in about 1516 by Kihapiʻilani, after his conquest and unification of the whole island. It was paved with stones along much of its extent, hence it was referred to as the "*kipapa* (pavement) of Kihapiʻilani." Beaches were used as crossings where gulches came down to the shore. There were no bridges; and beaches were also used along the seashore in many localities…Travelers were sometimes ferried across streams by canoe, or along shore, as between ʻOlowalu and Maʻalaea, around the rough southern tip of West Maui [this includes the area of the current study]. (1991:489).

The *ahupuaʻa* was further divided into smaller sections such as the *ʻili, moʻoʻaina, paukuʻaina, kihapai, koele, hakuone*, and *kuakua* (Hommon 1986, Pogue 1978). The chiefs of these land units gave their allegiance to a territorial chief or *moʻi* (king). *Heiau* building flourished during this period as religion became more complex and embedded in a sociopolitical climate of territorial competition. Monumental architecture, such as *heiau*, "played a key role as visual markers of chiefly dominance" (Kirch 1990:206). At least four *heiau* are known to exist in Ukumehame Ahupuaʻa; Ukumehame Heiau (Site 50-50-08-03) and Hikiʻi Heiau (Site 50-50-08-02), located on either side of Ukumehame Gulch to the west of the current project area, Kawaiʻaole Heiau (Site 50-50-08-04) located near the coast to the east of the current project area, and an unnamed upland *heiau* located on Puʻu Lūʻau (Site 50-50-09-5232) to the west of the current project area at a similar elevation (Athens 2002; Devereux et al. 1999; Walker 1931).

The Proto-Historic Period (A.D. 1650–1795) is marked by both intensification and stress. Wars occurred between intra-island and inter-island polities. This period was one of continual conquest by the reigning *aliʻi* of all islands. Kamakau (1992:74) relates that Alapaʻi, a Hawaiʻi Island chief, spent a whole year in preparation for a war with Maui, battles of which may have taken place nearby the current project area. Kamakau writes:

> It was 1738 that he set out for the war in which he swept the country…It employed the usual method of warfare of drying up streams…The wet taro patches and the brooks were dried so that there was no food for Ka-uhi [a Maui chief] or for the country people. Alapaʻi's men kept close watch over the brooks of Olowalu, Ukumehame, Wailuku, and Honokawai. (1992:74)

However, Alapaʻi's forces, consisting of some 8,440 warriors, were surprised and slaughtered by Peleioholani, an Oʻahu chief in cahoots with Kauhi, whose force consisted of only 640 warriors. According to Kamakau (1992:74), Alapaʻi regrouped and held Lahaina District from Ukumehame to Mala on the north. When Peleioholani tried to join his forces with Kauhi's forces, Alapaʻi forces, led by Kalaniʻōpuʻu and Keoua, attacked at Puʻunene and were victorious.

On Hawaiʻi Island, Keʻeaumoku, son of Keawepoepoe, set up a fort at Pololu and Honokane; he was attacked there by Kalaniʻōpuʻu, so he moved to Maui. About A.D. 1759 Kalaniʻōpuʻu conquered East Maui, defeating his wife's brother, the Maui king Kamehamehanui, by using Hana's prominent Puʻu Kauʻiki as his fortress. He appointed one of his Hawaiʻi chiefs, Puna, as governor of Hana and Kipahulu. Kahekili became king of Maui in A.D. 1766 when Kamehamehanui died following an illness. Keʻeaumoku took his widow, Namahana, a cousin of Kamehameha I, as his wife. Their daughter, Kaʻahumanu, the future favorite wife of Kamehameha I, was born in a cave at the base of Puʻu Kauʻiki, Hana, Maui in A.D. 1768 (Kamakau 1992). In A.D. 1775 Kalaniʻōpuʻu and his Hana forces raided and destroyed the neighboring Kaupo district, then launched several more raids on Molokai, Lanai, Kahoʻolawe, and parts of West Maui. It was at the battle of Kalaeokaʻilio that Kamehameha, a favorite of Kalaniʻōpuʻu, was first recognized as a great warrior and given the name of Paiʻea (hard-shelled crab) by the Maui chiefs and warriors (Kamakau 1992). During the battles between Kalaniʻōpuʻu and Kahekili (1777–1779), Kaʻahumanu and her parents left Maui to live on the island of Hawaiʻi (Kamakau 1992).

History After Contact

Captain James Cook landed in the Hawaiian Islands on January 18, 1778. Ten months later, on a return trip to Hawaiian waters, Kalaniʻōpuʻu, who was at war with Kahekili, visited Cook on board the *Resolution* off the East coast of Maui. Kamehameha observed this meeting, but chose not to participate. The following January [1779], Cook and Kalaniʻōpuʻu met again in Kealakekua Bay and exchanged gifts. In February, Cook set sail; however, a severe storm off the Kohala coast damaged a mast and they had to return to Kealakekua. Cook's return occurred at an inopportune time, and this misfortune cost him his life (Kuykendall and Day 1976).

Around A.D. 1780 Kalaniʻōpuʻu proclaimed that his son Kiwalao would be his successor, and he gave the guardianship of the war god Kuʻkaʻilimoku to Kamehameha. Kamehameha and a few other chiefs were concerned about their land claims, which Kiwalao did not seem to honor, so after usurping Kiwalao's authority with a sacrificial ritual, Kamehameha retreated to his district of Kohala. While in Kohala, Kamehameha farmed the land, growing taro and sweet potatoes (Handy et al. 1991). After Kalaniʻōpuʻu

died in A.D. 1782 civil war broke out and Kiwalao was killed. The wars between Maui and Hawaii continued until A.D. 1795 (Kuykendall and Day 1976; Handy et al. 1991).

In A.D. 1790 two American vessels, the *Eleanora* and *Fair American*, were in Hawaiian waters. Following an altercation between his crew and natives, the Captain of the *Eleanora* massacred more than 100 natives at Olowalu [Maui], then sailed away leaving one of its crew, John Young, on land. The other vessel, the *Fair American*, was captured and its crew killed except for one member, Issac Davis. Kamehameha also observed this but did not participate, although he did prevent Young and Davis from leaving. He also kept the vessel as part of his fleet. Young eventually became governor of the island of Hawai‘i. By 1796 Kamehameha had conquered all the island kingdoms except Kauai. It wasn’t until 1810, when Kaumuali‘i of Kauai gave his allegiance to Kamehameha, that the Hawaiian Islands were unified under one ruler (Kuykendall and Day 1976).

Demographic trends during this period indicate population reduction in some areas, due to war and disease, yet increases in others, with relatively little change in material culture. However, there was a continued trend toward craft and status specialization, intensification of agriculture, *ali‘i* controlled aquaculture, upland residential sites, and the enhancement of traditional oral history. The Kū cult, *luakini heiau*, and the *kapu* system were at their peaks, although western influence was already altering the cultural fabric of the Islands (Kirch 1985; Kent 1983). Foreigners had introduced the concept of trade for profit, and by the time Kamehameha I had conquered O‘ahu, Maui and Moloka‘i, in 1795, Hawaiian natives were actively engaged in a Western market system (Kent 1983). This marked the end of the Proto-Historic Period and the end of an era of uniquely Hawaiian culture.

Hawai‘i’s culture and economy continued to change drastically as capitalism and industry established a firm foothold. The sandalwood (*Santalum ellipticum*) trade, established by Euro-Americans in 1790 and turned into a viable commercial enterprise by 1805 (Oliver 1961), was flourishing by 1810. This added to the breakdown of the traditional subsistence system, as farmers and fishermen were ordered to spend most of their time logging, resulting in food shortages and famine that led to a population decline. Kamehameha I did manage to maintain some control over the trade (Kuykendall and Day 1976; Kent 1983).

Kamehameha I died on May 8, 1819 in Kailua-Kona, and once again the culture of Hawai‘i was to change radically. Six months after his death, during the reign of his son and successor, Liholiho (Kamehameha II), the traditional *kapu* system that governed all social political and religious interactions was abandoned (Oliver 1961; Kuykendall and Day 1976; Kamakau 1992).

Liholiho’s cousin, Kekuaokalani, caretaker of the war god *Ku-Kailimoku*, objected to the abolition of the traditional religious system and revolted. By December of 1819 the revolution was quelled. Kamehameha II sent edicts throughout the kingdom renouncing the ancient state religion, ordering the destruction of the *heiau* images, and ordering that the *heiau* structures be destroyed or abandoned and left to deteriorate. He did, however, allow the personal family religion, the *‘aumakua* worship, to continue (Oliver 1961; Kamakau 1992).

The religious, socioeconomic, and demographic changes that gradually took place in the period between 1790 and the 1840s throughout the Hawaiian Kingdom, promoted the establishment of a Euro-American style of land ownership, and the Great *Māhele* was the vehicle for determining ownership of the native land. During this period (1848-1899), the *Māhele* defined the land interests of the King (Kamehameha III), the high-ranking chiefs, and the low-ranking chiefs, the *konohiki*. The chiefs and *konohiki* were required to present their claims to the Land Commission to receive awards for lands provided to them by Kamehameha III. They were also required to provide commutations to the government in order to receive royal patents on their awards. The lands were identified by name only, with the understanding that the ancient boundaries would prevail until the land could be surveyed. This process expedited the work of the Land Commission and speeded the transfers (Chinen 1961:13).

During this process all lands were placed in one of three categories: Crown Lands (for the occupant of the throne), Government Lands, and Konohiki Lands. All three types of land were subject to the rights of

the native tenants. Commoners could make claims for land, and if substantiated, they would receive awards referred to as *kuleana*, from the Land Commission. During this period, other land grants were also made to individuals directly from the Kingdom. In 1862, the Commission of Boundaries (Boundary Commission) was established in the Kingdom of Hawai‘i to legally set the boundaries of all the *ahupua‘a* that had been awarded as a part of the *Māhele*. Subsequently, in 1874, the Commissioners of Boundaries was authorized to certify the boundaries for lands brought before them. The primary informants for the boundary descriptions were old native residents of the lands, many of which had also been claimants for *kuleana* during the *Māhele*. The information was collected primarily between 1873 and 1885. The testimonies were generally given in Hawaiian and simultaneously transcribed in English. Ukumehame Ahupua‘a was retained as Crown Lands during the *M hele.*

Ukumehame Ahupua‘a

Ukumehame Ahupua‘a straddles the boundary between the modern day judicial districts of Lahaina and Wailuku, but the *ahupua‘a* was once the easternmost of the traditional Hawaiian district of Lahaina (Tomonari-Tuggle and Tuggle 1991:8). The main productive area of the *ahupua‘a*, as described by Tomonari-Tuggle and Tuggle, was to the west of the current project area on “the broad coastal plain fronting Ukumehame Gulch and the smaller, neighboring gulches of Makiwa, Hanaula and Palaua” (1991:8) (Figure 10). On the Ukumehame plain and further inland within the gulches, Precontact peoples cultivated taro in irrigated fields. Handy (1940:103) describes taro cultivation on the flat entering Ukumehame Gulch still occurring in the 1940s. Although the *ahupua‘a* was retained as Crown Lands during the *Māhele*, forty-three claims were made for land in Ukumehame Ahupua‘a, all within the agriculturally productive gulches located to the west of the current project area. Only sixteen of the claims were awarded (Devereux et al. 1999:12). The distribution of Land Commission Awards (LCAw.) within Ukumehame Ahupua‘a supports the predicted Precontact settlement model. A smaller settlement area was located at Mā‘alaea to the east of the current project area.

Although coastal trails once ringed much of Maui, according to Handy et al. no coastal trail was present fronting the current project area because of the rough terrain, so “from ‘Olowalu [to the west of the current project area] travelers were ferried by canoe to Ma‘alaea [to the east of the current project area], thence to Makena” (1991:490). The main *mauka*/*makai* trail in the vicinity of the current project area followed Kealaloloa Ridge (Devereux et al. 1999), likely passing through the current project area. Devereux et al. (1999:12) relate that the more accessible areas of the Kealaloloa Trail were probably destroyed by a present day jeep trail.

One trail that still crosses through the current project area is the Lahaina Pali trail. This Historic trail was constructed around 1841 for horse traffic between the towns of Wailuku and Lahaina, with another branch connecting to Mā‘alaea (Tomonari-Tuggle and Tuggle 1991). Within Ukumehame Ahupua‘a the trail runs from the coast at Manawaipueo Gulch, inland to an elevation of 1,600 feet, and then back down towards the coast near Mā‘alaea. In Historic times the trail was known as a long and treacherous route. In 1841, Laura Fish Judd, a missionary who was making the trip between Lahaina and Wailuku, called the trail “the crookedest, the rockiest ever traveled by mortals” (Judd in Tomonari-Tuggle and Tuggle 1991:12). In 1847 Chester Lyman, a visitor to Maui, reiterates this point, writing that the trail “is one of the roughest and most difficult imaginable. It is all the way zigzag and winding, up steep, rocky and barren precipices, being in places dangerous on horseback (Lyman in Fleming 1933:21)” (Tomonari-Tuggle and Tuggle 1991:12).

Robbers were another danger encountered on the Lahaina Pali trail, especially on the remote section of trail in the vicinity of the current project area. The two stories provided below tell of the dangers of robbers:

> Kaiaupe was a noted female robber who lived by the pali road of Aala-loloa [Kealaloloa], Maui. She would entice men to lay with her at the edge of the pali and then kick them over the precipice with her foot. This act was known as Ka-ai-a-Kaiaupe. (T. Kelsey, from E. Sterling’s notes, Maui Historical Society in Tomonari-Tuggle and Tuggle 1991:12)

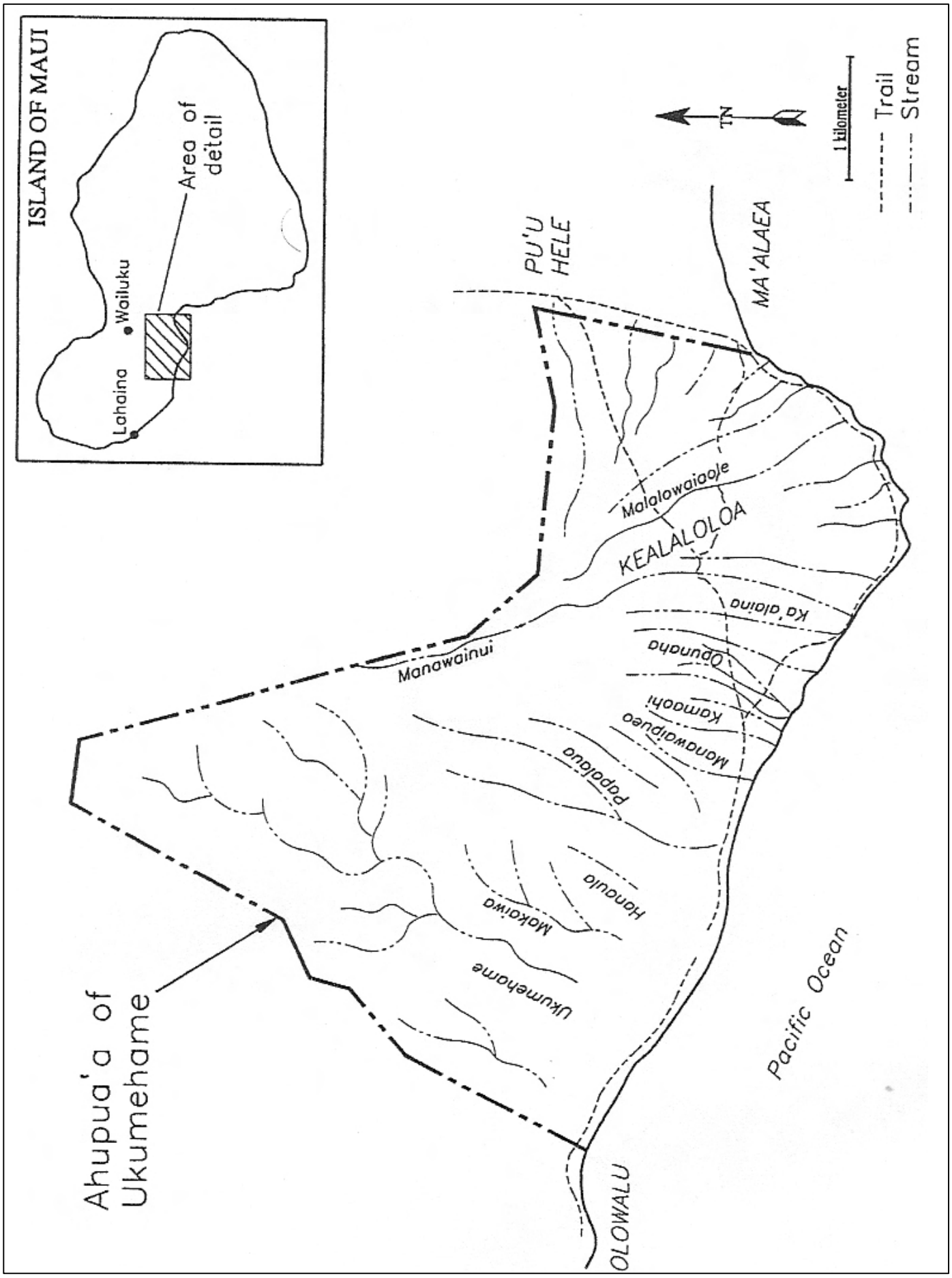


Figure 10. Gulch locations within Ukumehame Ahupua'a (from Tomonari-Tuggle 1998).

> About 1836, when I was a young lad at Lahaina, a native employed to bring letters from Wailuku to my father, reported that he was attacked by a robber on the mountain coast route not [far] from Maʻalaea Bay. In the struggle, he bit off one of the robber's big toes. The robber at once relaxed his hold and fled. In proof of his story, the messenger exhibited the bloody toe. (Dr. D. D. Baldwin, in Fleming) [Tomonari-Tuggle and Tuggle 1991:12]

By the 1850s, portions of Ukumehame Ahupuaʻa were being leased for various enterprises. An 1865 letter from William Enos and Joseph Sylva clarified a lease for the "pali of Ukumehame", which they 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 in Tomonari-Tuggle 1998:8). It appears that they had held this lease from at least the latter part of the 1850s, as an earlier letter, sent in 1858 from E. Duvauchelle to the king's land agent on Maui, William Webster, requested the Wailuku side of Ukumehame mountain, citing that Joe Sylva had related to him that he did not wish to renew his lease on this area. Nothing apparently came of the Duvauchelle letter, however, records indicate that Sylva held the lease on the land until at least 1871. Furthermore, it is apparent from the letter that the lease was for cattle ranching. Duvauchelle writes, "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 Tomonari-Tuggle 1998:8).

In 1886, the western half of Ukumehame Ahupuaʻa was listed as being leased to Olowalu Plantation Company, for sugarcane cultivation and sugar production, and the eastern half (including the current project area) was listed as leased to John Richardson and Kahahawai for cattle ranching (Tomonari-Tuggle 1998:8). The 1884, McKenney's Hawaiian Directory reveals that John Richardson was the proprietor of the Maalaea Bay Stock Ranch, with approximately 15,000 acres of pasture and mountain land, 200 head of cattle, and 100 head of horses (Bagot 1884 in Tomonari-Tuggle 1998:8). In a side note, Tomonari-Tuggle (1998:8) relates that the Maalaea Stock Ranch was listed in subsequent directories until at least 1900.

By 1889, a new carriage road was under construction from Māʻalaea to Lahaina, along the coast of Ukumehame Ahupuaʻa. With the opening of this new road, use of the mountainous Lahaina Pali Trail dwindled, and the trail eventually fell into disuse. The new road was gradually widened and straightened to accommodate vehicular use, and then oiled and paved in 1918 (Fleming 1933:22 in Tomonari-Tuggle and Tuggle 1991:13). The road was eventually abandoned in favor of the current alignment of Honoapiliʻilani Highway.

Cattle ranching continued in the vicinity of the current project area until the mid-1990s, while portions of the wetter, western half of Ukumehame Ahupuaʻa continue to be used for sugarcane cultivation. At some point in the mid-1940s the McGregor Point jeep road was bulldozed to the project area, allowing vehicular access to the *mauka* areas, and perhaps obliterating an older road or trail. The road has been subsequently maintained by ranchers, MECO, and DLNR, with newer bulldozer routes approximating the older ones. During the 1970s Maui Electric (MECO) erected power-lines between Māʻalaea and Lahaina (Devereux et al. 1999) that cross above the current project area at an elevation of approximately 2,400 feet above sea level; and a second set of power lines was established crossing the general project area at an elevation of about 1,880 feet above sea level in the late 1990s (Robins et al. 1994). In 2006 the access road to the existing wind farm was bulldozed across the current project area. It generally followed the alignment of the older jeep road until just below the Lahaina Pali Trail (Clark and Rechtman 2005).

AHUPUA‘A SETTLEMENT PATTERNS AND PROJECT EXPECTATIONS

Devereux et al. (1999:85-86) offer a detailed summary of settlement patterns in the vicinity of the current project area, describing that, besides the primary settlement area on the broad costal plain fronting Ukumehame Gulch:

> …pre-historic occupation of the Ukumehame *ahupua‘a* between the alluvial flats of Ukumehame Gulch and the Maui Island isthmus, seems to be focused on the coastal zone, particularly between Mā‘alaea Bay and McGregor’s Point. This settlement comprises at least 45 “house and shelter” sites, some of which may have been fishing shrines or *koa* (Walker 1931:43). It seems likely a major focus of this village was fishing, given the shrines, its cliff side location, and the lack of abundant agricultural land. A major *heiau* and extensive panels of petroglyphs were also identified by Walker just inland of the village complex.
>
> The steep topography and arid environment of the upper, *mauka* elevations of Ukumehame *ahupua‘a* (east of the broad coastal plain fronting Ukumehame Gulch) presents a relatively inhospitable and unproductive agricultural landscape. However, as indicated by a traditional Hawaiian trail present on the Mā‘alaea side of the region and the possible existence of comparable trails ascending *mauka* of Walker’s coastal settlement, the upper elevations of Ukumehame provide a way to the summit of West Maui and hence to the other side. Kealaloloa “long pathway” Ridge, as it name suggests, may have been the main travel route used during the prehistoric and early historic times to cross to the West Maui Mountain, with auxiliary trails once serving to connect the main travel route. This prominent landform ascends above McGregor’s Point, which apparently represents the western extent of the coastal settlement observed by Walker. The main travel route of Kealaloloa and auxiliary *mauka-makai* trails probably provided coastal residents with access to *mauka* resources (*e.g.* wild plant goods, bird catching, and stone materials), and communication with other West Maui regions.

Based on the results of previous archaeological surveys conducted within and in the vicinity of the current study area (Athens 2002, 2004; Clark and Rechtman 2005 and 2006; Magnuson 2003; Rasmussen 2005a, 2005b, 2005c; Tomonari-Tuggle 1998; Tomonari-Tuggle and Rasmussen 2005), it is known that one multi-feature Precontact temporary habitation site (Site 5648) will be present in the central portion of the main survey area. Trails may also be present that provided access to this habitation area, although the primary trail was likely converted to a 4WD road. Remnant trail routes could be marked by worn paths or cairn (Devereux et al. 1999). It is possible that additional Precontact habitation features may be encountered. If any such features are found they are expected to take the form of C-shape enclosures or stone alignments that block the prevailing trade winds. It is likely that Historic cattle ranching features are present within the project area. Such features may include concrete water troughs, metal water lines, wire fence lines, windbreak shelters, roads, or cairn that mark Historic trails. One Historic trail, the Lahaina Pali Trail, is known to pass through the project area.

FIELDWORK

Fieldwork for the current project was conducted between August 17-21, 2009 by Matthew R. Clark, B.A.., Christopher S. Hand, B.A.., and Ashton K. Dircks, B.A.., under the direction of Robert B. Rechtman, Ph.D.

Methods

The current inventory survey included a visual inspection of the entire project area. To accomplish this, fieldworkers walked east/west pedestrian transects spaced at 50-meter intervals working from the southern end of the project area to the northern end. This spacing was adequate for locating all archaeological resources. The low-lying vegetation allowed for an unobstructed view of the surface terrain. When

archaeological features (or land alterations; i.e. bulldozing, roads, etc.) were encountered, they were plotted on a map of the study area using Garmin 76s handheld GPS technology (with sub five-meter accuracy), and then (if necessary) cleared of vegetation, mapped in detail, photographed, and described using standardized site record forms. No subsurface testing was conducted during the current inventory survey. Random subsurface testing was deemed unnecessary given the geomorphic conditions of the project area.

Findings

As a result of the current inventory survey SIHP Site 5648, as recorded by Rasmussen (2005a), was relocated. The ten features comprising this site were identified and twenty new features were described. Following a discussion with DLNR-SHPD, it was decided that the Site 5648 designation would be retained for all of the related features recorded in this portion of the current study area. The thirty features of this site were assigned an alphabetic designation (A to DD) and the correlations with the earlier Rasmussen (2005a) feature designations (Features 1-10) are presented in the feature descriptions. In addition, the Lahaina Pali Trail was identified as was a section of the possible Mā‘alaea branch of that trail, a concrete water trough (SIHP Site 6665), and two seemingly modern rock piles located near the main Lahaina Pali Trail (Figure 11).

Each of the archaeological sites recorded within the project area are discussed in detail below, and their locations relative to the project area boundaries and the proposed KWP Phase 2 are shown in Figure 12.

Figure 11. One of two seemingly modern rock piles situated just above the Lahaina Pali Trail (possible dozer scarring noted).

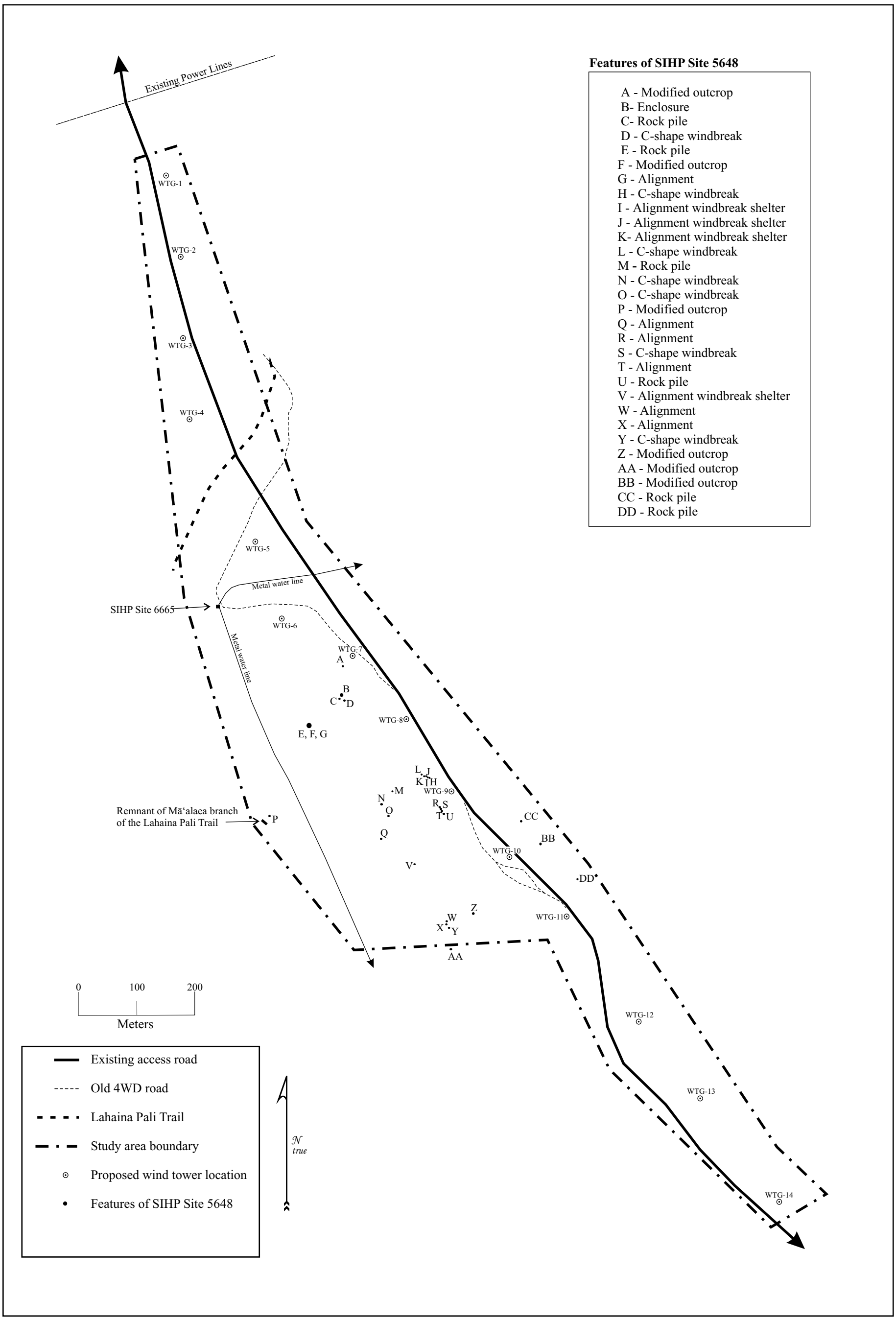


Figure 12. Project area plan view.

The Lahaina Pali Trail

The Lahaina Pali Trail is a 4.5-mile long section of a Historic trail that once connected the towns of Lahaina and Wailuku. The trail is currently part of the *Na Ala Hele* Statewide Trail and Access System. The Lahaina Pali Trail was constructed around 1841 for horse traffic, but fell into disuse approximately 50 years later when a carriage road was constructed along the coast to Lahaina (Rasmussen 2005a:5). The route of the trail crosses the current project area (Figure 13) at an elevation of roughly 1,600 feet above sea level (see Figure 12). This trail was extensively studied and thoroughly documented by Tomonari-Tuggle and Tuggle (1991) and Tomonari-Tuggle (1995). No state site number was assigned to the trail itself, but features along the trail were individually assigned state site numbers. No previously recorded sites related to the Lahaina Pali Trail are present in the immediate vicinity of the current project area. Tomonari-Tuggle and Tuggle describe the portion of the trail that crosses the current project area thusly:

> …This central section of the trail crosses the two deepest gulches and the highest point along the length of the trail. The trail is well defined, in generally excellent condition, and with minimal overgrowth.
>
> Within Manawainui Gulch, the trail is curbed, with water bars on the west side of the gulch. Where the trail crosses the gulch floor, cattle have created a wallow in the trail; there is one wiliwili tree at this point.
>
> On the gently sloping ridge between Manawainui and Malalowaiaole Gulches, the trail is a two meter wide swale, partially curbed; the area is presently used for cattle which, combined with the constant wind, keeps the vegetation close-cropped [Figure 15]. The trail in Malawaiaole Gulch has been obliterated by the McGregor Point jeep road. On the east ridge, where the jeep road continues uphill, the trail diverges slightly makai as a deeply eroded swale on which are scattered bottle glass fragments. (1991:23-25)

On an 1885 Hawaiian Government Survey Map (Figure 14) a branch of the Lahaina Pali Trail is shown to diverge from the main trail between Manawainui and Malalowaiaole Gulches (in the vicinity of the current project area) and continue on to the coast at Mā‘alaea. What may very likely be a small section of this branch of the trail was recorded during the current study (see Figure 12).

Figure 13. View to east of the Lahaina Pali Trail where it crosses the current project area.

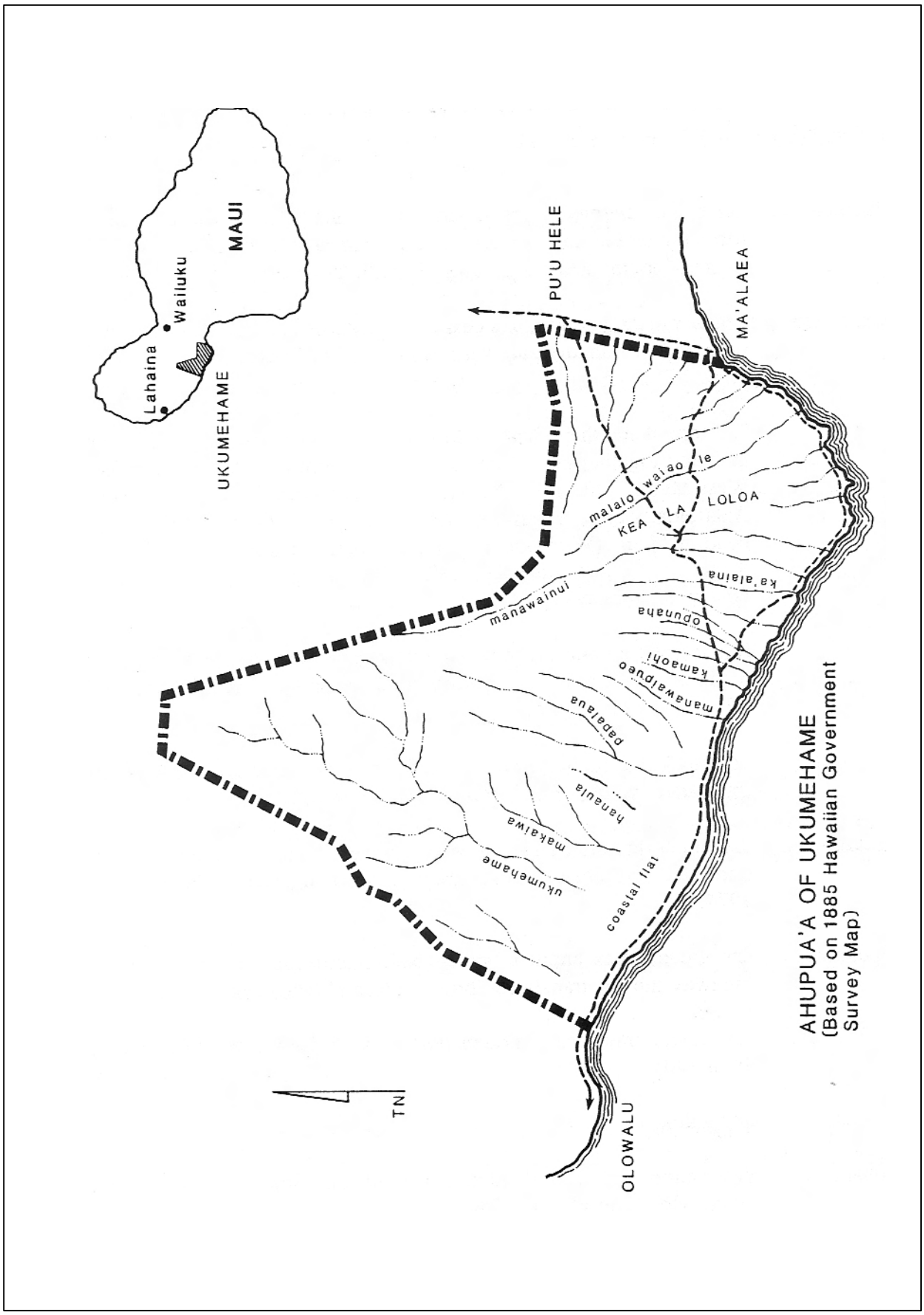


Figure 14. Map of the Lahaina Pali trail showing a branch leading to Mā'alaea (from Tomonari-Tuggle and Tuggle 1991:9).

Located approximately 13 meters southwest of Site 5648 Feature P, and constructed along the eastern edge of a natural drainage (Figure 15), is a 7 meter long section of constructed trail/roadway. The down slope edge of the construction is a stacked wall consisting of small to large cobbles oriented in a northeast/southwest direction (Figure 16). The stacking is between 0.9 an 1.1 meters tall and creates a level road bed 3.5 meters wide (Figure 17). To the southeast, this former pathway enters open pasture and is no longer distinguishable; to the northwest the trail descends the drainage and is washed out. Given its location, this trail segment appears to correlate with the branch trail that led to Mā‘alaea.

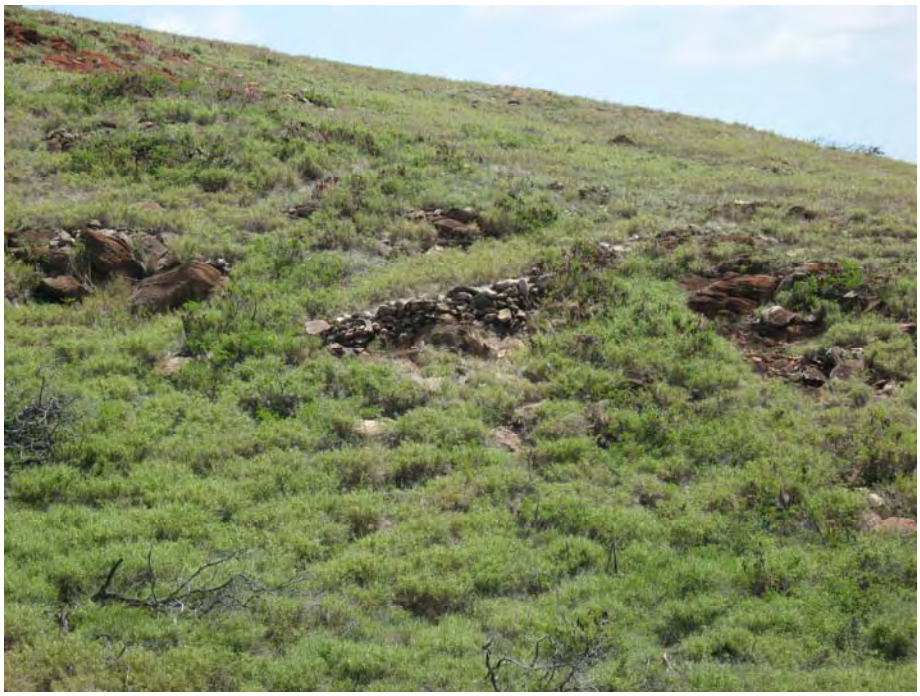


Figure 15. Remnant section of the Mā‘alaea branch of the Lahaina Pali Trail, view to the east.

Figure 16. Stacking along the down slope edge of the trail, view to the east.

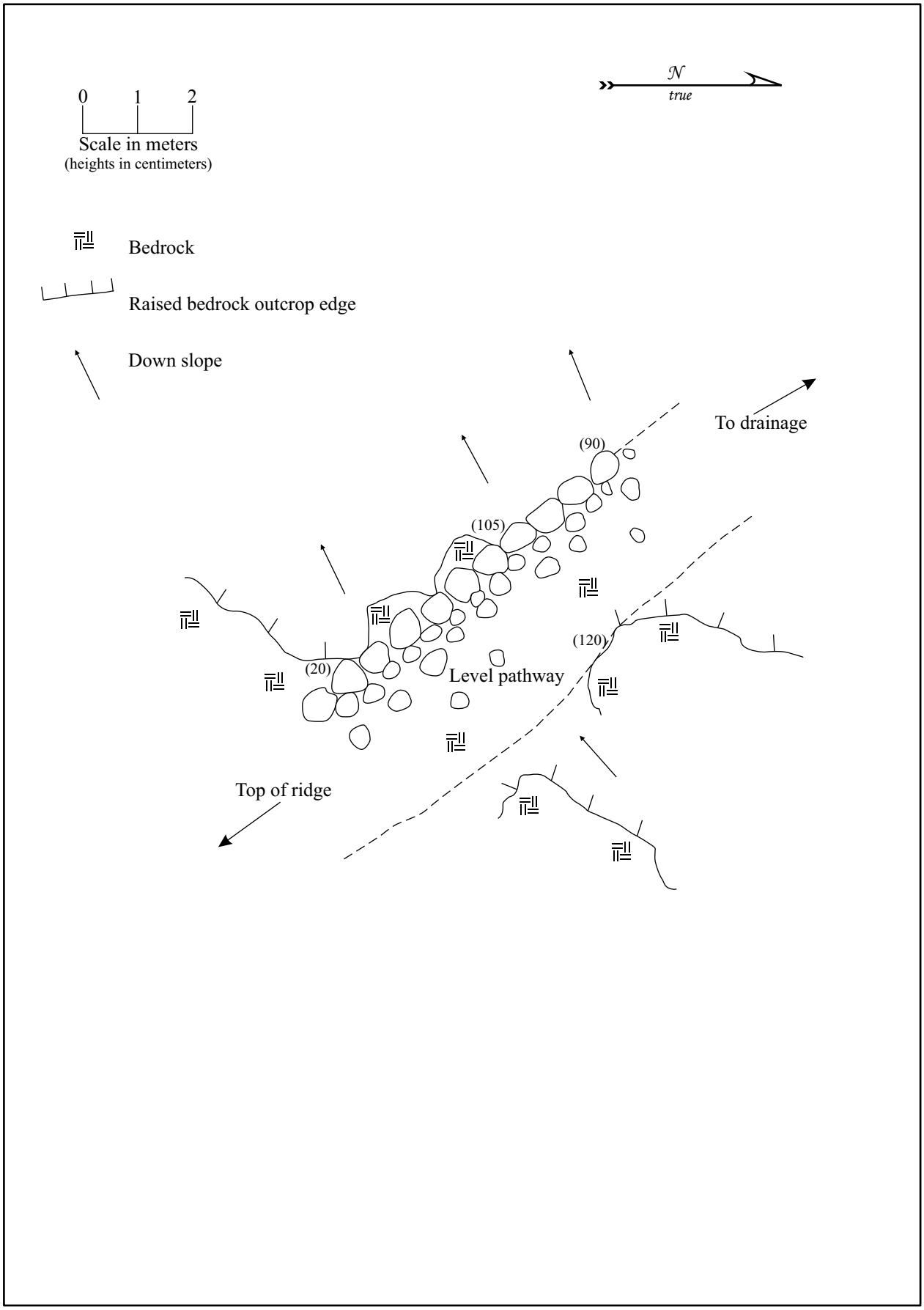


Figure 17. Remnant section of the Mā‘alaea branch of the Lahaina Pali Trail plan view.

SIHP Site 50-50-09-5648

Site 5648 was first reported by Rasmussen and described as "six C-shaped [SIC] rock structures (Feats. 1, 2, 5, 6, 7, and 9), one possible C-shaped [SIC] rock structure (Feat. 4), one modified outcrop (Feat. 10), one cupboard (Feat.3), and one rock cairn (Feat. 8)" (2005:7). She goes on to explain that "it is possible unrecorded features are present at Site 5648 since high grass limited ground visibility" (ibid.). Rasmussen's supposition was correct, as a result of the current study at total of thirty features were recorded for Site 5648. Collectively these features seem to represent temporary or short-term recurrent habitation likely associated with the use of upland trails. The historic expressions of these trails are still visible on the landscape (e.g. the Lahaina Pali Trail), but the earlier trails (perhaps even Precontact in age) are no longer discernable. Tomonari-Tuggle (1991) recorded similar sites (i.e., Site 2820 and 2828) to the west of the current study area that she believed were associated with the Lahaina Pali Trail. Overall Site 5648 retains integrity of location, design, and setting, and it is significant for the information it has provided relative to the past use of the current project area. The distribution of the Site 5648 features is shown on Figure 18.

Feature A

Feature A is a modified outcrop windbreak shelter located at the northern end of the north/south running drainage ravine (approximately 50 meters north of Feature B) (see Figure 18). This feature measures 5.0 meters by 3.5 meters and consists of a northwest/southeast running outcrop modified with a few medium cobbles piled to increase the wind blocking effect of the bedrock. The exposed bedrock along the outcrop ridge stands 0.50 to 0.70 meters above the surrounding ground surface. The cobbles used in the construction of Feature A have an average width of 0.40 meters, and stand 0.40 meters above surrounding bedrock and soil (Figure 19). The bedrock and cobbles create a total height of 0.60 to 1.10 meters on the southwest edge of this feature. A small curved section of piled cobbles extends for 1.1 meters west from the bedrock outcrop (Figure 20). Feature A was previously recorded by Rasmussen (2005) as Feature 10.

Figure 19. SIHP Site 5648 Feature A, view to the northeast.

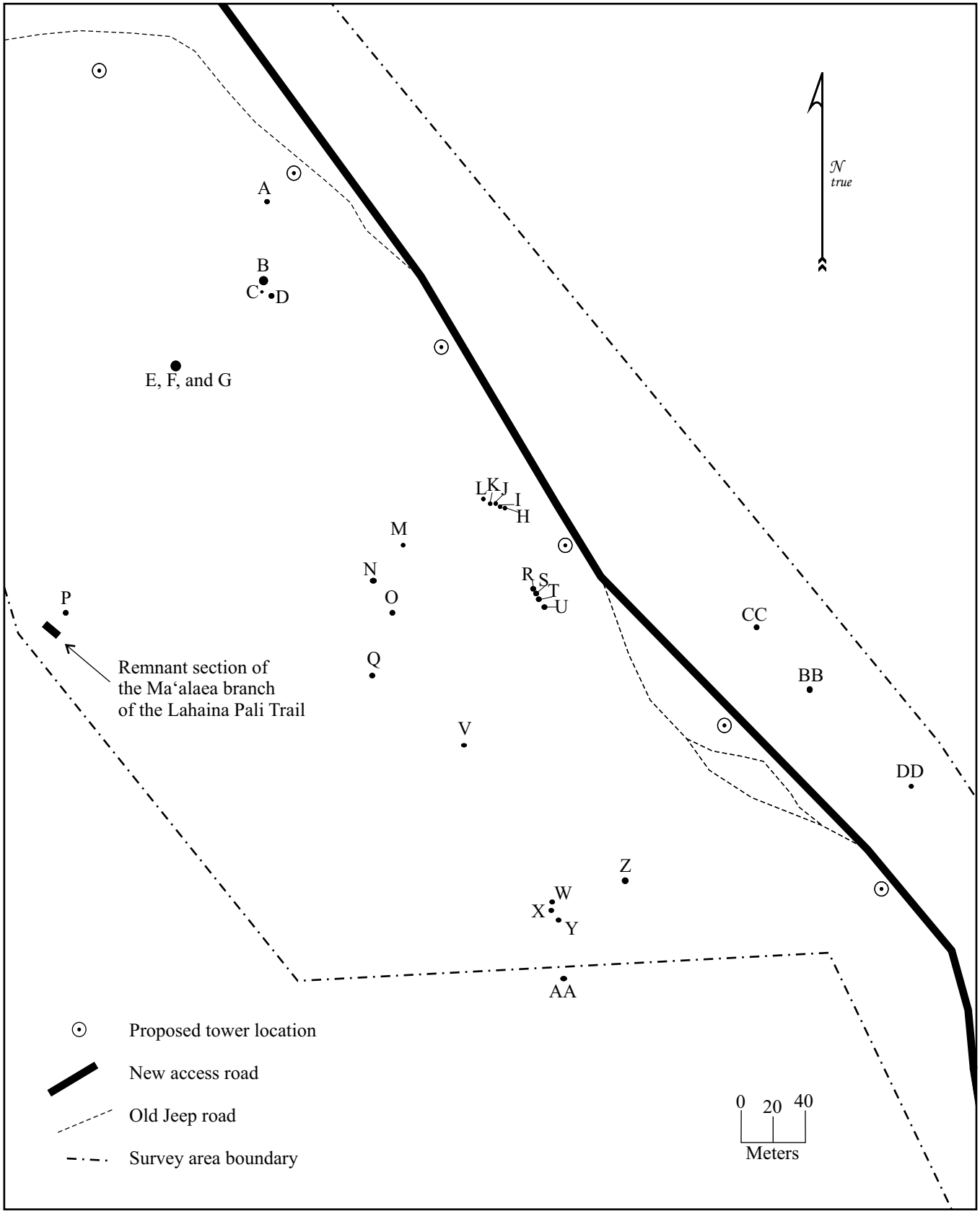


Figure 18. SIHP Site 5648 plan view.

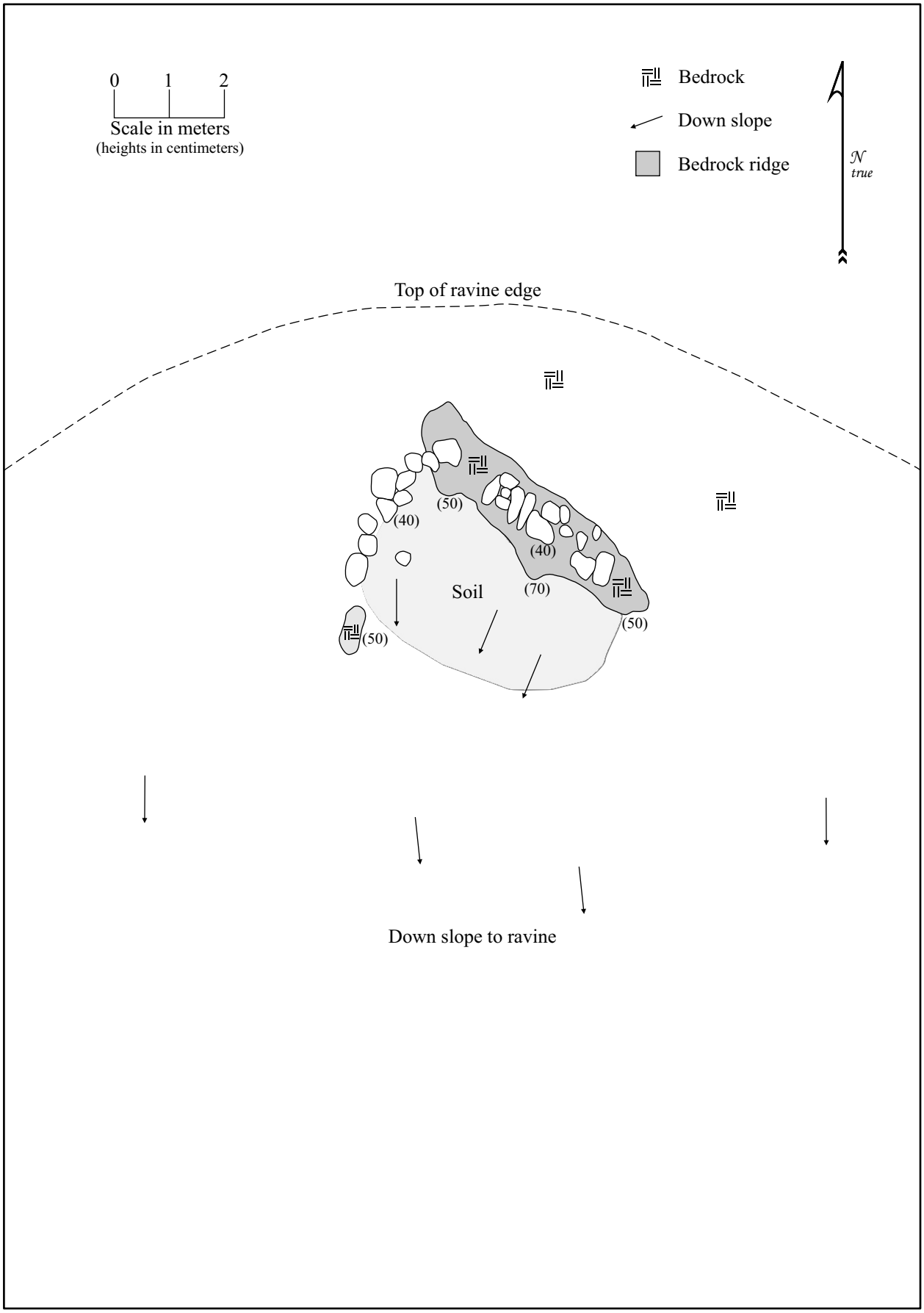


Figure 20. SIHP Site 5648 Feature A plan view.

Feature B

Feature B is a terraced enclosure area 50 meters south of Feature A (see Figure 18) that measures 3.5 meters long by 2.5 meters wide, and stands 0.20 to 0.75 meters tall (Figure 21). It is constructed against the west facing edge of a raised bedrock ridge formation standing 2.0 meters above the surrounding ground surface (Figure 22). This feature consists of piled and stacked small to large cobbles. The interior of Feature B is fairly level with soil and cobbles. In the southern edge of the feature is a slab with a smooth concave surface that measures 0.70 meters long by 0.40 meters wide, and is 0.10 meters thick. This slab appears placed and could have been used for processing resources or sitting. It does not appear ground, but it is pitted and wind blown. In the southeast corner of the feature is an upright boulder that measures 0.60 meters tall by 0.40 meters wide, and 0.25 meters thick. The boulder appears placed at its location, though it could be naturally occurring. There is a wall along the back (north) edge of the feature constructed of piled and stacked small to large cobbles. This wall measures 2.7 meters long by 0.60 meters wide, and stands 0.75 meters above the surrounding ground surface. The east end of the wall is built on raised bedrock and it along with the bedrock ridge act as a barrier to the prevailing wind.

Figure 21. SIHP Site 5648 Feature B, view to the northeast.

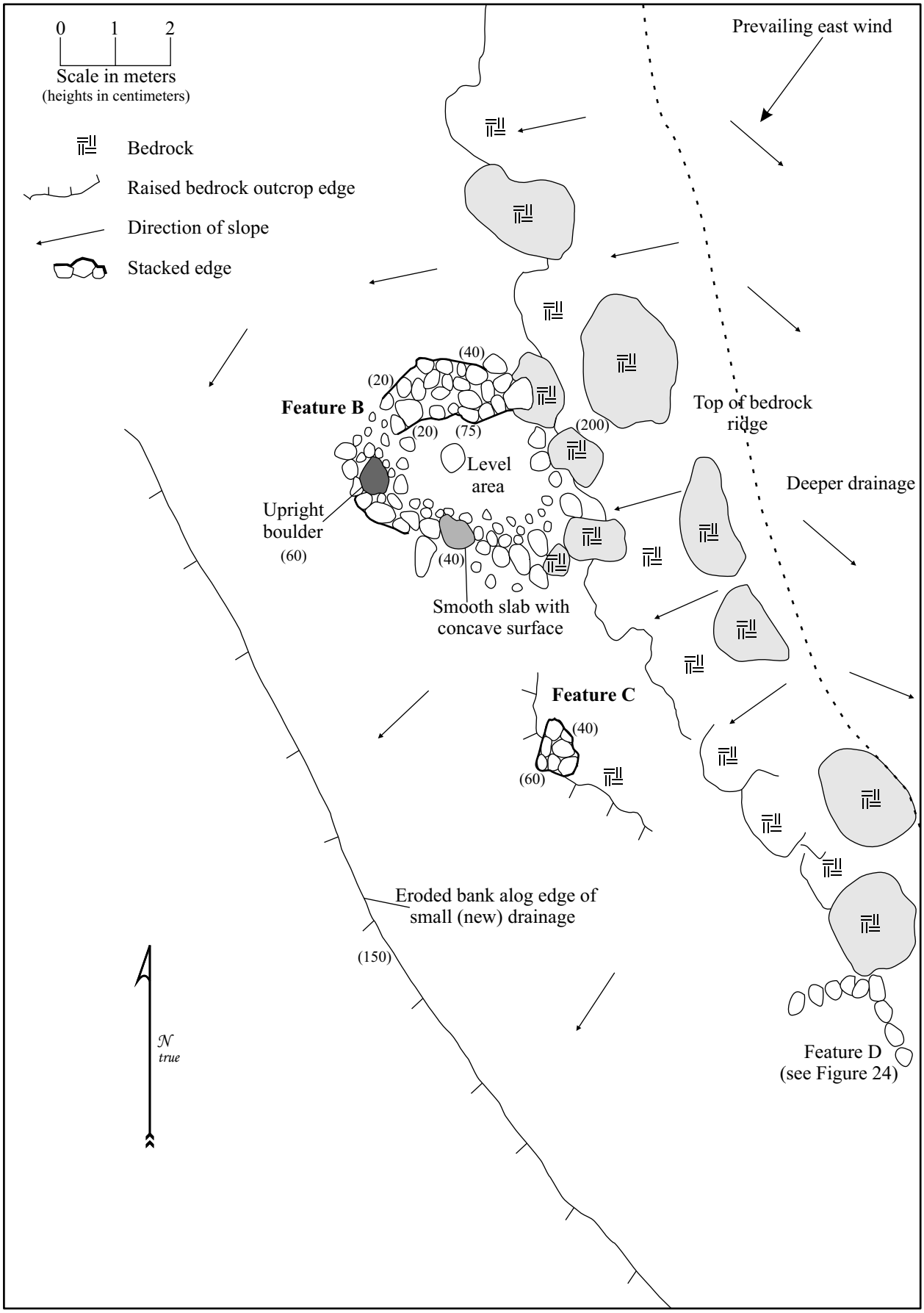


Figure 22. SIHP Site 5648 Features B and C plan view.

Feature C

Feature C is a rock pile located 3 meters south of Feature B (see Figure 18) constructed of approximately fifteen medium to large cobbles (Figure 23). It measures 0.90 meters by 0.80 meters, and stands 0.40 to 0.60 meters above the surrounding ground surface (see Figure 22).

Figure 23. SIHP Site 5648 Feature C, view to the northeast.

Feature D

Feature D is a C-shape windbreak shelter located 13 meters southwest of Feature C (see Figure 18). This feature opens to the southwest. Feature D is located on the top of a west facing slope at the western edge of the steep sided north/south running natural drainage (Figure 24). This feature is constructed of eroded bedrock boulders and medium to large cobbles stacked 0.40 to 0.70 meters above the surrounding ground surface (Figure 25). The bedrock boulders have heights ranging from 0.30 to 0.80 meters tall. This feature measures 2.8 meters by 2.5 meters. The immediate area southwest of Feature D measures 2.0 meters wide, and 1.0 to 1.5 meters deep. This area consists of fine soil and is protected from the prevailing northeasterly winds. Feature D was previously recorded by Rasmussen (2005a) as Feature 9.

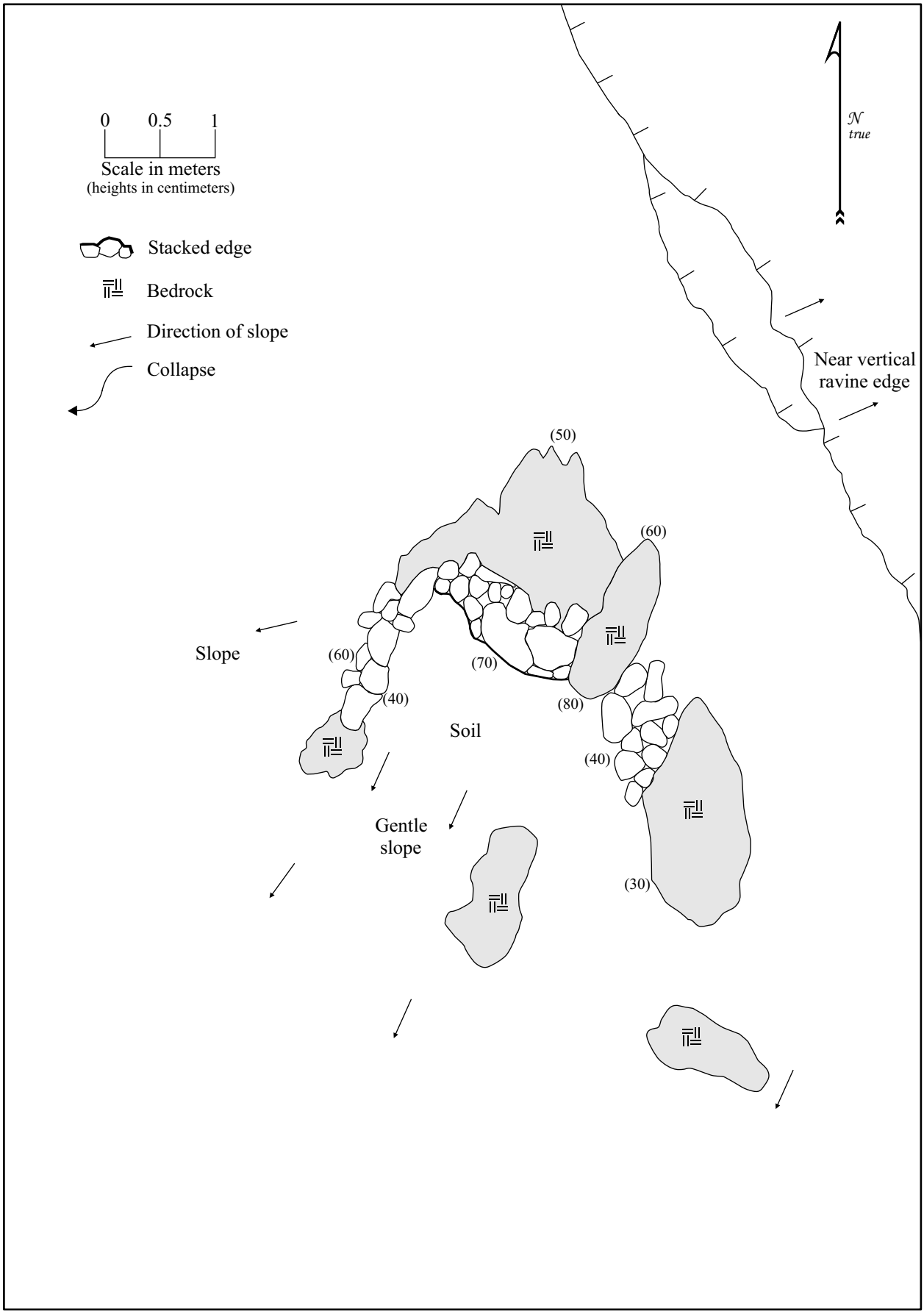


Figure 24. SIHP Site 5648 Feature D plan view.

Figure 25. SIHP Site 5648 Feature D, view to the northeast.

Feature E

Feature E is located on top of a small outcrop approximately 74 meters west/southwest of Feature D (see Figure 18). Feature E consists of fifty to seventy-five piled medium angular basalt cobbles, measures 3.5 meters by 2.1 meters, and stands 0.2 to 0.3 meters above the surrounding bedrock outcrop (Figure 26). A small level area to the south of the feature may have been utilized as a windbreak shelter (Figure 27).

Feature F

Feature F is a possible storage area located 2 meters southwest of Feature E (see Figure 18). Bedrock boulders are used along with placed boulders and cobbles to create a small enclosed storage space 0.60 meters deep and 0.60 meters in diameter (Figure 28). This feature measures 4.7 meters by 2.7 meters with heights ranging from 0.45 to 0.90 meters. To the west of the cupboard is a small leveled area of cobbles against a bedrock boulder, possibly an enlargement of the level area near Feature E. One water rounded cobble observed. To the southeast of the bedrock outcrop, a low piled wall extends for 2.2 meters. To the south of outcrop area, the ground surface is level and protected from the prevailing trade winds (see Figure 26).

Feature G

Feature G is an alignment stacked against bedrock located 4.5 meters southeast of Feature F (see Figure 18). The area between the alignment and bedrock is backfilled with medium cobbles creating a level terraced area (Figure 29). Feature G measures 3.7 meters long by 1.5 meters wide, and stands 0.60 meters above surrounding ground surface on the downslope (southern) edge, and is level with the bedrock on the upslope (north) edge (see Figure 26). The constructed level area increases the size of usable space on the outcrop.

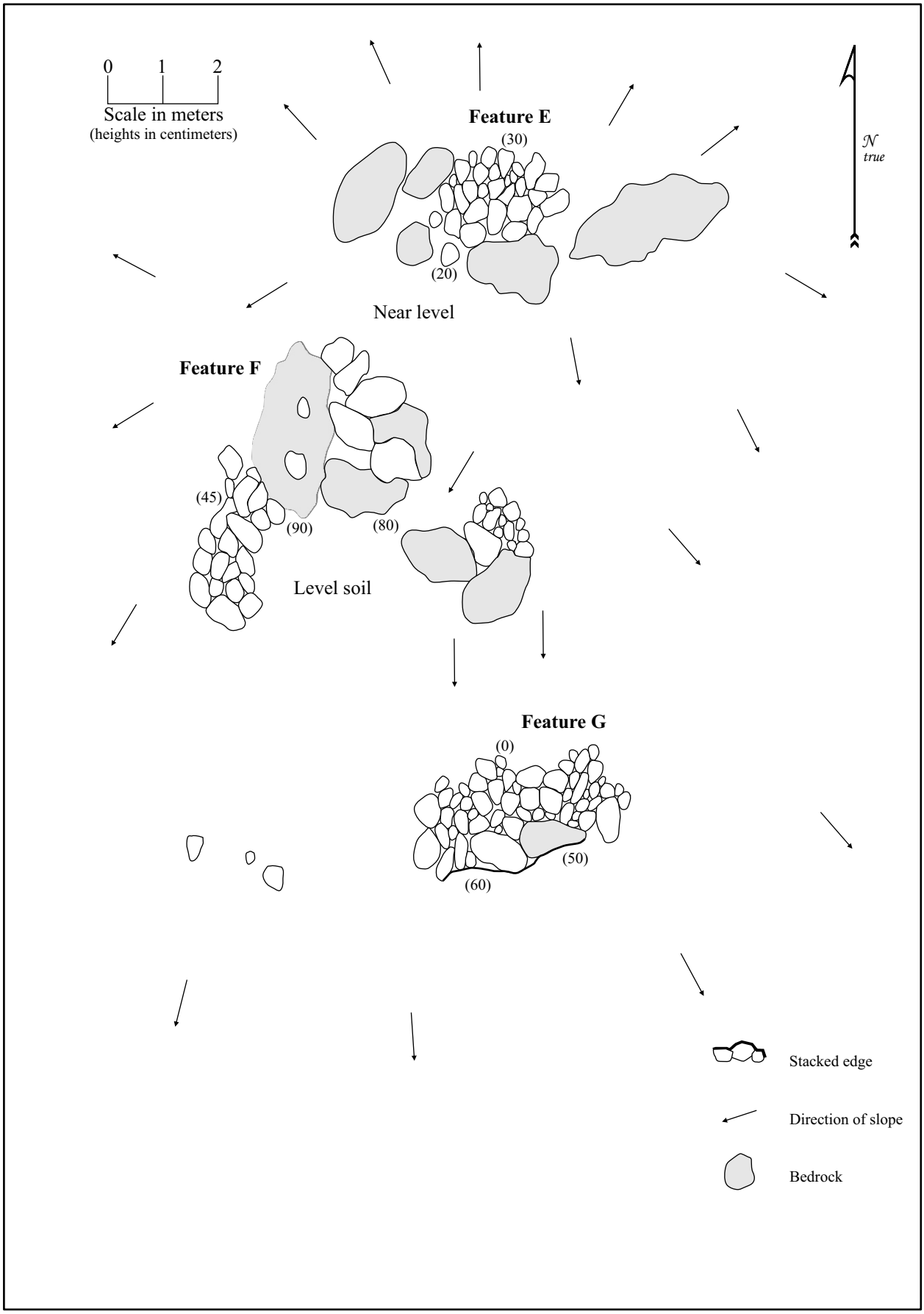


Figure 26. SIHP Site 5648 Features E, F, and G plan view.

Figure 27. SIHP Site 5648 Feature E, view to the northwest.

Figure 28. SIHP Site 5648 Feature F, view to the north-northwest.

Figure 29. SIHP Site 5648 Feature G (Feature F in background), view to the north.

Feature H

Feature H is a C-shape enclosure that opens to the southwest and is located southeast of Feature I (see Figure 18). It is constructed of piled and loosely stacked small to large cobbles and measures 3.2 meters long by 1.3 meter wide (Figure 30). This feature affords good wind protection on a slightly south sloping ground surface (well suited for sleeping or sitting). The C-shape stands 0.17 to 0.45 meters tall, and 0.80 to 1.2 meters wide along its edges (Figure 31). The north end of this C-shape abuts exposed bedrock that runs 2.1 meters north to Feature I. Feature H exhibits collapse throughout.

Feature I

Feature I is an alignment windbreak shelter located 2.1 meters northwest from Feature H (see Figure 30). It is constructed of roughly thirty piled and loosely stacked small to large cobbles. This feature measures 1.7 meters long by 0.60 meters to 0.80 meters wide, and stands 0.26 to 0.52 meters on its downslope (southwest) edge, and 0.05 to 0.12 meters on its upslope side (where exposed bedrock is present). The slightly sloped area to the southwest of the cobbles is protected from the wind and measures 2.3 meters by 1.6 meters (Figure 32). A long cylindrical cobble is present at the north end of Feature I and measures 0.68 meters long by 0.20 meters wide. This cobble is 0.15 meters thick and could have been placed there as an upright stone (currently dislodged).

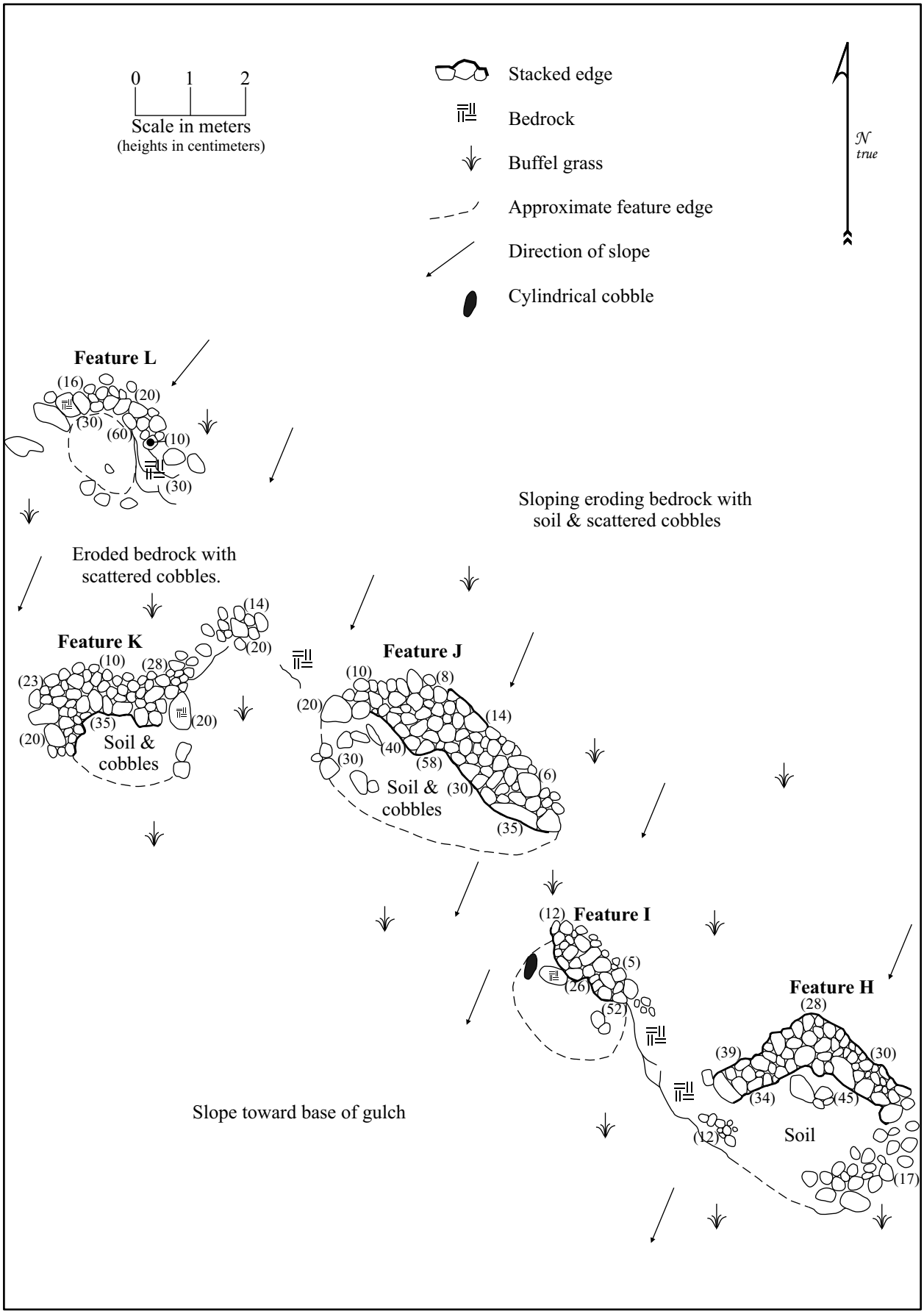


Figure 30. SIHP Site 5648 Features H, I, J, K, and L plan view.

Figure 31. SIHP Site 5648 Feature H, view to the north-northeast.

Figure 32. SIHP Site 5648 Feature I, view to the northeast.

Feature J

Feature J is an alignment windbreak shelter situated 2.1 meters north of Feature I along the same natural slope contour (see Figure 30). It consists of loosely stacked small to large cobbles on the bedrock slope. The stacking measures 4.2 meters long by 0.80 meters wide, and stands 0.58 meters tall in the center of the downslope side, and 0.06 to 0.20 meters tall on the upslope side (Figure 33). A 1.0 meter wide area at base of the southwest portion of the stacking is fairly level and protected from the wind.

Figure 33.SIHP Site 5648 Feature J, view to the northwest.

Feature K

Feature K is an L-shape alignment located 2.5 meters northwest of Feature J (see Figure 30). The alignment is constructed of small to large cobbles piled and loosely stacked on top of a natural bedrock contour. This feature measures 2.3 meters long (northwest/southeast) and has a 1.0 meter long extension perpendicular to its northwest end (Figure 34). It stands 0.35 meters high at the center of the downslope edge and 0.20 to 0.28 meters on the upslope edge, with a width of 0.80 meters. A 1.9 meter by 1.3 meter area southwest of the alignment is fairly level and protected from the wind. A loose collection of cobbles on bedrock runs northeast for 1.8 meters from the south end of Feature K.

Feature L

Feature L is a small C-shape shelter located 4.8 meters northeast of Feature K (see Figure 30). This feature is constructed of roughly twenty small to large cobbles which have been placed along an exposed nearly vertical bedrock face. It measures 3.2 meters long by 0.60 meters wide, and stands 0.10 to 0.60 meters tall (Figure 35). At its north end, three large bedrock slabs appear to have eroded from the outcrop and tumbled downslope. A 2.6 meter by 2.0 meter area of soil and loose gravel southwest of Feature L is fairly level and protected from the wind.

Figure 34. SIHP Site 5648 Feature K, view to the northeast.

Figure 35. SIHP Site 5648 Feature L, view to the north.

Feature M

Feature M is a rock pile located on the western side of a north/south running drainage, west of the current access road (see Figure 18). This feature is constructed of seventeen medium to large cobbles and boulders piled on an exposed section of bedrock (Figure 36). It measures 1.1 meters in diameter with a downslope height of 1.3 meters and upslope height of 0.50 meters. Feature M was previously recorded by Rasmussen (2005a) as Feature 8. It is possible that the pile is an *ahu* marking the route of a former trail, although no such route was observed across the rocky terrain.

Figure 36. SIHP Site 5648 Feature M, view to the west.

Feature N

Feature N is a C-shape enclosure located approximately 23 meters northwest of Feature O (see Figure 18). This feature is constructed on a *makai* (south) sloping portion of a ridge with piled small to medium cobbles, and opens to the southwest. The enclosure measures 2.3 meters long by 2.1 meters wide (Figure 37). The enclosing edges have widths from 0.3 meters to 1.2 meters (Figure 38). Feature N has an interior height of 0.55 meters and exterior heights that range from 0.23 to 0.63 meters above the surrounding ground surface. The enclosed area slopes to the southwest and consists of mostly soil and bedrock with a few small loose cobbles. Feature N was previously recorded by Rasmussen (2005a) as Feature 7.

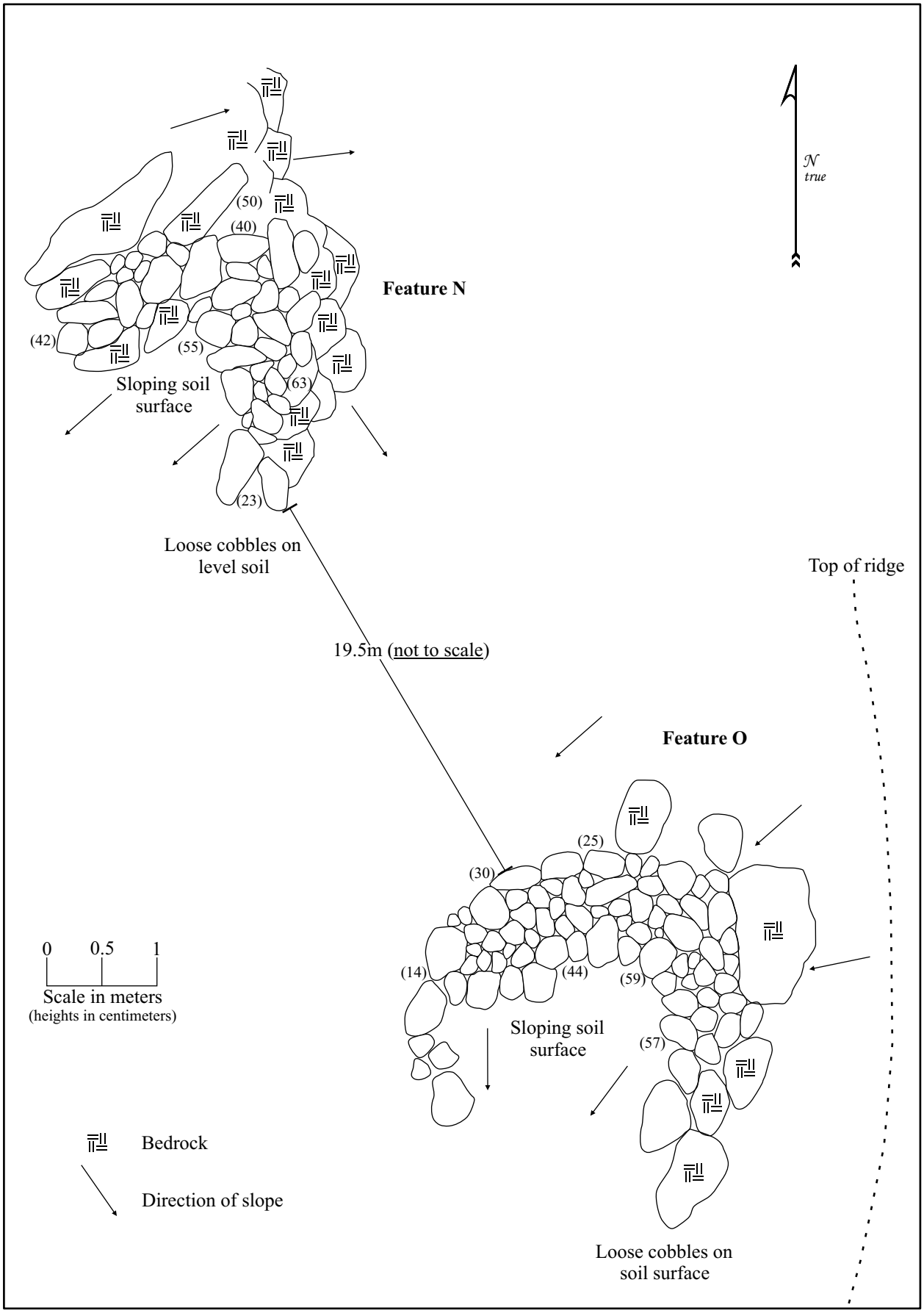


Figure 37. SIHP Site 5648 Features N and O plan view.

Figure 38. SIHP Site 5648 Feature N, view to the north.

Feature O

Feature O is a C-shaped enclosure located 23 meters southeast of Site Feature N (see Figure 18). This enclosure is constructed against the western edge of a *mauka/makai* running ridge. It utilizes large bedrock in its construction. This enclosure opens to the southwest, and is constructed of piled small to large cobbles (Figure 39). The enclosure measures 3.0 meters long by 2.4 meters wide with widths ranging from 0.7 meters to 1.1 meters. It has interior heights range from 0.44 to 0.59 meters and exterior heights from 0.14 to 0.30 meters (see Figure 37). The interior ground surface slopes to the southwest and consists of mostly soil with a few small cobbles. Feature O was previously recorded by Rasmussen (2005a) as Feature 6.

Figure 39. SIHP Site 5648 Feature O, view to the northeast.

Feature P

Feature P is a modified outcrop windbreak shelter located approximately 13 meters northeast of the Mā‘alaea branch of the Lahaina Pali Trail (see Figures 12 and 18). This feature is constructed of medium to large cobbles stacked and piled against a raised portion of a bedrock outcrop (Figure 40). The windbreak shelter measures 2.7 meters long (east/west) by 0.40 meters wide (north/south), and stands 0.40 meters above the surrounding ground surface (Figure 41). The bedrock below the stacking is 0.50 meters tall giving the total modification a height of 0.90 meters above natural grade (Figure 42). The ground surface leeward (southwest) of the windbreak consists of near level, smooth bedrock with a light soil and small cobble accumulation. This protected area provides shelter from the prevailing winds. A pile of twelve small to medium cobbles are located 1.0 meters southwest of Feature P’s west end. This windbreak shelter could have been used as a rest area by travelers along the nearby trail.

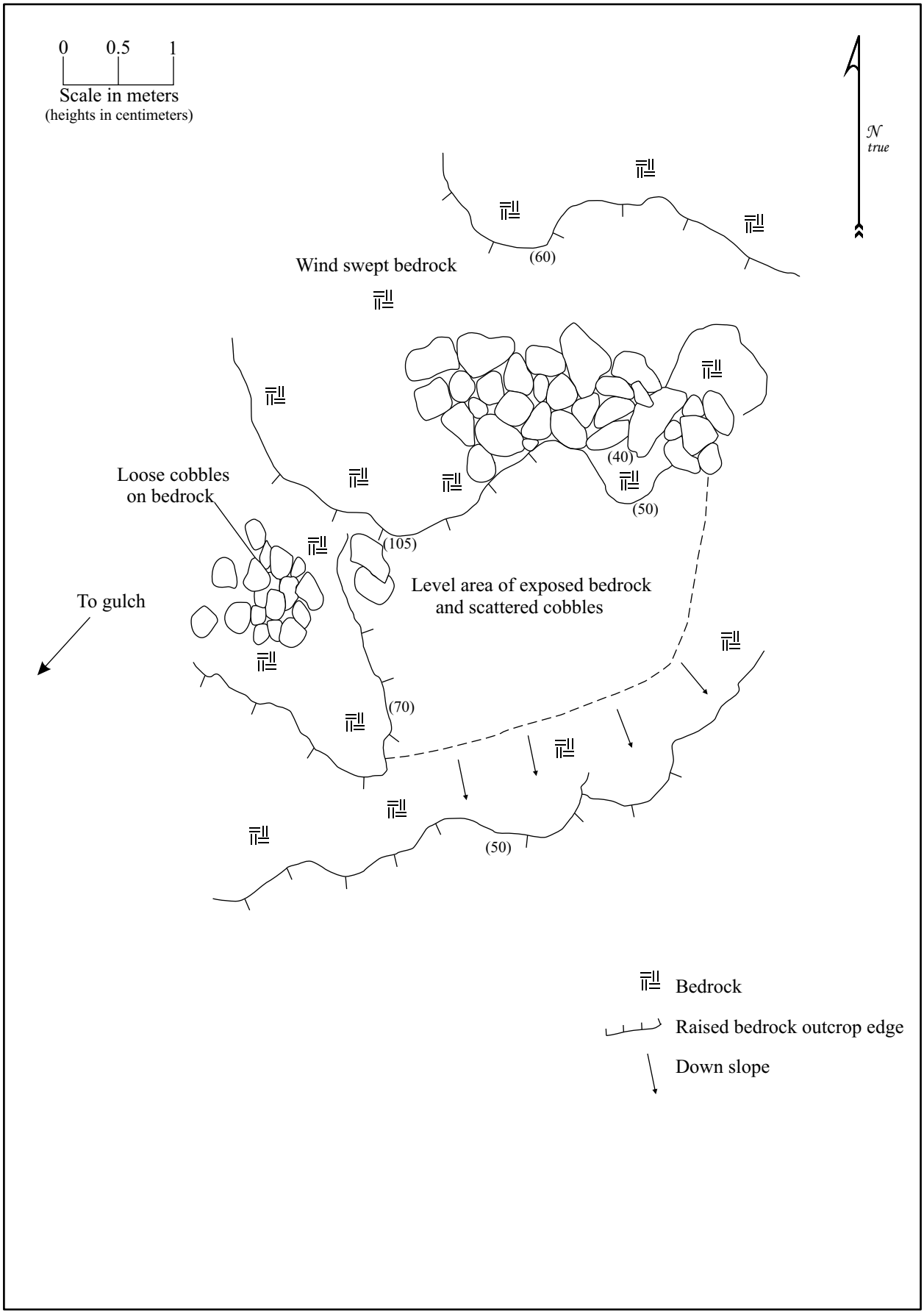


Figure 40. SIHP Site 5648 Feature P plan view.

Figure 41. SIHP Site 5648 Feature P, view to the southwest.

Figure 42. SIHP Site 5648 Feature P, view to the northeast.

Feature Q

Feature Q is a low-lying cobble alignment located approximately 42 meters southwest of Feature O (see Figure 18). This feature is constructed on a level ground surface consisting of soil and loose cobble near the edge of a steep drop which slopes to the south (*makai*) (Figure 43). The alignment is oriented in a north/south direction and constructed on the north side of a (1.2 meter) tall bedrock boulder with piled small to large cobbles (Figure 44). The alignment measures 2.2 meters long by 1.0 meter wide, and stands 0.30 to 0.50 meters above the surrounding ground surface (Figure 45). This area provides an excellent view of surrounding terrain. Feature Q was previously recorded by Rasmussen (2005a) as Feature 5.

Figure 43. SIHP Site 5648 Feature Q, view to the southwest.

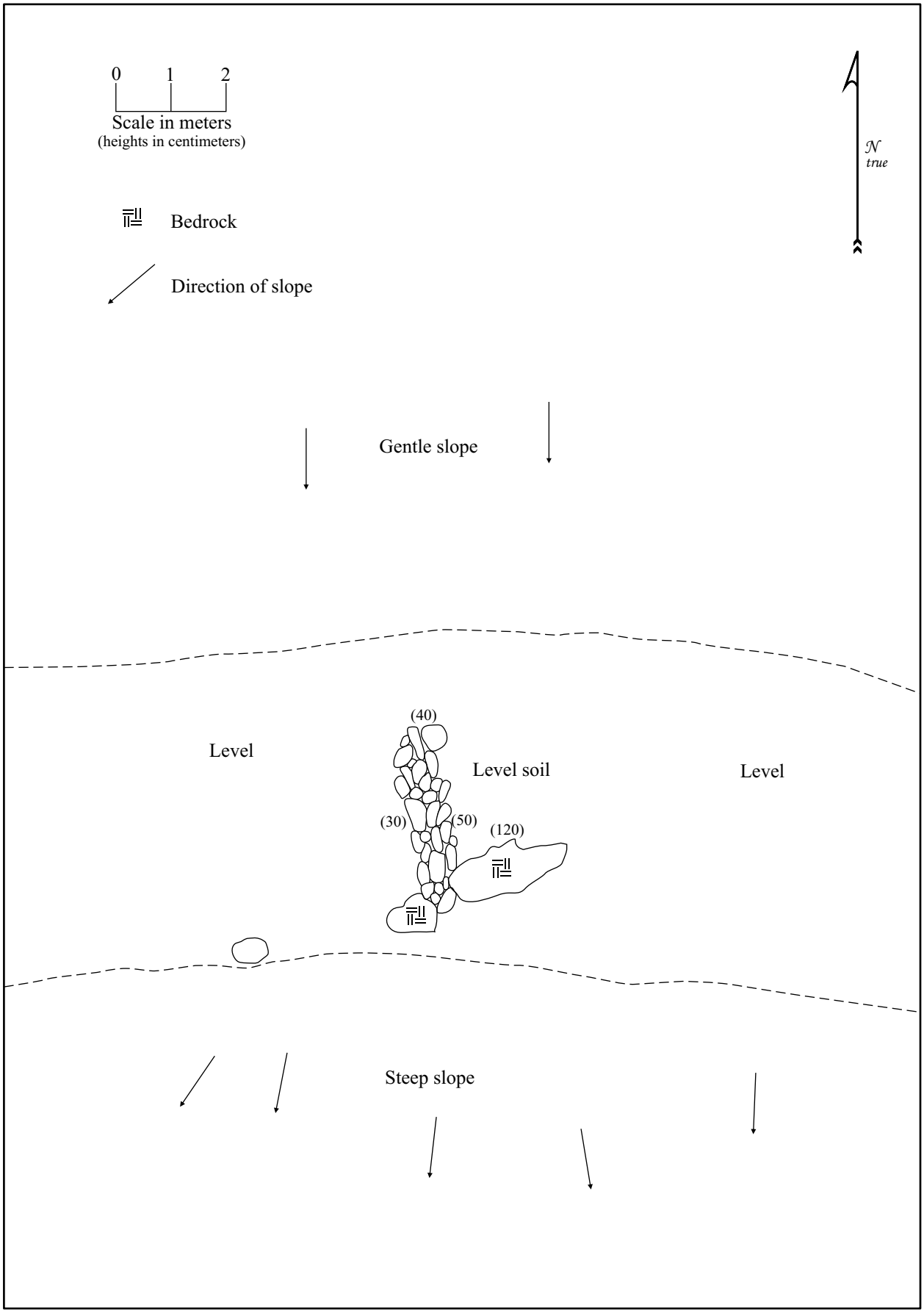


Figure 44. SIHP Site 5648 Feature Q plan view.

Figure 45. SIHP Site5648 Feature Q, view to the south.

Feature R

Feature R is an alignment located approximately 55 meters southeast of Feature H (see Figure 18). This linear pile of small to large cobbles is constructed of against a vertical bedrock edge (Figure 46), and measures 3.0 meters long by 1.6 meters wide with heights ranging from 0.24 to 0.60 meters above the surrounding ground surface. The outcrop edge that the linear pile sits against has a length of 8.0 meters with heights ranging from 0.50 to 1.3 meters (Figure 47). The ground surface southwest of the outcrop edge is sloping bedrock, soil, and loose cobbles. A single piece of marine shell was observed in the southern portion of Feature R.

Figure 46. SIHP Site 5648 Feature R, view to the northeast.

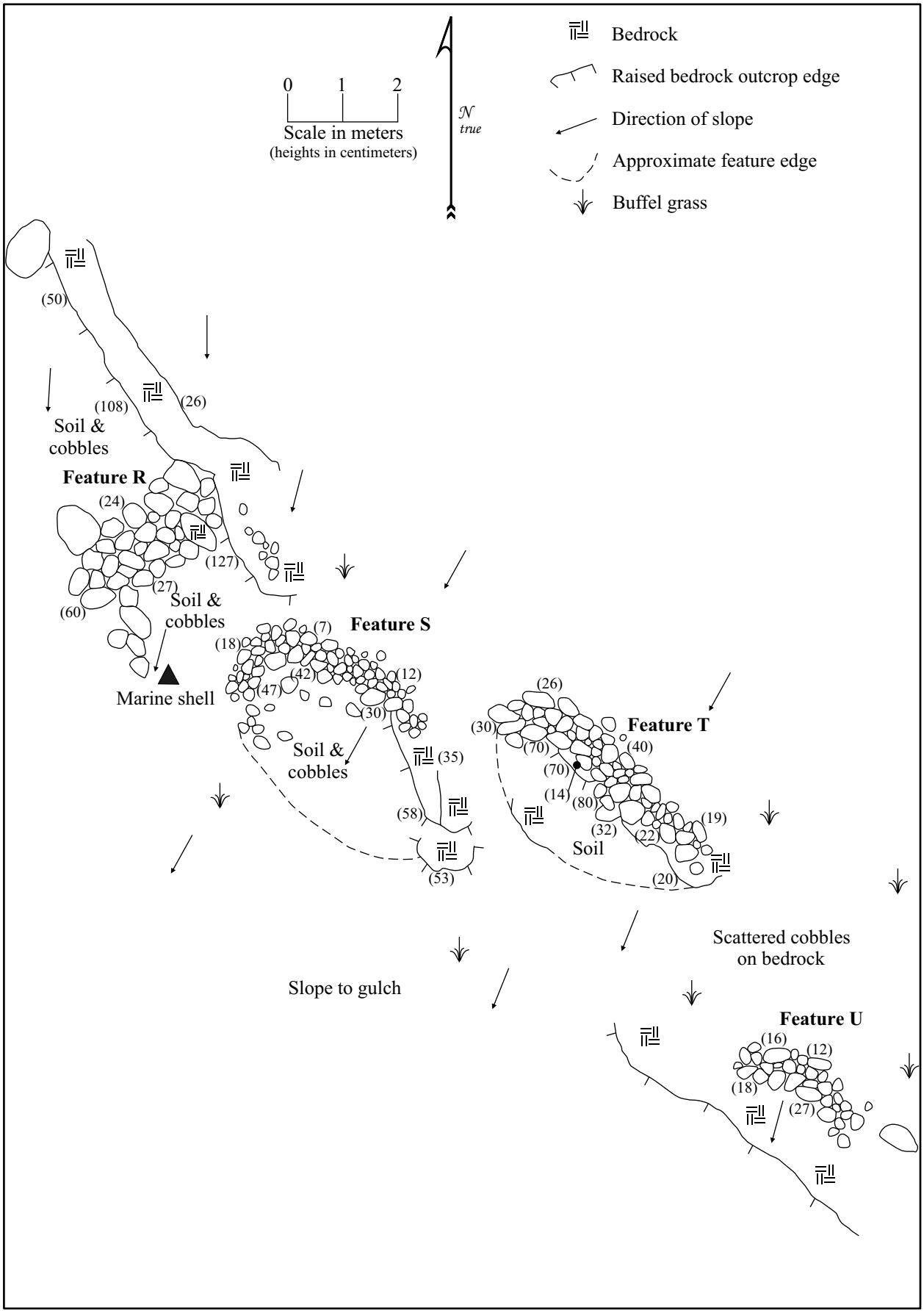


Figure 47. SIHP Site 5648 Features R, S, T, and U plan view.

Feature S

Feature S is a C-shape enclosure located 0.70 meters southeast of Feature R (see Figure 18). This enclosure is constructed on a raised southeast facing portion of bedrock with piled small to medium cobbles (Figure 48). Feature S measures 3.6 meters long (northwest/southeast) by 1.6 meters wide (northeast/southwest). The enclosing wall measures 0.6 to 0.8 meters wide, with an upslope height of 0.07 to 0.18 meters and a downslope height ranging from 0.3 to 0.5 meters above the surrounding ground surface (see Figure 47). A portion of the bedrock located at the feature's southeast end stands 0.35 to 0.58 meters tall. A soil and cobble area located immediately southwest of Feature S slopes southwest to the base of a small gulch.

Figure 48. SIHP Site 5648 Feature S, view to the north-northwest.

Feature T

Feature T is a cobble alignment located 1.2 meters east of Feature S (see Figure 18). It is constructed of piled small to medium cobbles, and measures 4.5 meters long (northwest/southeast) by 1.6 meters wide (northeast/southwest) (see Figure 47). Stacking is evident on vertical bedrock edges in the central and southeast portions of alignment (Figure 49). The alignment has an average width of 0.80 meters, with upslope heights ranging from 0.19 to 0.40 meters and downslope heights ranging from 0.22 to 0.80 meters. The wind protected area immediately southwest of the alignment consists of soil that slopes southwest.

Figure 49. SIHP Site 5648 Feature T, view to the north.

Feature U

Feature U is a linear rock pile located approximately 3.7 meters southeast of Feature T (see Figure 18). This linear rock pile is constructed of small to medium cobbles, and measures 2.6 meters long (northwest/southeast) by 0.6 to 0.8 meters wide (northeast/southwest) (see Figure 47). This feature has upslope heights ranging from 0.12 to 0.16 meters and downslope heights ranging from 0.18 to 0.27 meters (Figure 50). The surrounding ground surface consists of soil and loose cobbles on bedrock.

Figure 50. SIHP Site 5648 Feature U, view to the north.

Feature V

Feature V is a piled alignment windbreak shelter located approximately 70 meters southeast of Feature Q (see Figure 18). The feature is constructed on a level ground surface which is located on ridge between two drainages (Figure 51). This feature is oriented in a northwest/southeast direction to block the prevailing easterly winds (providing a sheltered area to the southwest). Feature V is constructed of small to large cobbles and a few small boulders piled to a height of 0.9 meters (up to 1.0 meters in the center), and stands 0.3 meters to 0.8 meters at its edges (Figure 52). The windbreak shelter measures 4.0 meters long by 1.8 meters wide (Figure 53). A cleared level soil area to southwest of Feature V measures roughly 3.0 meters long by 2.0 meters wide. Feature V was previously recorded by Rasmussen (2005a) as Feature 4.

Figure 51. SIHP Site 5648 Feature V, view to the southwest.

Figure 52. SIHP Site 5648 Feature V, view to the northeast.

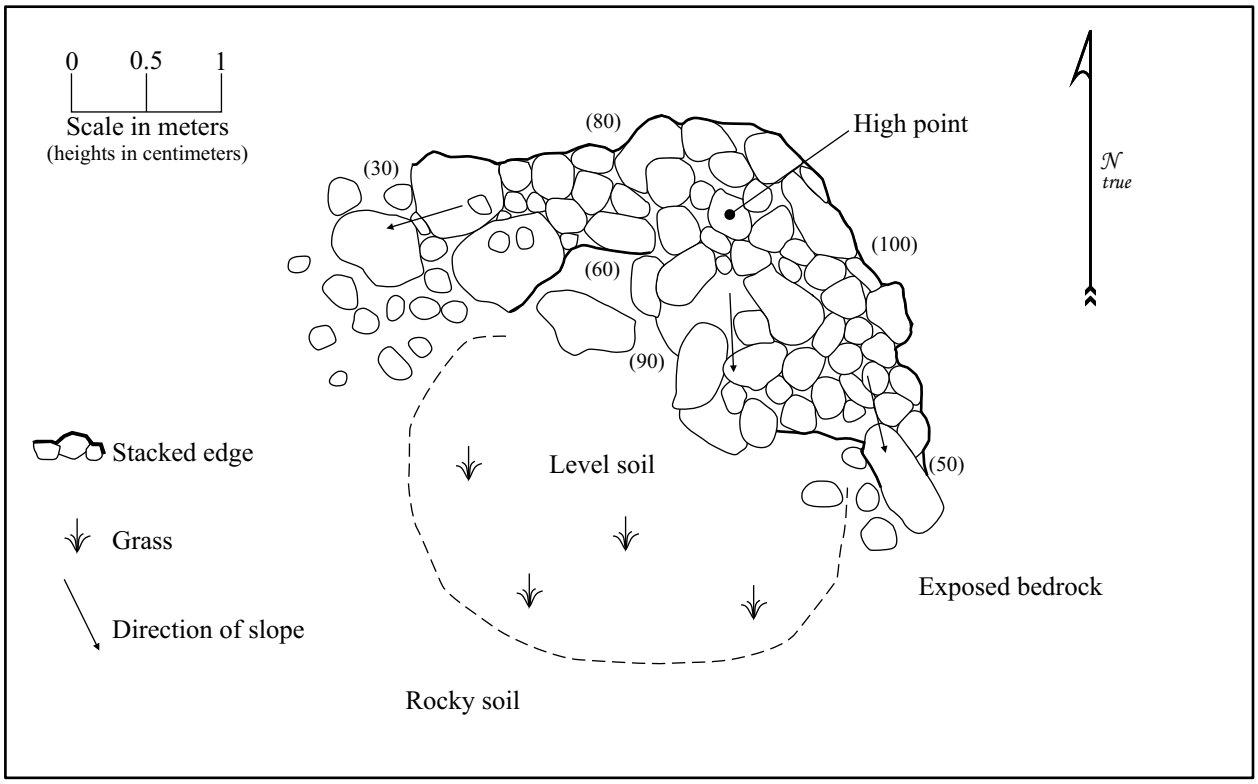


Figure 53. SIHP Site 5648 Feature V plan view.

Feature W

Feature W is a small alignment that is located approximately 115 meters south/southeast of Feature V (see Figure 18). This alignment is constructed of piled small to medium cobbles on fractured/raised bedrock (Figure 54). Feature W measures 1.8 meters long by 0.6 meters wide, and has an interior height of 0.63 meters above the ground surface and exterior heights of 0.14 to 0.32 meters above the bedrock (Figure 55). This alignment creates a small windbreak. The interior west facing ground surface consists of sloping soil with scattered cobbles.

Figure 54. SIHP Site 5648 Feature W, view to the east.

Feature X

Feature X is a small alignment that is located 1.7 meters southwest of Feature W (see Figure 18). Feature X is constructed of piled small to large cobbles. This alignment measures 1.6 meters long by 0.6 meters wide, and extends in a westerly direction from the outcrop (see Figure 55). Feature X stands 0.16 to 0.46 meters above the surrounding ground surface and 0.17 meters above the bedrock (Figure 56). The interior south facing ground surface consists of mostly soil with a few scattered cobbles. Feature X was previously recorded by Rasmussen (2005a) as Feature 2.

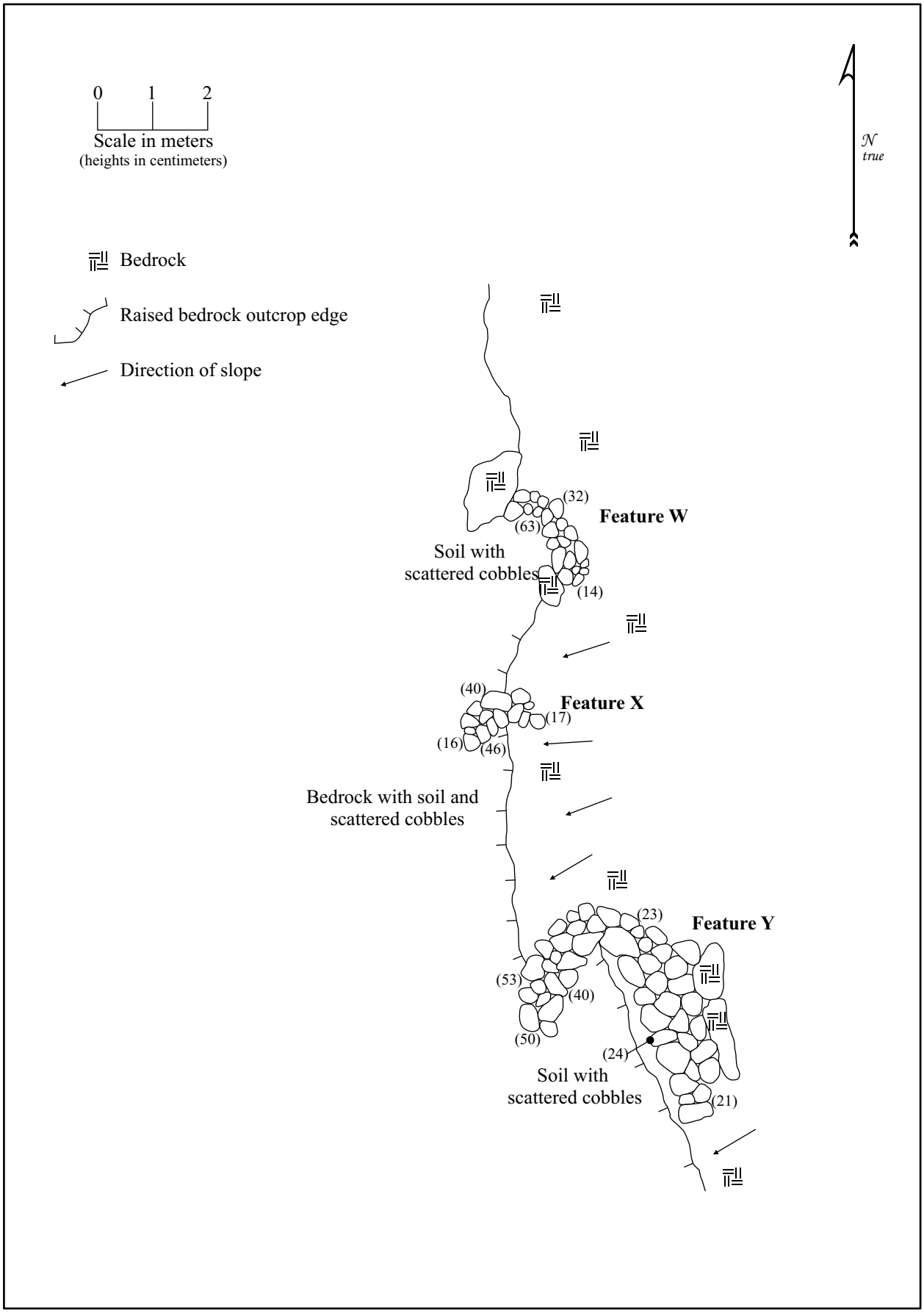


Figure 55. SIHP Site 5648 Features W, X, and Y plan view.

Figure 56. SIHP Site 5648 Feature X, view to the northeast.

Feature Y

Feature Y is a C-shape enclosure located 4.5 meters southwest of Feature X (see Figure 18) that opens to the southwest and is constructed of stacked and piled small to large cobbles (Figure 57). This feature measures 4.4 meters long by 3.0 meters long, and has an average width of 1.0 meters with heights ranging from 0.40 to 0.53 meters above the surrounding ground surface (see Figure 55). The northeastern portion of the enclosure is constructed on/against a bedrock ridge. The enclosed interior consists of a fairly level soil surface with sporadic small cobbles. Feature Y was previously recorded by Rasmussen (2005a) as Site 5648 Feature 1.

Figure 57. SIHP Site 5648 Feature Y, view to the southeast.

Feature Z

Feature Z is a triangular shape feature located approximately 48 meters east of Feature W (see Figure 18). Feature Z is constructed of two leaning slabs supporting each other over a protected covered space (Figure 58). The slabs measure 0.75 to 0.80 meters long by 0.40 meters wide and are 0.10 meters thick. The area under the slabs is protected from the wind and sun. A bedrock outcrop surrounds the feature creating a natural enclosure. Feature Z was previously recorded by Rasmussen (2005a) as Site 5648 Feature 3.

Figure 58. SIHP Site 5648 Feature Z, view to the southwest.

Feature AA

Feature AA is a modified outcrop windbreak shelter located approximately 40 meters south of Feature Y (see Figure X). This feature is constructed along the upper edge of a short, southwest sloping (into a shallow drainage) ridge. The windbreak is constructed of roughly fifty small to large cobbles (Figure 59), and it measures 2.0 meters long by 0.8 meters wide. The cobbles used in the construction of Feature AA are piled on bedrock, standing 0.2 to 0.5 meters tall along the north edge, and 0.9 meters tall along the south edge (Figure 60). The immediate area southwest of construction is protected from the prevailing winds.

Figure 59. SIHP Site 5648 Feature AA, view to the north.

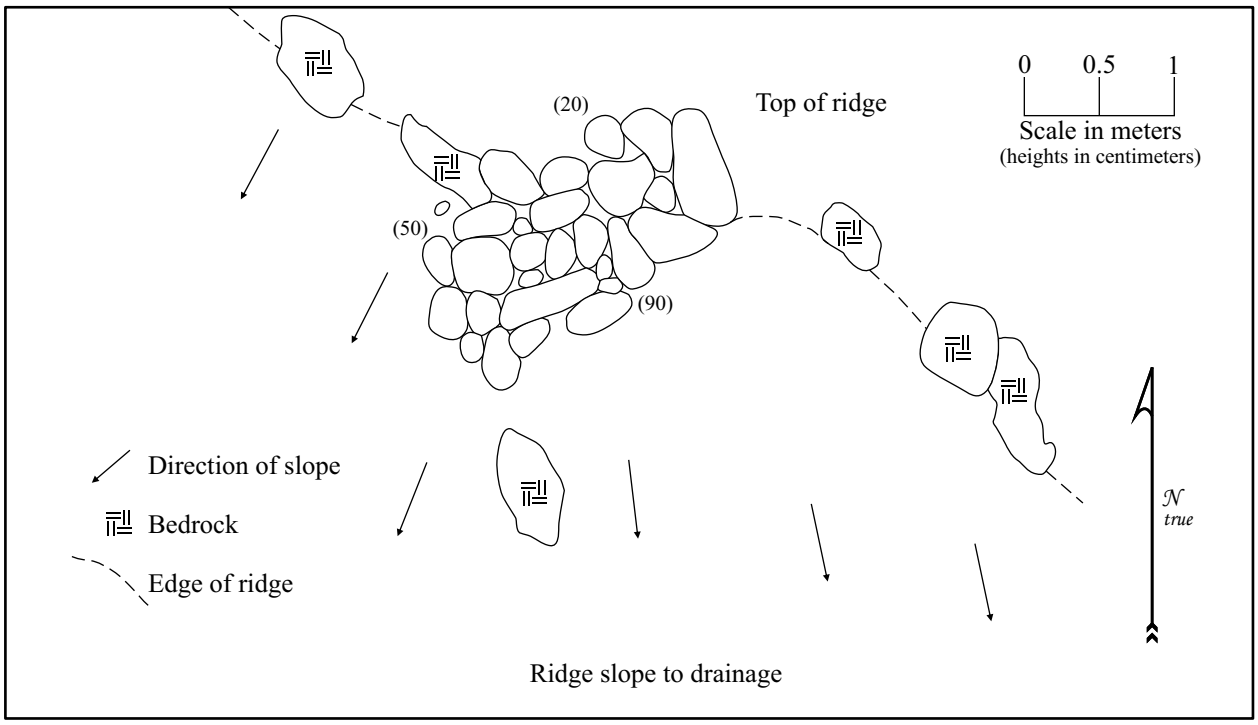


Figure 60. SIHP Site 5648 Feature AA plan view.

Feature BB (T-20)

Feature BB is a modified outcrop windbreak shelter located approximately 180 meters east-southeast of Feature U (see Figure 18). This feature is constructed 20 meters west of a steep cliff face that defines the eastern boundary of the current study area (see Figure 12). The curvilinear windbreak consists of piled and stacked small to large cobbles (Figure 61). It measures 2.4 meters long by 0.60 meters wide, with heights ranging 0.10 to 0.50 meters above the surrounding ground surface (Figure 62). Feature BB is slightly concave to the southwest (leeward) side, almost to the point of being considered a C-shape enclosure.

Figure 61. SIHP 5648 Feature BB, view to the north.

Feature CC (Cairn #4)

Feature CC is a rock pile located approximately 52 meters northwest of Feature BB (see Figure 18). It consists of 7 large flat cobbles and 15 smaller cobbles loosely stacked against a small outcropping of bedrock (Figure 63). This rock pile is 1.40 meters long by 0.70 meters wide and stands 0.46 meters tall. Feature CC is only visible from a downslope vantage point.

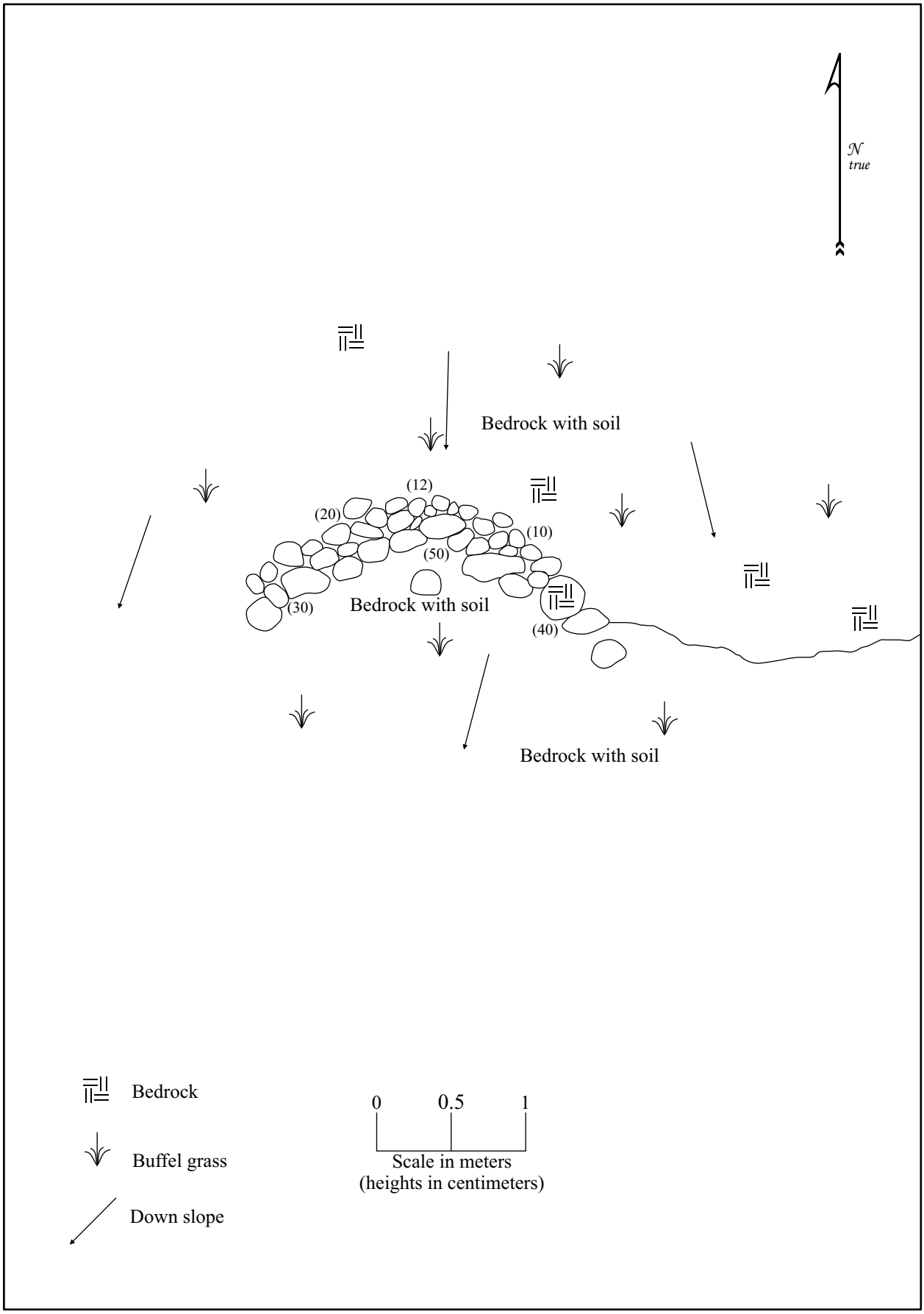


Figure 62. SIHP Site 5648 Feature BB plan view.

Figure 63. SIHP 5648 Feature CC, view to the northwest.

Feature DD

Feature DD is a rock pile located approximately 190 meters east/northeast of Feature Z (see Figure 18). It consists of four flat cobbles placed on a large bedrock boulder (Figure 64). Feature DD does not appear to possess great antiquity.

Figure 64. SIHP 5648 Feature DD, view to the southeast.

SIHP Site 50-50-09-6665

Site 6665 is a concrete water trough (Figure 65) located in the upper portion of the main study area, west of main access road roughly 5 meters northwest of the old jeep access road area (see Figure 12). The trough measures 3.05 meters long by 1.7 meters wide and stands 0.60 to 0.80 meters above the surrounding ground surface, with an interior height of 0.48 to 0.74 meters from the base to the top of the trough (Figure 66). The concrete walls of the trough measure 0.13 meters thick and were poured in place using a wooden form. Two rusted anchor bolts are located in the top surface of the trough and the interior currently contains some soil and a small amount of collected rainwater with a fragment of decomposing burned lumber, and a section of galvanized water pipe. Other sections of galvanized water pipe extend both *mauka* and *makai* from the water trough. Several inscriptions are present in the concrete along the top surface of the trough (Figures 67 and 68). The inscriptions include several names and initials, presumably of the ranch hands that constructed the trough, along with the dates "DEC. 14/ 43" in two locations, and "12-14-43" and "1943" in separate locations. The names and initials include "LONO POAIPUNI", "MICKEY", "C.K.N.", "HUA KEKIWI", "S.K.N.", and "S.K.P." Some of these same names also appear on the other concrete water troughs recorded in the Kaheawa Pastures area (Clark and Rechtman 2005, 2006). Site 6665 is part of a water system developed by Honoula Ranch in Ukumehame in the 1940s. As documented in Clark and Rechtman (2005 and 2006), this system also included several other water troughs (Sites 5402 and 6222), interconnected by galvanized metal water supply pipes. This system provided drinking water for cattle in the once extensive, but arid pastures of this upland area. Cattle ranching continued within the project area until the 1990s.

Figure 65. SIHP Site 6665, view to the south.

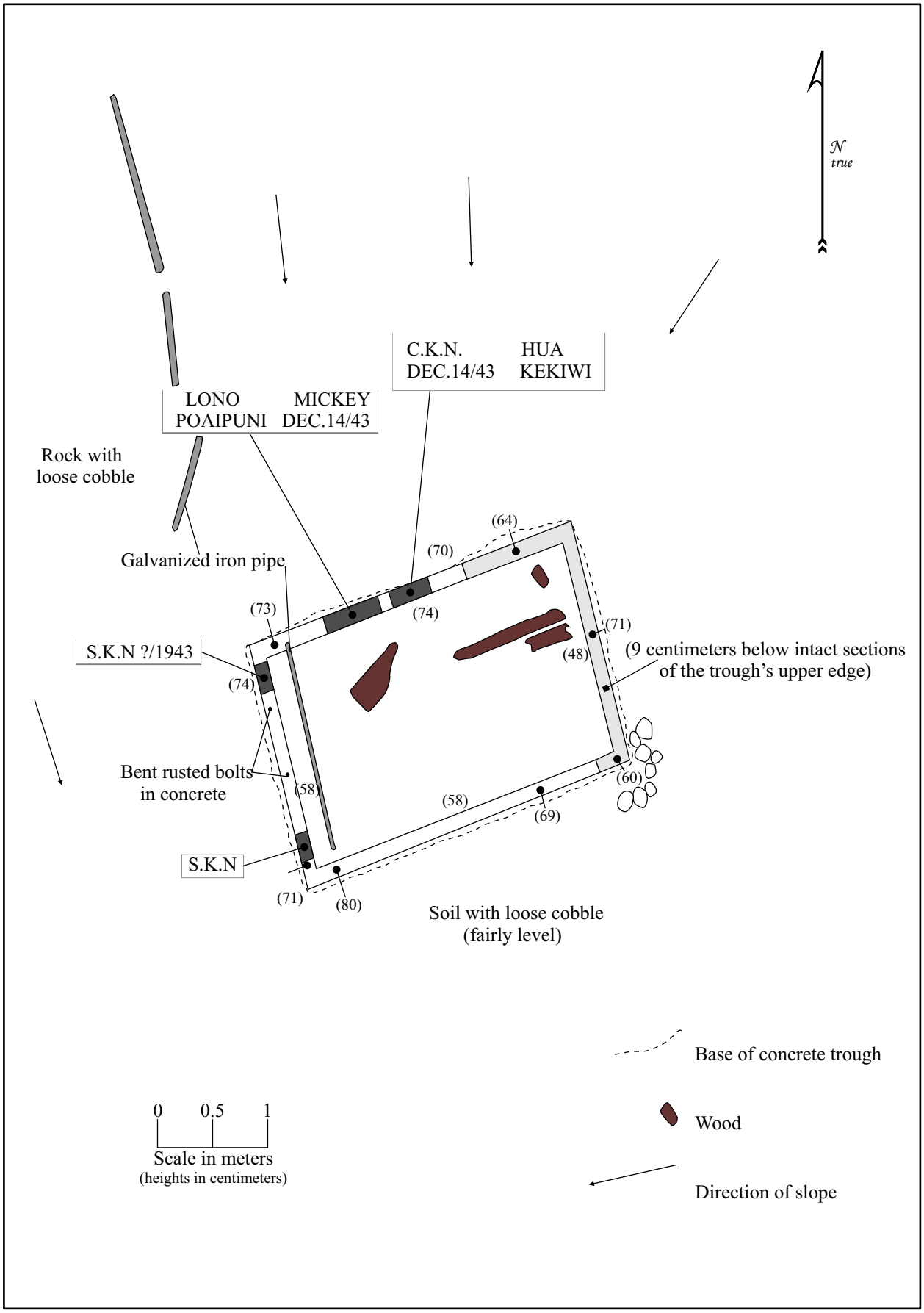


Figure 66. SIHP Site 6665 plan view.

Figure 67. SIHP Site 6665 inscriptions.

Figure 68. SIHP Site 6665 inscriptions.

SUMMARY AND CONCLUSIONS

As a result of the current inventory survey the Lahaina Pali Trail and a possible remnant section of its Mā‘alaea branch were identified as was the previously recorded Site 5648, along with a concrete water trough (Site 6665) (Table 1). The Lahaina Pali Trail and the Mā‘alaea branch of this trail were constructed in 1841 and remained in use until 1891. It seems reasonable to assume that during earlier times other trails accessed this area; however, the physical evidence of such trails is no longer observable on the surface having been superseded by either the historic trails or the Jeep roads.

Table 1. Summary of sites recorded within the current project area.

Site	*Formal Type*	*Functional Type*	*Age*
Lahaina Pali Trail	Trail	Transportation	Historic
SIHP 5648	Complex	Habitation	Precontact/Historic
SIHP 6665	Concrete water trough	Ranching	Historic

At Site 5648, twenty new features were documented; bringing the total number of features at this site to thirty. The features are indicative of temporary habitation and may represent recurrent use shelters associated with trail routes. The use of these features likely dates from both Precontact and Historic times. The most intensive habitation may have occurred between 1841 and 1891 when the Lahaina Pali Trail and its Mā‘alaea branch were still in use.

Site 6665 is a concrete water trough that was built on December 14, 1943. This water trough is part of a water system developed by Honoula Ranch in Ukumehame in the 1940s. As documented in Clark and Rechtman (2005 and 2006), this system also included other water troughs (Sites 5402 and 6222), interconnected by metal pipes that supplied water. This system provided drinking water for cattle in the once extensive, but arid pastures of this upland area. Cattle ranching continued within the project area until the 1990s.

SIGNIFICANCE EVALUATION AND TREATMENT RECOMMENDATIONS

The above-described archaeological resources are assessed for their significance based on criteria established and promoted by the DLNR-SHPD and contained in the Hawai‘i Administrative Rules 13§13-284-6. These significance evaluations should be considered as preliminary until DLNR-SHPD provides concurrence. For resources to be considered significant they must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

A Be associated with events that have made an important contribution to the broad patterns of our history;

B Be associated with the lives of persons important in our past;

C Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;

D Have yielded, or is likely to yield, information important for research on prehistory or history;

E Have an important traditional cultural value to the native Hawaiian people or to another ethnic group of the state due to associations with traditional cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group’s history and cultural identity.

The significance and recommended treatments for the recorded sites are discussed below and are presented in Table 2.

Table 2. Site significance and treatment recommendations.

Site	*Site Type*	*Significance*	*Recommended Treatment*
Lahaina Pali Trail	Transportation	D	Preservation*
SIHP 5648	Habitation	D	Preservation
SIHP 6665	Historic ranching	D	No further work

* The preservation of this site is guided by an existing cultural resource management plan (Tomonari-Tuggle 1995).

The Lahaina Pali Trail and the remnant of the Mā‘alaea branch of this trail are considered significant under Criterion D for the information yielded relative to middle and late nineteenth century transportation patterns and evolving modes of transportation. The main trail branch is already governed by a management plan (Tomonari-Tuggle 1995) and it will not be directly impacted as a result of the current proposed expansion of the wind power project. The newly discovered remnant portion of the Mā‘alaea branch of this trail should be preserved although it does not currently provide a continuous link to the main branch of the Lahaina Pali Trail or to Mā‘alaea. A preservation plan for this site should be prepared and submitted to DLNR-SHPD for review and approval.

Site 5648 is considered significant under Criterion D for both the information it has yielded and the potential information it is likely to yield if future work were to be conducted. The locations of the proposed wind generating towers and the associated infrastructure are being designed to avoid all of the features of this site. While it is possible that data recovery might enhance our knowledge relative to the age and specific function of the various features of Site 5648, such mitigation work is not necessary given the current proposed project layout. Therefore a preservation plan for this site should be prepared and submitted to DLNR-SHPD for review and approval. If in the future, it is necessary to impact one or more of the site’s features, DLNR-SHPD should be contacted to address possible mitigation of impacts through data recovery.

Site 6665 is considered significant under Criterion D for information it has yielded relative to the middle twentieth century ranching practices in the area. As it is not exceptional, nor is it likely to yield further important information, no further work in the recommended treatment for Site 6665.

REFERENCES CITED

Athens, J.

2002 *An Upland Heiau Site*. Ukumehame Ahupuaʻa, Maui. International Archaeological Research Institute, Inc., Honolulu. Prepared for GE Wind Energy, LLC, Tehachapi, California.

2004 Supplemental Archaeological Survey for Access Road, Wind Turbine Project at Kaheawa Pastures, Upland Ukumehame Ahupuaʻa, Maui (TMK 4-8-01:1 & 3-6-01:14). International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

Bagot, F. (ed.)

1884 *McKenney's Hawaiian Directory.* L.M. McKenney & Co., California.

Bellwood, P.

1978 *The Polynesians: Prehistory of an Island People*. Thames and Hudson, Ltd., London.

Chinen, J.

1961 *Original Land Titles in Hawaii*. Privately published.

Clark, M., and R. Rechtman

2005 An Archaeological Inventory Survey of the Proposed Kaheawa Wind Farm Project Area (Portions of TMK:2-3-6-01:14 and 2-4-8-01:1), Ukamehame Ahupuaʻa, Lahaina abd Wailuku Districts, Island of Maui. Rechtman Consulting, LLC Report RC-0328. Prepared for Kaheawa Wind Power, LLC, Makawao, HI.

2006 An Archaeological Inventory Survey of 333 Acres for the Proposed Expansion of the Kaheawa Wind Farm (TMK:2-4-8-01: por. 001). Ukumehame Ahupua'a, Lahaina District, Island of Maui. Rechtman Consulting Report RC-0438. Prepared for Mike Gresham, Kaheawa Wind Power, LLC., 1043 Makawao, Hawaiʻi.

Devereux, T., I. Masterson, M. Heidel, V. Creed, L. Pyle, and H. Hammatt

1999 Archaeological Inventory Survey and Subsurface Testing of a 440 Acre Parcel. Ahupuaʻa of Ukamehame, District of Lahaina, Island of Maui (TMK 4-8-02:09). Cultural Surveys Hawaii. Prepared for Sugar Way Ltd.

Duvauchelle, E.

1858 Letter from E. Duvauchelle to William Webster. July 16. In the Interior Department Land Files of the Hawaii State Archives.

Enos, W. and J. Sylva

1865 Letters from Wm. Enos and Joseph Sylva to John O. Domini. May 16. In the Interior Department Land Files of the Hawaii State Archives.

Fleming, M.

1933 *Old Trails of Maui*. Wailuku, Maui. Prepared for the William and Mary Alexander Chapter, Daughters of the American Revolution.

Foote, D., E. Hill, S. Nakamura, and F. Stephens

1972 *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii.* United States Department of Agriculture, in conjunction with the University of Hawaii Agricultural Extension. U.S. Government Printing Office, Washington, D.C.

Fornander, A.
1969 *An Account of the Polynesian Race: Its Origin and Migrations.* Tokyo: Charles E. Tuttle Co., Inc.

Giambelluca, T., M. Nullet, and T. Schroeder
1986 *Rainfall Atlas of Hawai‘i.* Report R76. Water Resources Research Center, University of Hawaii at Manoa, with the cooperation of the Department of Meteorology, University of Hawaii at Manoa. State of Hawaii, Department of Land and Natural Resources, Division of Water and Land Development.

Hammatt, H., I. Masterson, and T. Devereux
1996 Archaeological Inventory Survey of Access Roads Adjacent to the Maalaea-Lahaina Third 69KV Transmission Line Corridor. Cultural Surveys Hawaii. Prepared for Dames and Moore and Maui Electric Co.

Handy, E.S.C.
1940 *The Hawaiian Planter.* B.P. Bishop Museum Bulletin No. 126. Bishop Museum Press, Honolulu.

Handy, E.S.C., E.G. Handy and M. Pukui
1991 *Native Planters in Old Hawaii: Their Life, Lore and Environment.* B.P. Bishop Museum Bulletin 223. Bishop Museum Press, Honolulu. (Revised edition)

Hommon, R.
1986 Social Evolution in Ancient Hawai‘i. IN Kirch, P. (ed.), *Island Societies: Archaeological Approaches to Evolution and Trans-formation*: 55-88. Cambridge: University Press.

Hono-ko-hau Study Advisory Commission
1974 The Spirit of Ka-Loko Hono-Ko-Hau. National Park Service, U.S. Department of the Interior.

Kamakau, S.
1976 The Works of the People of Old, Na hana a ka Po‘e Kahiko. *B.P. Bishop Museum Special Publication* 61. Bishop Museum Press, Honolulu.

1992 *Ruling Chiefs of Hawaii*. The Kamehameha Schools Press, Honolulu (revised ed.).

Kent, N.
1983 *Hawaii: Islands Under the Influence*. University of Hawai‘i Press, Honolulu.

Kirch, P.
1984 *The Evolution of the Polynesian Chiefdoms.* Cambridge University Press, New York.

1985 *Feathered Gods and Fishhooks: An Introduction to Hawaiian Archaeology and Prehistory*. University of Hawaii Press, Honolulu.

1990 Monumental Architecture and Power in Polynesian Chiefdoms: A Comparison of Tonga and Hawaii. *World Archaeology* 22(2).

Kuykendall, R., and A. Day
1976 *Hawaii: A History From Polynesian Kingdom to American Statehood.* Prentice-Hall, Inc., Englewood Cliffs.

Magnuson, C.
2003 Supplemental Archaeological Survey of Turbine Pad Alignments, Kaheawa Pastures, Upland Ukumehame Ahupuaʻa. International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

Oliver, D.
1961 *The Pacific Islands.* University of Hawaii Press, Honolulu.

Pogue, J.
1978 *Mooleo Hawaii*. Hale Paipalapala Aupuni, Honolulu (Revised Edition).

Rasmussen, C.
2005a Supplemental Archaeological Reconnaissance Survey of the Southern Portion of the New Low Impact Road for the Wind Turbine Project at Kaheawa Pastures, Upland Ukumehame Ahupuaʻa, Maui (TMK 3-6-01:14). International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

2005b Supplemental Archaeological Reconnaissance Survey within the SMA Zone for the Wind Turbine Project at Ukumehame Ahupuaʻa, Maui (TMK 3-6-01:14). Draft. International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

2005c Field Inspection Letter for the SMA Portion of the New Low Impact Road for the Wind Turbine Project at Kaheawa Pastures, Ukumehame Ahupuaʻa, Maui. Letter report. International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

Robins, J., W. Folk, and H. Hammatt
1994 An Archaeological Inventory Survey of an Approximately 14.7 Mile Proposed Transmission Line, from Maʻalaea to Lahaina, Maui, Hawaiʻi, Cultural Surveys Hawaii, Kailua, Hawaii. Original 1991, Revised 1994.

Tomonari-Tuggle, M.
1995 A Cultural Resource Management Plan for the Lahaina Pali Trail. International Archaeological Research Institute, Inc., Honolulu. Prepared for Na Ala Hele Program, DOFAW and Tri-Isles RC&D Council, Inc., Wailuku.

1998 An Archaeological Reconnaissance Survey for 27 Wind Turbines in the Ukumehame Uplands, Island of Maui. International Archaeological Research Institute, Inc., Honolulu. Prepared for Warren S. Bollmeier II, WSB Hawaii, Kaneohe.

Tomonari-Tuggle, M. and C. Rasmussen
2005 Preservation Plan for Site 50-50-09-5232, and Upland Heiau in Ukumehame Ahupuaʻa, Island of Maui (TMK 4-8-01:1). International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

Tomonari-Tuggle, M., and H. Tuggle
1991 Archaeological Survey of Two Demonstration Trails of the Hawaii Statewide Trail and Access System: Lahaina Pali Trail, Island of Maui and Kaiolohia-Kahue Trail, Island of Lanaʻi. International Archaeological Research Institute, Inc., Honolulu. Prepared for Na Ala Hele Program, DOFAW.

Walker, W.
1931 Archaeology of Maui. Manuscript. Department of Anthropology, B.P. Bishop Museum, Honolulu.

RC-0438

An Archaeological Inventory Survey of 333 Acres for the Proposed Expansion of the Kaheawa Wind Farm (TMK:2-4-8-01: por. 001)

Ukumehame Ahupua'a
Lahaina District
Island of Maui

PREPARED BY:

Matthew R. Clark, B.A.,
and
Robert B. Rechtman, Ph.D.

PREPARED FOR:

Mike Gresham
Kaheawa Wind Power, LLC.
1043 Makawao Ave., Suite 208
Makawao, HI 96768

November 2006

RECHTMAN CONSULTING, LLC
HC 1 Box 4149 Kea'au, Hawai'i 96749-9710
phone: (808) 966-7636 fax: (808) 443-0065
e-mail: bob@rechtmanconsulting.com
ARCHAEOLOGICAL, CULTURAL, AND HISTORICAL STUDIES

An Archaeological Inventory Survey of 333 acres for the Proposed Expansion of the Kaheawa Wind Farm (TMK: 2-4-8-01:por. 001)

Ukumehame Ahupua'a
Lahaina District
Island of Maui

RECHTMAN CONSULTING

EXECUTIVE SUMMARY

At the request of Mr. Mike Gresham of Kaheawa Wind Power, LLC, Rechtman Consulting, LLC conducted an archaeological inventory survey of a roughly 333-acre project area in Ukumehame Ahupua'a, Lahaina District, Island of Maui (TMK:2-4-8-001:por. 001). The land encompassed by the current project area is owned by the State of Hawai'i and is administered through the Department of Land and Natural Resources (DLNR); it is designated as conservation land. The objective of the survey was to record the locations of all archaeological sites and features present within the study area and to provide preliminary significance evaluations for any recorded sites. Kaheawa Wind Power, LLC would like to expand its existing wind farm operation by erecting eighteen new power generating wind turbines within the 333-acre project area (Figure 2). Rechtman Consulting, LLC previously conducted an archaeological inventory survey of an adjacent 200 acres for the construction of the existing wind farm (Clark and Rechtman 2005).

Fieldwork for the current project was conducted between October 9-13, 2006 by Matthew R. Clark, B.A., J. David Nelson, B.A., Christopher S. Hand, B.A., and Ashton K. Dircks, B.A. under the direction of Robert B. Rechtman, Ph.D. The survey included a visual inspection of the entire project area. To accomplish this, fieldworkers walked east/west pedestrian transects spaced at 50-meter intervals working from the southern end of the project area to the northern end. This spacing was adequate for locating all archaeological resources, as a recent wildfire had burned the vegetation off nearly the entire project area prior to the commencement of fieldwork. The lack of vegetation allowed for an unobstructed view of the surface terrain.

As a result of the inventory survey SIHP Site 50-50-09-5232, an upland *heiau* previously recorded by Athens (2002) was relocated, and five new sites including a windbreak shelter (SIHP Site 50-50-09-6218), three cairn (SHIP Sites 50-50-09-6219, 50-50-09-6220, and 50-50-09-6221), and a Historic ranching area containing the remains of a concrete trough and two recently burned wooden structures (possible troughs; SIHP Site 50-50-09-6222) were recorded within the project area. Two segments of an old metal waterline associated with Site 6222 also cross the project area from north to south. With the exception of the previously identified *heiau*, all of the newly recorded archaeological sites are present within the southern portion of the project area *makai* of the existing wind farm. The *heiau* (Site 5232) is located along the southwestern flank of Pu'u Lū'au near the western boundary of the existing wind farm. The site was examined and photographed during the current survey, but no new work was conducted at it, and no new features were discovered in its vicinity. In addition to the recorded archaeological sites a single, isolated piece of branch coral was found on ground surface to the west of Site 6218 and the old metal waterline.

Site 5232 is considered significant under Criterion D because of its important research potential, and under Criterion E because of its important traditional cultural value. This site was previously recommended for preservation (Athens 2002), and a preservation plan has already been prepared and partially implemented for it (Tomonari-Tuggle and Rasmussen 2005). As recommended in that plan, an archaeological monitor should be present during any future development activities that occur within 500 feet of the *heiau*. The five remaining sites (Sites 6218 to 6222) are all considered significant under Criterion D for information they presented relative to past use of the project area. It is argued that research potential has been exhausted at these sites, and they are therefore recommended for no further work.

Contents

Figures

Tables

INTRODUCTION

At the request of Mr. Mike Gresham of Kaheawa Wind Power, LLC, Rechtman Consulting, LLC conducted an archaeological inventory survey of a roughly 333-acre project area in Ukumehame Ahupua'a, Lahaina District, Island of Maui (TMK:2-4-8-001:por. 001) (Figure 1). The land encompassed by the current project area is owned by the State of Hawai'i and is administered through the Department of Land and Natural Resources (DLNR); it is designated as conservation land. The objective of the survey was to record the locations of all archaeological sites and features present within the study area and to provide preliminary significance evaluations for any recorded sites. Kaheawa Wind Power, LLC would like to expand its existing wind farm operation by erecting eighteen new power generating wind turbines within the 333-acre project area (Figure 2). Rechtman Consulting, LLC previously conducted an archaeological inventory survey of an adjacent 200 acres for the construction of the existing wind farm (Clark and Rechtman 2005). The current project was undertaken in support of all necessary permit approvals and in compliance with both the historic preservation review process requirements (HAR 13§13-275-5) of the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD) and the County of Maui Planning Department.

This report contains background information outlining the project area's physical and cultural contexts, a presentation of previous archaeological work in the immediate vicinity of the parcel, and current survey expectations based on that previous work. Also presented is an explanation of the project's methods, detailed description of the archaeological resources encountered, interpretation and evaluation of those resources, and treatment recommendations for all of the documented sites.

Project Area Description

The current project area is located on the southern slopes of West Maui Mountains in Ukumehame Ahupua'a, Lahaina District, Island of Maui (TMK:2-3-8-01:por. 001). The 333-acre study area stretches from an elevation of approximately 1,300 to 2,900 feet above sea level. It is located south and west of the existing wind farm between Pāpalaua Gulch (to the west; Figure 3) and Manawainui Gulch (to the east) in an area commonly referred to as Pōhakuloa ("long ridge") (see Figure 1). A prominent hill named Pu'u Lū'au is present in the east-central portion of the project area. The terrain consists of what is commonly referred to as tableland. Typical of the south rift of the West Maui volcano, this land consists of high, inter-valley ridges separated by steep-sided, dry gulches that descend the steep, southwest facing slope to the ocean (Tomonari-Tuggle 1998). There are three soil zones in the project area (Tomonari-Tuggle 1998). The upper edge of the area is Olelo silty clay, which is well-drained upland soil formed in "material derived from basic igneous rock" and occurring on narrow to broad ridge tops (Foote et al. 1972:101). The central portion of the project area, inland of Pu'u Lū'au, consists of Maiwa silty clay loam, which is a well-drained upland soil developed in volcanic ash and weathered igneous rock (Foote et al. 1972:102-103). The top of Pu'u Lū'au and scattered areas along the upper edge of Manawainui gulch are deflated, with exposed dirt and boulders and cobbles. The area below the *pu'u* is steep, rocky, and punctured by numerous boulder outcrops. The adjacent gulches are classified as rough broken and stony land in very steep gulches, and as rock land where exposed rock covers 25 to 90 percent of the surface (Tomonari-Tuggle 1998).

Owing to a recent wild fire, almost no vegetation was present within the project area at the time of the current fieldwork (Figures 4, 5, and 6). Grasses and weeds interspersed with thick stands of lantana (*Lantana camara*), molasses grass (*Melinis minutiflora*), *kiawe* (*Prosopis pallida*), *koa-haole* (*Leucaena leucocephala*), and ironwood trees (*Casuarina equisitfolia*) were the dominant floral species prior to the fire. Native plants such as *pūkiawe* (*Syphelia* sp.), *'a'ali'i* (*Dodonaea viscosa*), and *'ūlei* (*Osteomeles anthyllidifolia*) were also formerly present. Currently, this vegetation pattern exists only at the extreme *mauka* end of the project area, where a newly bulldozed firebreak kept the fire from spreading further *mauka* (Figure 7).

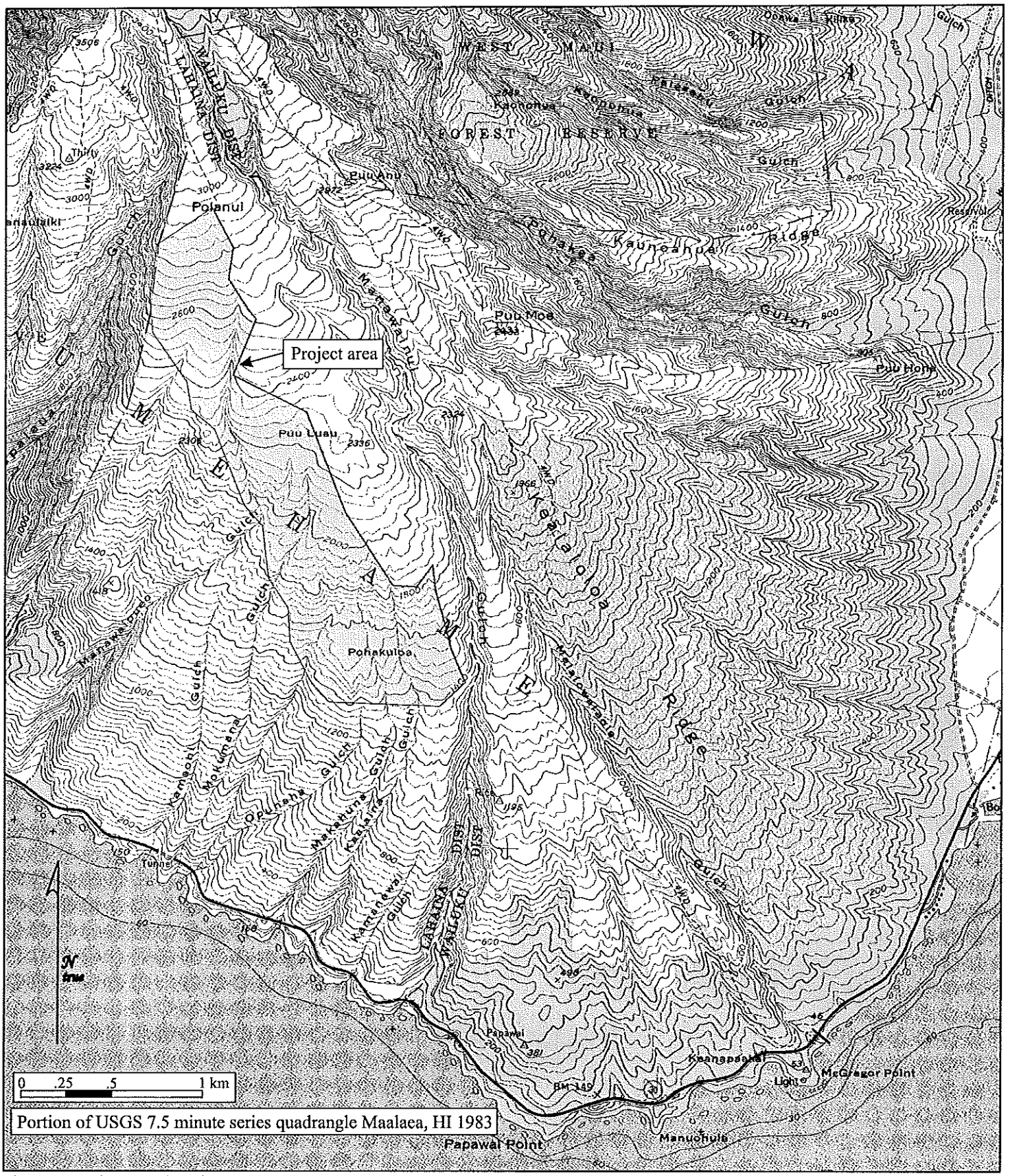


Figure 1. Project area location.

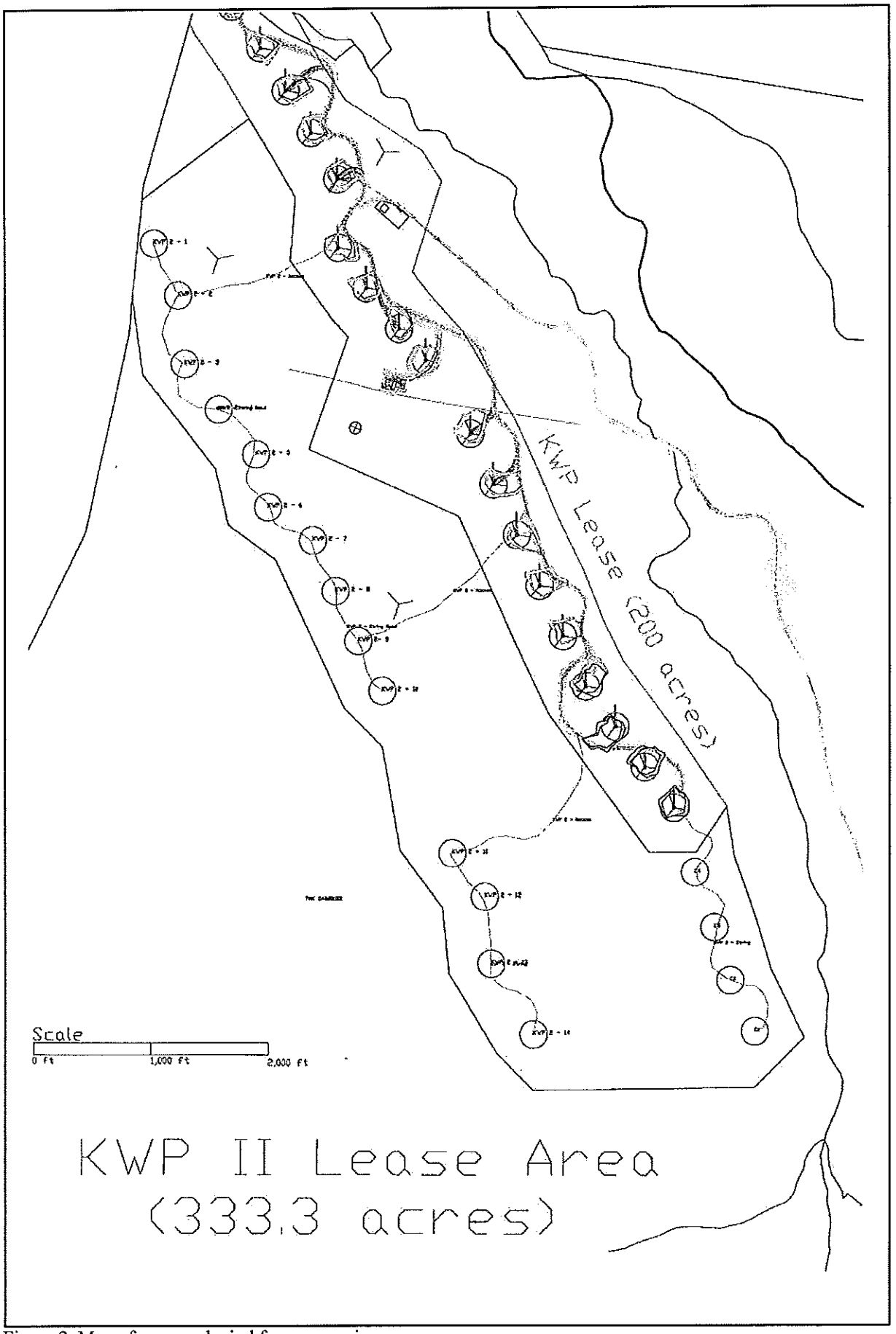


Figure 2. Map of proposed wind farm expansion area.

Figure 3. Pāpalaua Gulch along the western project area boundary, view to southwest.

Figure 4. Middle project area terrain, view to southeast.

Figure 5. Lower project area terrain, view to east toward Manawainui Gulch.

Figure 6. Typical small gulch within the project area, view to southwest.

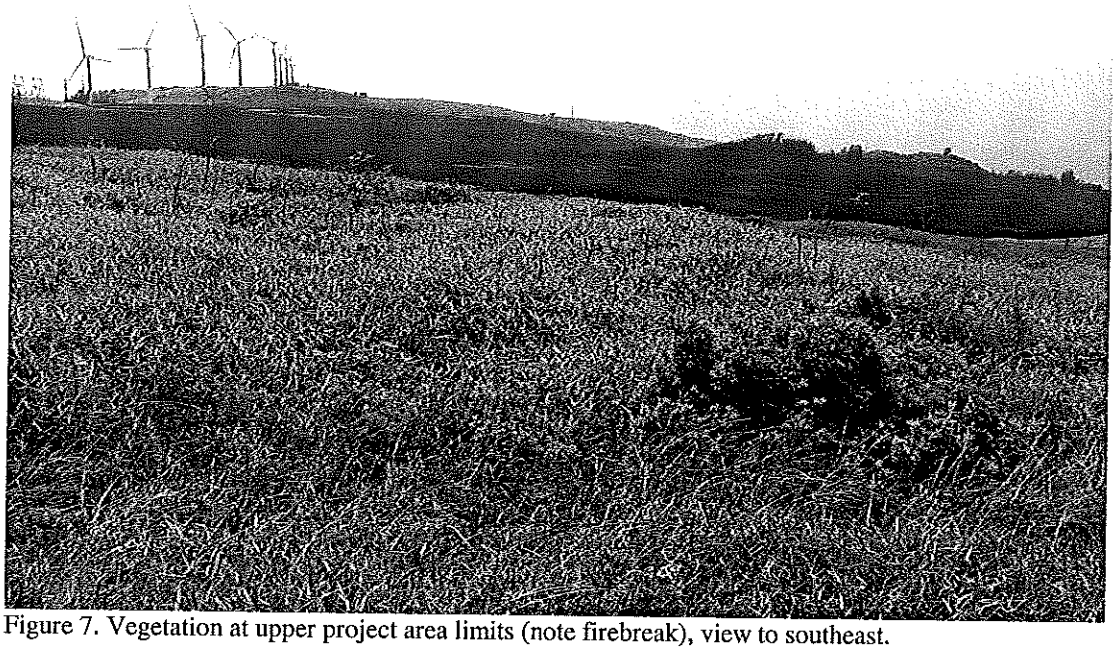


Figure 7. Vegetation at upper project area limits (note firebreak), view to southeast.

BACKGROUND

To generate set of expectations regarding the nature of archaeological resources that might be encountered on the study parcel, and to establish an environment within which to assess the significance of any such resources, previous archaeological studies relative to the project area and a general historical context for the region are presented.

Previous Archaeological Research

Eight previous archaeological studies were conducted for the previously developed portion of the Kaheawa Wind Farm. These studies included a reconnaissance survey of twenty-seven wind turbine locations (Tomonari-Tuggle 1998), a study of an upland *heiau* site (Site 5232; Athens 2002) and a preservation plan for that *heiau* (Tomonari-Tuggle and Rasmussen 2005), a supplemental survey of the wind turbine pad alignments (Magnuson 2003), a supplemental survey for a proposed access road (Athens 2004), a reconnaissance survey of the southern portion of a new low impact road (Rasmussen 2005a), a supplemental reconnaissance survey within the SMA zone for a proposed staging area (Rasmussen 2005b), and an inventory survey of the entire proposed development area (Clark and Rechtman 2005). Three of these studies included portions of the current project area (Athens 2002; Magnuson 2003; Tomonari-Tuggle and Rasmussen 2005). In addition to these studies, an archaeological survey report (Tomonari-Tuggle and Tuggle 1991) and a cultural resource management plan (Tomonari-Tuggle 1995) were prepared for the Lahaina Pali trail, a portion of which crosses *makai* of the current project area, and an inventory survey was conducted for MECO transmission lines that cross the current project area (Hammatt et al. 1996; Robins et al. 1994). The findings of each of the previous archaeological studies are summarized below and their locations are shown in Figure 8.

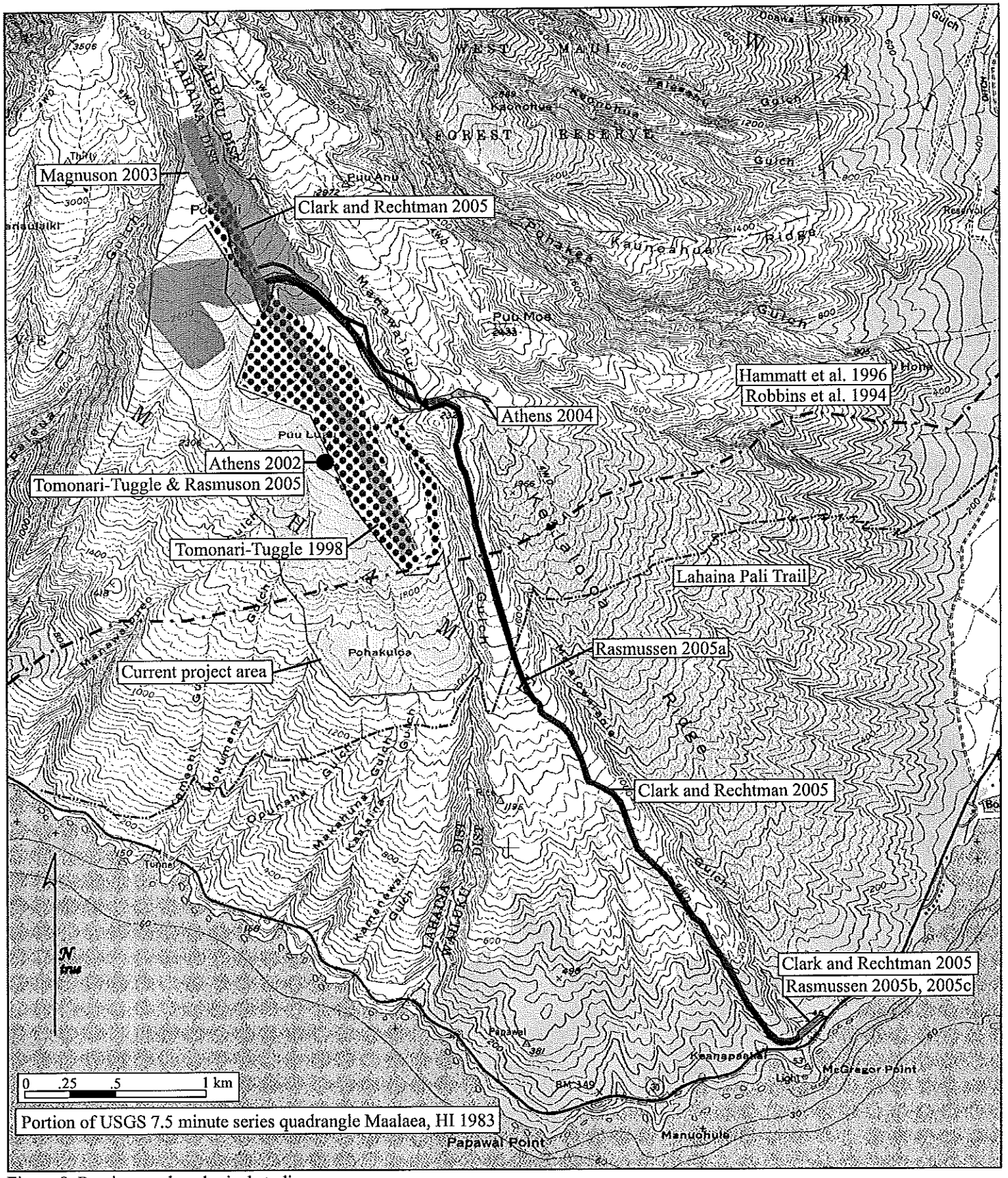


Figure 8. Previous archaeological studies.

Tomonari-Tuggle and Tuggle (1991) conducted an archaeological survey of two demonstration trails for the Hawai'i statewide trail and access system. One of the demonstration trails was the Historic Lahaina Pali trail, a portion of which runs *makai* of the current project area. This trail was constructed around 1841 to accommodate horse traffic between the towns of Lahaina and Wailuku. Tomonari-Tuggle (1995) later prepared a cultural resource management plan for the trail as well. The trail is currently open to the public as part of the Na Ala Hele Statewide Trail and Access System. Tomonari-Tuggle and Tuggle describe the trail thusly:

> The Lahaina Pali trail extends 4.5 miles across the lower southern slopes of West Maui Mountains. At its west end, the trail is anchored inland of the Honoapili'ilani Highway just east of Ukumehame State Beach Park. Its east end is located just inland of the pineapple fields near Ma'alaea Harbor. The trail covers an elevation range from about 100 feet to 1600 feat above sea level. (1991:5)

During the survey of the Lahaina Pali Trail Tomonari-Tuggle and Tuggle (1991) recorded eighteen archaeological sites (Sites 2816 to 2833) along its route, but they did not assign a Site number to the trail itself. Sixteen of the sites were related to the construction and use of the trail or the old coastal road. These sites included alignments, enclosures, walls, petroglyphs, terraces, and C-shaped structures. The two sites not related to the trail included a midden scatter (Site 2816) and a rock shelter (Site 2833). Both of these sites were determined to be of likely Precontact Hawaiian origins. One of the recorded sites (Site 2821) is located directly south of the current project area. Tomonari-Tuggle describes Site 2821 thusly, and makes the following recommendations:

> Probable historic period petroglyphs on large boulder outcrops adjacent to the trail between Ōpūnahā and Makahuna Gulches. There is a quantity of bottle glass and Chinese crockery on the makai edge of the trail and on top of the outcrops on the mauka side of the trail. The outcrops do not have a definite overhang but are high enough to provide afternoon shade, making this an inviting place to rest along the trail. Therefore, there is potential for negative impact on this site. A surface collection of all artifacts, detailed mapping of petroglyphs, and survey of the area *mauka* among the rocks is recommended. The location is also recommended for interpretation. [1995:16]

Robins et al. (1994) conducted an archaeological inventory survey of a then proposed 14.7-mile long transmission line corridor from Mā'alaea to Lahaina. The alignment of the transmission lines crosses the current project area at an elevation of approximately 1,880 feet above sea level. A later survey for access roads leading to the transmission lines was conducted by Hammatt et al. (1996). While these two surveys did locate a number of sites including Historic irrigation ditches, a Historic dam, Historic cattle walls, and Precontact temporary shelters, wind breaks, enclosures, and agricultural features, no archaeological resources were encountered in the vicinity of the current project area.

Archaeological studies of the previously developed portion of the Kaheawa Wind Power project area began in 1998 with a reconnaissance survey of twenty-seven proposed wind turbine locations (Tomonari-Tuggle 1998). This survey took place at elevations ranging from roughly 2,000 to 2,900 feet above sea level. The survey area included a 200-foot wide by roughly 1.5-mile long corridor following a line of five anemometer towers and a potion of Manawainui Gulch extending inland from the MECO transmission line inland approximately 3,000 feet. The only cultural sites observed during the reconnaissance survey were a concrete water trough and a metal waterline. Tomonari-Tuggle concludes that:

> 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 the pipeline, there are no remains of cattle ranching, the only identified use of this area in historic and modern times. (1998:15)

In 1999 a brush fire burned a portion of the wind farm project area, removing some dense brush from the southwestern edge of Pu'u Lū'au, and revealing the presence of an upland *heiau* in Ukumehame Ahupua'a (Site 50-50-09-5232). The location of the *heiau* places it within the current project area, slightly to the west of the area studied by Tomonari-Tuggle (1998). Mr. Ed Lindsey, a cultural monitor for the wind farm project, discovered the site in late 1999 and notified Dr. Melissa Kirkendall, staff archaeologist at the Maui Branch office of the SHPD (Athens 2002:1). After a field visit by SHPD staff members, it was recommended that a qualified archaeologist document the *heiau* in detail. In 2002 IARII conducted archaeological investigations at the *heiau* that included site mapping, photographs, and subsurface testing (Athens 2002).

According to Athens (2002), the *heiau* consists of two adjacent stone enclosures joined by a massive central wall, with one of the enclosures displaying a notch on one side. Excavation inside the notched enclosure revealed a dense deposit of charcoal associated with use of the *heiau*. An AMS radiocarbon determination on charcoal from a short-lived wood taxon (*Chamaesyce* sp.) indicated that the *heiau* likely dated to AD 1670-1770. Several pieces of branch coral were also recovered from the *heiau*, further confirming the religious nature of the site. No food (marine shell or animal bone) or tool (basalt or volcanic glass flake debris, abraders) remains were found either in the excavation or on the surface of the site.

Tomonari-Tuggle and Rasmussen (2005) prepared a preservation plan for the *heiau* (on behalf of the Michael Gresham of Makani Nui Associates, LLC). The plan calls for several short-term preservation measures including a temporary buffer of 100 to 200 feet around the entire site (this buffer was to be marked by 4 to 6 foot high construction fencing prior to any construction activities), monitoring by a qualified archaeologist during any construction activities that take place within 500 feet of the *heiau*, for a pre-construction briefing to be conducted by a qualified archaeologist with the project manager, construction supervisors, and crews prior to any ground alteration activity, and that a report be prepared detailing these short-term preservation measures and submitted to SHPD (Tomonari-Tuggle and Rasmussen 2005:11-14). Long-term preservation measures called for in the plan include the creation of permanent signage and markers around the site, education for individuals and organizations having access to the project area, and community involvement in the maintenance and protection of the site (Tomonari-Tuggle and Rasmussen 2005:14-15). The long-term preservation of this site would be the responsibility of the State. All of the short-term preservation measures proposed by Tomonari-Tuggle and Rasmussen (2005) were followed during the construction of the existing wind farm, but the long-term preservation measures have not yet been implemented.

In 2003, IARII conducted a supplemental archaeological survey of a revised alignment for wind turbine pad locations that included a portion of the current project area (Magnuson 2003). This supplemental survey included three 200-foot wide corridors for two possible turbine rows and an access road connecting them. The survey corridor extended a total distance of 2,130 meters from elevations of 2,400 to 3,100 feet above sea level. As a result of the survey one site, a watering trough previously noted by Tomonari-Tuggle (1998), was relocated, mapped in detailed, photographed, and assigned an SIHP site number (Site 50-50-09-5402). Based on inscriptions in the concrete of the trough, it appears that Site 5402 was built in 1943 (Magnuson 2003:3).

In 2004, IARII conducted a supplemental archaeological survey for an access road leading to the existing wind farm (Athens 2004). The survey area consisted of a 75-meter wide corridor stretching 2.5 kilometers northwest from an existing jeep road across Manawainui Gulch to the previously surveyed wind farm area. As a result of the survey two small rock piles that probably served as cairns (Sites 50-50-09-5625 and 50-50-09-5626) were located and recorded. Site 5625 was located on a natural bench immediately upslope of a small unnamed cinder cone within a dense growth of ironwood samplings, and Site 5626 was situated on the edge of a small ridge descending into Manawainui Gulch from its western edge (Athens 2004:2). Athens (2004:3) concluded that the two stacked rock piles, probably cairns, were fully documented, and no further archaeological documentation was needed. In addition to these sites, a single

brass 45-70 cartridge casing manufactured by Winchester Repeating Arms Company between 1866 and 1932 was also discovered along the western edge of Manawainui Gulch (Athens 2004:3).

In 2005, IARII conducted a supplemental archaeological reconnaissance survey of a new proposed low impact road leading to the existing wind farm (Rasmussen 2005a). This survey area consisted of a corridor approximately 75 meters wide that extended from roughly 1,400 to 2,300 feet above sea level (Rasmussen 2005a:6). The corridor commenced at an existing access road, followed a narrow ridge to the northwest, ande ventually crossed Manawainui Gulch and joined up with the wind turbine locations. As a result of the reconnaissance survey three previously unrecorded archaeological sites thought to be of traditional Hawaiian origins were discovered (Sites 5648, 5649, and 5650). Two of the recorded sites (Sites 5648 and 5650) were located outside (to the west of) the actual road survey corridor.

Site 50-50-09-5648, located between ca. 1,280 and 1,420 feet above sea level, consisted of six C-shaped rock shelters (Features 1, 2, 5, 6, 7, and 9), a possible C-shaped rock structure (Feature 4), one modified outcrop (Feature 10), and a cupboard (Feature 3). Marine shell was observed near Feature 4. Based on the presence of the shell and the formal attributes of the features, Site 5648 was interpreted as being used habitation, perhaps related to the Lahaina Pali Trail, or an earlier trail (Rasmussen 2005a:7). Site 50-50-09-5649, located between ca. 1,880 and 1,980 feet above sea level, consisted of a rock cairn (Feature 11) and modified outcrop (Feature 12). Site 50-50-5650, located at the top of an unnamed cinder cone at an elevation of ca. 2,300 feet above sea level, consisted of four rock cairns (Features 13 to 16). Rasmussen concluded that, "the location (on top of a *pu'u*) and type of features present (cairn with linear stones that may be fallen upright stones) suggest that this site may have a ceremonial function" (2005a:8).

Later in 2005, IARII conducted a supplemental archaeological reconnaissance survey of a roughly 1.75-acre SMA area located along the northern (*mauka*) edge of Honoapili'ilani Highway (Rasmussen 2005b). As a result of that survey three archaeological sites were recorded. In the Rasmussen (2005b) report the sites are referred to with temporary site numbers, but in a letter dated February 11, 2005 the sites are referred to with SIHP site numbers (Rasmussen 2005c). The three recorded sites included a Historic road remnant (Site 50-50-09-5652), a traditional Hawaiian habitation area comprised of several rough features on a small knoll north of the staging area (Site 50-50-09-5654), and set of concrete steps with the date 1908 inscribed into one of the steps (Site 50-50-09-5654). According to Rasmussen (2005b) only Site 5652 was located within the SMA project area, and according to Rasmussen (2005c) all three sites were located outside of the project area. Nevertheless, Rasmussen (2005c:2) suggests that measures be taken to protect the sites during any construction activities in the area, and recommended that a full archaeological inventory survey be conducted of the access road leading to the proposed wind farm area prior to any development.

Following all of the preliminary work conducted by IARII, Rechtman Consulting, LLC conducted an archaeological inventory survey of the entire wind farm project area (Clark and Rechtman 2005). As a result of the inventory survey seven previously identified archaeological sites and two newly identified sites were recorded. The previously identified sites included the Historic Lahaina Pali Trail, a section of Historic highway (Site 4696), a concrete watering trough (Site 5402), a lone cairn (Site 5625), a cairn and a modified outcrop located next to one another (Site 5649), a terraced section of old road (Site 5652), and the remains of a Historic structure (Site 5654). The newly identified sites included a possible privy (Site 5714) and a Historic hoist location (Site 5715). Two isolated finds, consisting of marine shell fragments and an adze fragment, were also discovered. Five other archaeological sites previously recorded by IARII outside the boundaries of the current project area were also relocated. These sites included an upland *heiau* (Site 5352) located within the current project area, a lone cairn (Site 5626), a Precontact habitation complex located between 1,280 and 1,420 feet above sea level (Site 5648), a grouping of four cairns atop an unnamed *pu'u* (Site 5650), and a Precontact habitation complex located at approximately 70 feet above sea level (Site 5653). Clark and Rechtman summarize the findings within the existing wind farm project area thusly:

A review of archival resources and previous archaeological studies, combined with the findings of the current inventory survey, indicates that Precontact use of the project area centered around coastal habitation and the exploitation of marine resources, as indicated by Site 5653. A network of trails may have connected the coastal habitation area with inland resource areas (Devereux et al. 1999). Site 5648 may have been a Precontact habitation area located along one of these trails, or perhaps an early Historic site related to the use of the Lahaina Pali trail (Rasmussen 2005a). If a Precontact *mauka/makai* trail route traversed the current project area, then it likely accessed inland resource areas, and may have connected to trails leading to other areas of West Maui. No evidence of a Precontact trail was observed during the current survey, and it is likely that if one did exist, it was destroyed by the McGregor Point jeep road (Devereux et al. 1999). In late Precontact times trails likely ran to Site 5352, an inland *heiau* located on Pu'u Lū'au (Athens 2002). Isolated marine shell fragments and an adze fragment observed within the wind turbine survey corridor may have been dropped along such a trail route leading to or from the *heiau*.

Sites related to Historic use of the current project area are far more numerous than Precontact ones. Recorded Historic sites indicate that the area along the old Highway alignment (Site 4696) was the primary focus of Historic use. The date "1908" within the concrete stairs at Site 5654, indicates that a Historic structure was in use on the ridge to the west of Malalowaiole Gulch around that time period. Site 5652, a terraced roadbed may have run from Site 4696 to the structure. A possible privy (Site 5714) and a Hoist location (Site 5715) were also located in the area. All of these sites may relate to the use of the current project area for cattle ranching purposes. The land in the vicinity of the current project area was leased for ranching purposes and used as pasture from the late 1850s to the early 1990s (Tomonari-Tuggle 1998). The only site recorded in the extreme inland portions of the current project area was a concrete watering trough constructed in 1943 (Site 5402).

In addition to these sites the Lahaina Pali trail crosses the current project area. This Historic trail was constructed around 1841 for horse travel between Wailuku and Lahaina. The trail fell into disuse approximately fifty years later with the construction of a carriage road (Site 4696) along the coast in Ukumehame Ahupua'a (Tomonari-Tuggle and Tuggle 1991). The trail brought numerous Historic travelers across the lower slopes of the West Maui Mountains, and it continues to bring modern day visitors to the area as part of the *Nā Ala Hele* Statewide Trail and Access System. [2005:40]

Cultural-Historical Context

A generalized Cultural-Historical model for the Hawaiian Islands, with specific reference to Maui Island, and Ukumehame Ahupua'a is presented in order to better understand the current survey area within its regional context.

A Generalized Model of Hawaiian Prehistory

The generalized cultural sequence that follows is based on Kirch's (1985) model. The Settlement or Colonization Period is believed to have occurred in Hawai'i between A.D. 300–600 from the southern Marquesas Islands. This was a period of great exploitation and environmental modification, when early Hawaiian farmers developed new subsistence strategies by adapting their familiar patterns and traditional tools to their new environment (Kirch 1985; Pogue 1978). Their ancient and ingrained philosophy of life tied them to their environment and kept order. Order was further assured by the conical clan principle of genealogical seniority (Kirch 1984). According to Fornander (1969), the Hawaiians brought from their homeland certain universal Polynesian customs: the major gods *Kane, Ku*, and *Lono*; the *kapu* system of law and order; cities of refuge; the *'aumakua* concept; various superstitions; and the concept of *mana*.

The Development Period (A.D. 600–1100) brought about a uniquely Hawaiian culture. The portable artifacts found in archaeological sites of this period reflect not only an evolution of the traditional tools, but some distinctly Hawaiian inventions. The adze (*ko'i*) evolved from the typical Polynesian variations of

plano-convex, trapezoidal, and reverse-triangular cross-section to a very standard Hawaiian rectangular quadrangular tanged adze. The two-piece fishhook and the octopus-lure breadloaf sinker are Hawaiian inventions of this period, as are *'ulu maika* stones and *lei niho palaoa*. The later was a status item worn by those of high rank, indicating a trend toward greater status differentiation (Kirch 1985).

The Expansion Period (A.D. 1100–1650) is characterized by the greatest social stratification, major socioeconomic changes, and intensive land modification. Most of the ecologically favorable zones of the windward and coastal regions of all major islands were settled and the more marginal leeward areas were being developed. The greatest population growth occurred during the Expansion Period. Subsistence patterns intensified as crop farming evolved into large irrigated field systems and expanded into the marginal dryland areas. The *loko* or fishpond aquaculture flourished during this period (Bellwood 1978; Kirch 1985). It was during the Expansion Period that a second major migration settled in Hawai'i, this time from Tahiti in the Society Islands (Kamakau 1976).

The concept of the *ahupua'a* was established during the A.D. 1400s (Kirch 1985), adding another component to a then well-stratified society. This land unit became the equivalent of a local community, with its own social, economic, and political significance. *Ahupua'a* were ruled by *ali'i 'ai ahupua'a* or lesser chiefs; who, for the most part, had complete autonomy over this generally economically self-supporting piece of land, which was managed by a *konohiki*. *Ahupua'a* were usually wedge or pie-shaped, incorporating all of the eco-zones from the mountains to the sea and for several hundred yards beyond the shore, assuring a diverse subsistence resource base (Hommon 1986). The *ali'i* and the *maka'āinana* (commoners) were not confined to the boundaries of the *ahupua'a*; when there was a perceived need, they also shared with their neighbor *ahupua'a ohana* (Hono-ko-hou 1974).

Handy et al. relate that, "Maui was the only island that had a paved way that ran all the way around both its east and west ends" (1991:489). This road was known as the *Alaloa* (long road). Martha Foss Fleming (1933:3-9 in Handy et al. 1991) writes that:

> ...This road was built in about 1516 by Kihapi'ilani, after his conquest and unification of the whole island. It was paved with stones along much of its extent, hence it was referred to as the "*kipapa* (pavement) of Kihapi'ilani." Beaches were used as crossings where gulches came down to the shore. There were no bridges; and beaches were also used along the seashore in many localities...Travelers were sometimes ferried across streams by canoe, or along shore, as between 'Olowalu and Ma'alaea, around the rough southern tip of West Maui [this includes the area of the current study]. (1991:489).

The *ahupua'a* was further divided into smaller sections such as the *'ili, mo'o'aina, pauku'aina, kihapai, koele, hakuone*, and *kuakua* (Hommon 1986, Pogue 1978). The chiefs of these land units gave their allegiance to a territorial chief or *mo'i* (king). *Heiau* building flourished during this period as religion became more complex and embedded in a sociopolitical climate of territorial competition. Monumental architecture, such as *heiau*, "played a key role as visual markers of chiefly dominance" (Kirch 1990:206). At least four *heiau* are known to exist in Ukumehame Ahupua'a; Ukumehame Heiau and Hiki'i Heiau, located on either side of Ukumehame Gulch to the west of the current project area, Kawai'aole Heiau located near the coast to the east of the current project area, and an unnamed upland *heiau* located on Pu'u Lū'au slightly to the west of the current project area (Athens 2002; Devereux et al. 1999; Walker 1931).

The Proto-Historic Period (A.D. 1650–1795) is marked by both intensification and stress. Wars occurred between intra-island and inter-island polities. This period was one of continual conquest by the reigning *ali'i* of all islands. Kamakau (1992:74) relates that Alapa'i, a Hawai'i Island chief, spent a whole year in preparation for a war with Maui, battles of which may have taken place nearby the current project area. Kamakau writes:

> It was 1738 that he set out for the war in which he swept the country...It employed the usual method of warfare of drying up streams...The wet taro patches and the brooks were dried so that there was no food for Ka-uhi [a Maui chief] or for the country people. Alapa'i's men kept close watch over the brooks of Olowalu, Ukumehame, Wailuku, and Honokawai. (1992:74)

However, Alapa'i's forces, consisting of some 8,440 warriors, were surprised and slaughtered by Peleioholani, an O'ahu chief in cahoots with Kauhi, whose force consisted of only 640 warriors. According

to Kamakau (1992:74), Alapa'i regrouped and held Lahaina District from Ukumehame to Mala on the north. When Peleioholani tried to join his forces with Kauhi's forces, Alapa'i forces, led by Kalani'opu'u and Keoua, attacked at Pu'unene and were victorious.

On Hawai'i Island, Ke'eaumoku, son of Keawepoepoe, set up a fort at Pololu and Honokane; he was attacked there by Kalaniopu'u, so he moved to Maui. About A.D. 1759 Kalani'opu'u conquered East Maui, defeating his wife's brother, the Maui king Kamehamehanui, by using Hana's prominent Pu'u Kau'iki as his fortress. He appointed one of his Hawai'i chiefs, Puna, as governor of Hana and Kipahulu. Kahekili became king of Maui in A.D. 1766 when Kamehamehanui died following an illness. Ke'eaumoku took his widow, Namahana, a cousin of Kamehameha I, as his wife. Their daughter, Ka'ahumanu, the future favorite wife of Kamehameha I, was born in a cave at the base of Pu'u Kau'iki, Hana, Maui in A.D. 1768 (Kamakau 1992). In A.D. 1775 Kalani'opu'u and his Hana forces raided and destroyed the neighboring Kaupo district, then launched several more raids on Molokai, Lanai, Kaho'olawe, and parts of West Maui. It was at the battle of Kalaeoka'ilio that Kamehameha, a favorite of Kalaniopu'u, was first recognized as a great warrior and given the name of Pai'ea (hard-shelled crab) by the Maui chiefs and warriors (Kamakau 1992). During the battles between Kalaniopu'u and Kahekili (1777–1779), Ka'ahumanu and her parents left Maui to live on the island of Hawai'i (Kamakau 1992).

History After Contact

Captain James Cook landed in the Hawaiian Islands on January 18, 1778. Ten months later, on a return trip to Hawaiian waters, Kalaniopu'u, who was at war with Kahekili, visited Cook on board the *Resolution* off the East coast of Maui. Kamehameha observed this meeting, but chose not to participate. The following January [1779], Cook and Kalaniopu'u met again in Kealakekua Bay and exchanged gifts. In February, Cook set sail; however, a severe storm off the Kohala coast damaged a mast and they had to return to Kealakekua. Cook's return occurred at an inopportune time, and this misfortune cost him his life (Kuykendall and Day 1976).

Around A.D. 1780 Kalaniopu'u proclaimed that his son Kiwalao would be his successor, and he gave the guardianship of the war god Ku'ka'ilimoku to Kamehameha. Kamehameha and a few other chiefs were concerned about their land claims, which Kiwalao did not seem to honor, so after usurping Kiwalao's authority with a sacrificial ritual, Kamehameha retreated to his district of Kohala. While in Kohala, Kamehameha farmed the land, growing taro and sweet potatoes (Handy et al. 1991). After Kalani'opu'u died in A.D. 1782 civil war broke out: Kiwalao was killed. The wars between Maui and Hawaii continued until A.D. 1795 (Kuykendall and Day 1976; Handy et al. 1991).

In A.D. 1790 two American vessels, the *Eleanora* and *Fair American*, were in Hawaiian waters. Following an altercation between his crew and natives, the Captain of the *Eleanora* massacred more than 100 natives at Olowalu [Maui], then sailed away leaving one of its crew, John Young, on land. The other vessel, the *Fair American,* was captured and its crew killed except for one member, Issac Davis. Kamehameha also observed this but did not participate, although he did prevent Young and Davis from leaving. He also kept the vessel as part of his fleet. Young eventually became governor of the island of Hawai'i. By 1796 Kamehameha had conquered all the island kingdoms except Kauai. It wasn't until 1810, when Kaumuali'i of Kauai gave his allegiance to Kamehameha, that the Hawaiian Islands were unified under one ruler (Kuykendall and Day 1976).

Demographic trends during this period indicate population reduction in some areas, due to war and disease, yet increases in others, with relatively little change in material culture. However, there was a continued trend toward craft and status specialization, intensification of agriculture, *ali'i* controlled aquaculture, upland residential sites, and the enhancement of traditional oral history. The Kū cult, *luakini heiau*, and the *kapu* system were at their peaks, although western influence was already altering the cultural fabric of the Islands (Kirch 1985; Kent 1983). Foreigners had introduced the concept of trade for profit, and by the time Kamehameha I had conquered O'ahu, Maui and Moloka'i, in 1795, the women of Hawai'i had learned the profitable concept of prostitution (Kent 1983). This marked the end of the Proto-Historic Period and the end of an era of uniquely Hawaiian culture.

Hawai'i's culture and economy continued to change drastically as capitalism and industry established a firm foothold. The sandalwood (*Santalum ellipticum*) trade, established by Euro-Americans in 1790 and turned into a viable commercial enterprise by 1805 (Oliver 1961), was flourishing by 1810. This added to the breakdown of the traditional subsistence system, as farmers and fishermen were ordered to spend most of their time logging, resulting in food shortages and famine that led to a population decline. Kamehameha did manage to maintain some control over the trade (Kuykendall and Day 1976; Kent 1983).

Kamehameha I died on May 8, 1819 in Kailua-Kona, and once again the culture of Hawai'i was to change radically. Six months after his death, his son and successor, Liholiho (Kamehameha II), met with *kuhina nui,* Ka'ahumanu, and a council of chiefs and chiefesses at Kawaihae. His advisors, which included the *kahuna* Hewahewa, convinced him to abolish the *kapu* system. He signified his agreement by sitting down and eating with his mother Keopulani, breaking the *'ai kapu* (Oliver 1961; Kuykendall and Day 1976; Kamakau 1992).

Liholiho's cousin, Kekuaokalani, caretaker of the war god *Ku-Kailimoku*, disagreed and revolted. By December of 1819 the revolution was quelled. Kamehameha II sent edicts throughout the kingdom renouncing the ancient state religion, ordering the destruction of the *heiau* images, and ordering that the *heiau* structures be destroyed or abandoned and left to deteriorate. He did, however, allow the personal family religion, the *'aumakua* worship, to continue (Oliver 1961; Kamakau 1992).

The religious, socioeconomic, and demographic changes that gradually took place in the period between 1790 and the 1840s throughout the Hawaiian Kingdom, promoted the establishment of a Euro-American style of land ownership, and the Great *Māhele* was the vehicle for determining ownership of the native land. During this period (1848-1899), the *Māhele* defined the land interests of the King (Kamehameha III), the high-ranking chiefs, and the low-ranking chiefs, the *konohiki.* The chiefs and *konohiki* were required to present their claims to the Land Commission to receive awards for lands provided to them by Kamehameha III. They were also required to provide commutations to the government in order to receive royal patents on their awards. The lands were identified by name only, with the understanding that the ancient boundaries would prevail until the land could be surveyed. This process expedited the work of the Land Commission and speeded the transfers (Chinen 1961:13).

During this process all lands were placed in one of three categories: Crown Lands (for the occupant of the throne), Government Lands, and Konohiki Lands. All three types of land were subject to the rights of the native tenants. Commoners could make claims for land, and if substantiated, they would receive awards referred to as *kuleana*, from the Land Commission. During this period, other land grants were also made to individuals directly from the Kingdom. In 1862, the Commission of Boundaries (Boundary Commission) was established in the Kingdom of Hawai'i to legally set the boundaries of all the *ahupua'a* that had been awarded as a part of the *Māhele*. Subsequently, in 1874, the Commissioners of Boundaries was authorized to certify the boundaries for lands brought before them. The primary informants for the boundary descriptions were old native residents of the lands, many of which had also been claimants for *kuleana* during the *Māhele*. The information was collected primarily between 1873 and 1885. The testimonies were generally given in Hawaiian and simultaneously transcribed in English.

Ukumehame Ahupua'a

Ukumehame Ahupua'a straddles the boundary between the modern day judicial districts of Lahaina and Wailuku, but the *ahupua'a* was once the easternmost of the traditional Hawaiian district of Lahaina (Tomonari-Tuggle and Tuggle 1991:8). The main productive area of the *ahupua'a*, as described by Tomonari-Tuggle and Tuggle, was to the west of the current project area on "the broad coastal plain fronting Ukumehame Gulch and the smaller, neighboring gulches of Makiwa, Hanaula and Palaua" (1991:8) (Figure 9). On the Ukumehame plain and further inland within the gulches, Precontact peoples would have cultivated taro in irrigated fields. Handy (1940:103) describes taro cultivation on the flat entering Ukumehame Gulch still occurring in the 1940s. The distribution of Land Commission Awards (LCAw.) within Ukumehame Ahupua'a supports the predicted Precontact settlement model. Although the *ahupua'a* was retained as Crown Lands during the *Māhele*, forty-three claims were made for land in

Ukumehame Ahupua'a, all within the agriculturally productive gulches located to the west of the current project area. Only sixteen of the claims were awarded (Devereux et al. 1999:12). A smaller settlement area was located at Mā'alaea to the east of the current project area.

Although coastal trails once ringed much of Maui, according to Handy et al. no coastal trail was present fronting the current project area because of the rough terrain, so "from 'Olowalu [to the west of the current project area] travelers were ferried by canoe to Ma'alaea [to the east of the current project area], thence to Makena" (1991:490). The main *mauka/makai* trail in the vicinity of the current project area followed Kealaloloa Ridge to the east of the current project area (Devereux et al. 1999:12). Devereux et al. (1999:12) relate that the more accessible areas of the Kealaloloa Trail were probably destroyed by a present day jeep trail.

One trail crosses *makai* of the current project area is the Lahaina Pali trail. This Historic trail was constructed around 1841 for horse traffic between the towns of Wailuku and Lahaina, with another branch connecting to Mā'alaea (Tomonari-Tuggle and Tuggle 1991). Within Ukumehame Ahupua'a the trail runs from the coast at Manawaipueo Gulch, inland to an elevation of 1,600 feet, and then back down towards the coast near Mā'alaea. In Historic times the trail was known as a long and treacherous route. In 1841, Laura Fish Judd, a missionary who was making the trip between Lahaina and Wailuku, called the trail "the crookedest, the rockiest ever traveled by mortals" (Judd in Tomonari-Tuggle and Tuggle 1991:12). In 1847 Chester Lyman, a visitor to Maui, reiterates this point, writing that the trail "is one of the roughest and most difficult imaginable. It is all the way zigzag and winding, up steep, rocky and barren precipices, being in places dangerous on horseback" (Lyman in Tomonari-Tuggle and Tuggle 1991:12).

Robbers were another danger encountered on the Lahaina Pali trail, especially on the remote section of trail in the vicinity of the current project area. Tomonari-Tuggle and Tuggle (1991) record that:

> Kaiaupe was a noted female robber who lived by the pali road of Aala-loloa [Kealaloloa], Maui. She would entice men to lay with her at the edge of the pali and then kick them over the precipice with her foot. This act was known as Ka-ai-a-Kaiaupe. (T. Kelsey, from E. Sterling's notes, Maui Historical Society in Tomonari-Tuggle and Tuggle 1991:12)
>
> About 1836, when I was a young lad at Lahaina, a native employed to bring letters from Wailuku to my father, reported that he was attacked by a robber on the mountain coast route not [far] from Ma'alaea Bay. In the struggle, he bit off one of the robber's big toes. The robber at once relaxed his hold and fled. In proof of his story, the messenger exhibited the bloody toe. (Dr. D. D. Baldwin, in Tomonari-Tuggle and Tuggle 1991:12)

By the 1850s, portions of Ukumehame Ahupua'a were being leased for various enterprises. An 1865 letter from William Enos and Joseph Sylva clarified a lease for the "pali of Ukumehame", which they 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 in Tomonari-Tuggle 1998:8). It appears that they had held this lease from at least the latter part of the 1850s, as an earlier letter, sent in 1858 from E. Duvauchelle to the king's land agent on Maui, William Webster, requested the Wailuku side of Ukumehame mountain, citing that Joe Sylva had related to him that he did not wish to renew his lease on this area. Nothing apparently came of the Duvauchelle letter, however, records indicate that Sylva held the lease on the land until at least 1871. Furthermore, it is apparent from the letter that the lease was for cattle ranching. Duvauchelle writes, "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 Tomonari-Tuggle 1998:8).

In 1886, the western half of Ukumehame Ahupua'a is listed as being leased to Olowalu Plantation Company, for sugarcane cultivation and sugar production, and the eastern half (including the current project area) is listed as leased to John Richardson and Kahahawai for cattle ranching (Tomonari-Tuggle 1998:8). The 1884 McKenney's Hawaiian Directory reveals that John Richardson was the proprietor of the Maalaea Bay Stock Ranch, with approximately 15,000 acres of pasture and mountain land, 200 head of cattle, and 100 head of horses (Bagot 1884 in Tomonari-Tuggle 1998:8). In a side note, Tomonari-Tuggle (1998:8) relates that the Maalaea Stock Ranch was listed in subsequent directories until at least 1900.

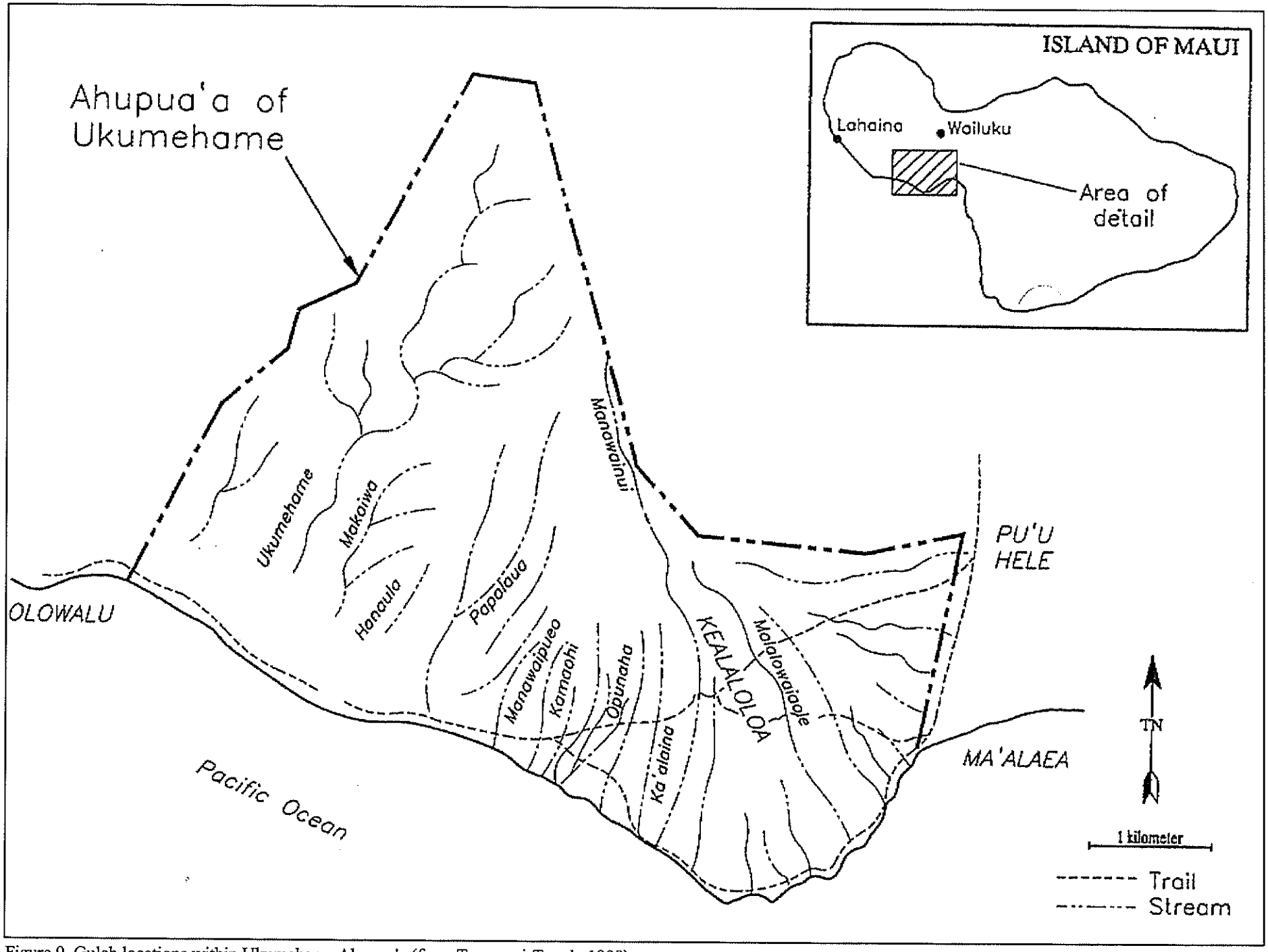


Figure 9. Gulch locations within Ukumehame Ahupua'a (from Tomonari-Tuggle 1998).

By 1889, a new carriage road was under construction from Mā'alaea to Lahaina, along the coast of Ukumehame Ahupua'a. With the opening of this new road, use of the mountainous Lahaina Pali Trail dwindled, and the trail eventually fell into disuse. The new road was gradually widened and straightened to accommodate vehicular use, and then oiled and paved in 1918 (Fleming 1933:22 in Tomonari-Tuggle and Tuggle 1991:13). The road was eventually abandoned in favor of the current alignment of Honoapili'ilani Highway.

Cattle ranching continued in the vicinity of the current project area until the mid-1990s, while portions of the wetter, western half of Ukumehame Ahupua'a continue to be used for sugarcane cultivation. At some point in the mid-1940s the McGregor Point jeep road was bulldozed to the project area, allowing vehicular access to the *mauka* areas, and perhaps obliterating an older road or trail. The road has been subsequently maintained by ranchers, MECO, and DLNR, with newer bulldozer routes approximating the older ones. During the 1970s Maui Electric (MECO) erected power-lines between Mā'alaea and Lahaina (Devereux et al. 1999) that cross the current project area at an elevation of approximately 2,400 feet above sea level.

AHUPUA'A SETTLEMENT PATTERNS AND PROJECT EXPECTATIONS

Devereux et al. (1999) offer a detailed summary of settlement patterns in the vicinity of the current project area, describing that, besides the primary settlement area on the broad costal plain fronting Ukumehame Gulch:

> ...pre-historic occupation of the Ukumehame *ahupua'a* between the alluvial flats of Ukumehame Gulch and the Maui Island isthmus, seems to be focused on the coastal zone, particularly between Mā'alaea Bay and McGregor's Point. This settlement comprises at least 45 "house and shelter" sites, some of which may have been fishing shrines or *koa* (Walker 1931:43). It seems likely a major focus of this village was fishing, given the shrines, its cliff side location, and the lack of abundant agricultural land. A major *heiau* and extensive panels of petroglyphs were also identified by Walker just inland of the village complex.
>
> The steep topography and arid environment of the upper, *mauka* elevations of Ukumehame *ahupua'a* (east of the broad coastal plain fronting Ukumehame Gulch) presents a relatively inhospitable and unproductive agricultural landscape. However, as indicated by a traditional Hawaiian trail present on the Mā'alaea side of the region and the possible existence of comparable trails ascending *mauka* of Walker's coastal settlement, the upper elevations of Ukumehame provide a way to the summit of West Maui and hence to the other side. Kealaloloa "long pathway" Ridge, as it name suggests, may have been the main travel route used during the prehistoric and early historic times to cross to the West Maui Mountain, with auxiliary trails once serving to connect the main travel route. This prominent landform ascends above McGregor's Point, which apparently represents the western extent of the coastal settlement observed by Walker. The main travel route of Kealaloloa and auxiliary *mauka-makai* trails probably provided coastal residents with access to *mauka* resources (*e.g.* wild plant goods, bird catching, and stone materials), and communication with other West Maui regions. (Devereux et al. 1999:85-86)

Based on the results of previous archaeological surveys conducted for the existing wind farm (Athens 2002, 2004; Clark and Rechtman 2005; Magnuson 2003; Rasmussen 2005a, 2005b, 2005c; Tomonari-Tuggle 1998; Tomonari-Tuggle and Rasmussen 2005), it is known that an upland *heiau* (Site 5232) will be present along the southwestern flank of Pu'u Lū'au near the eastern edge of the current project area. Trails may also be present that run to or from this upland *heiau*. These trail routes could be marked by worn paths or cairn (Devereux et al. (1999). It is possible, although unlikely, that Precontact habitation features also exist in this area. If any such features are encountered they are expected to take the form of C-shape enclosures or stone alignments that block the prevailing trade winds, and were likely only used on a short-

term or recurrent basis. These features are likely to be more prevalent along trail routes that received repeated use. It is likely that Historic cattle ranching features are present within the project area. Such features may include concrete water troughs, metal water lines, wire fence lines, windbreak shelters, roads, or cairn that mark Historic trails. One Historic trail, the Lahaina Pali Trail, is known to pass *makai* (south) of the current project area. Tomonari-Tuggle and Tuggle (1991) recorded Historic petroglyphs and temporary shelters (Site 2821) along this trail in the vicinity of the project area, but the trail should be far enough removed from the project area that these features will not be included in the current survey area.

FIELDWORK

Fieldwork for the current project was conducted between October 9-13, 2006 by Matthew R. Clark, B.A., J. David Nelson, B.A., Christopher S. Hand, B.A., and Ashton K. Dircks, B.A. under the direction of Robert B. Rechtman, Ph.D.

Methods

The current inventory survey included a visual inspection of the entire project area. To accomplish this, fieldworkers walked east/west pedestrian transects spaced at 50-meter intervals working from the southern end of the project area to the northern end. This spacing was adequate for locating all archaeological resources, as a recent wildfire had burned the vegetation off nearly the entire project area prior to the commencement of fieldwork. The lack of vegetation allowed for an unobstructed view of the surface terrain. When archaeological features (or land alterations; i.e. bulldozing, roads, etc.) were encountered, they were plotted on a map of the study parcel using Garmin 76s handheld GPS technology (with sub five-meter accuracy), and then (if necessary) cleared of vegetation, mapped in detail, photographed, and described using standardized site record forms. No subsurface testing was conducted during the current inventory survey.

Findings

As a result of the current inventory survey Site 5232, an upland *heiau* previously recorded by Athens (2002) was relocated, and five new sites including a windbreak shelter (Site 6218), three cairn (Sites 6219, 6220, and 6221), and a Historic ranching area containing the remains of a concrete trough and two recently burned wooden structures (possible troughs; Site 6222) were recorded within the project area (Figure 10). Two segments of an old metal waterline associated with Site 6222 also cross the project area from north to south. With the exception of the previously identified *heiau*, all of the newly recorded archaeological sites are present within the southern portion of the project area *makai* of the existing wind farm. The *heiau* (Site 5232) is located along the southwestern flank of Pu'u Lū'au near the western boundary of the existing wind farm. This site has a previously approved and partially implemented preservation plan (Tomonari-Tuggle and Rasmussen 2005). The site was examined and photographed during the current survey, but no new work was conducted at it, and no new features were discovered in its vicinity. In addition to the recorded archaeological sites a single, isolated piece of branch coral was found on ground surface to the west of Site 6218 and the old metal waterline.

Site 2821, as recorded by Tomonari-Tuggle and Tuggle (1991), was also relocated along the *mauka* edge of the Lahaina Pali Trail. This site and the Lahaina Pali Trail are far enough removed from the current project area that they will not be directly affected by the proposed development. It was noted, however, that feature density, as compared to the low feature density within the current project area, dramatically increases in the vicinity of the Lahaina Pali Trail, where numerous temporary shelters are present. Care should be taken to avoid this area during any future development activities. Also, as a side note, it was discovered that the Historic petroglyphs at Site 2821 have been negatively impacted by pedestrian traffic on the Lahaina Pali Trail since the time of the earlier archaeological study. Several new names and pictures have been scratched into the rocks at that site in recent years. The Department of Land and Natural Resources may want to consider corrective actions, such as signs, to help prevent further deterioration of this site in the future.

Each of the archaeological sites recorded within the project area are discussed in detail below, and their locations relative to the project area boundaries and the proposed wind farm development are shown in Figure 10.

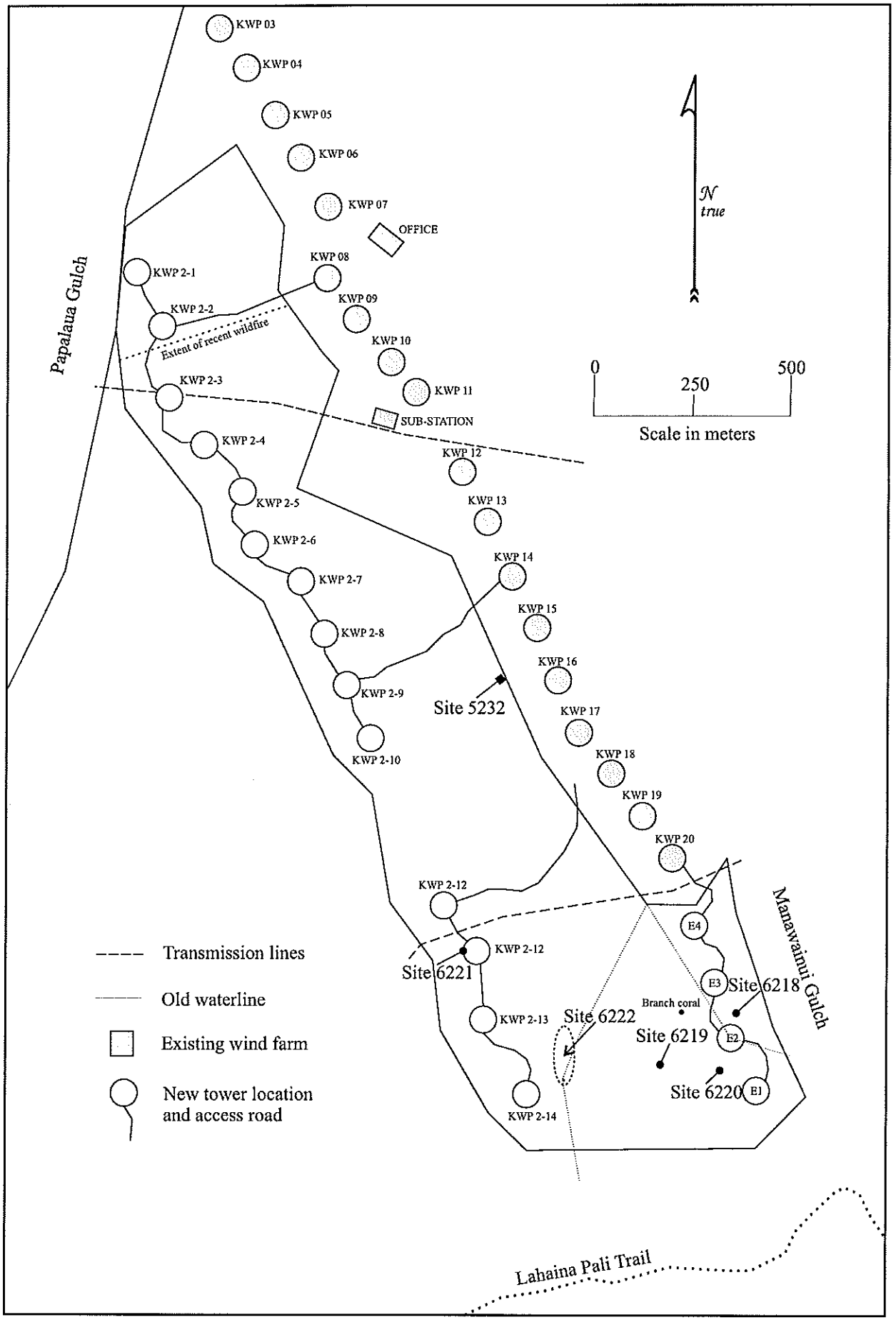


Figure 10. Project area plan view.

SIHP Site 5232

Site 5232 is an upland *heiau* located in the east-central portion of the current project area along the western edge of the existing wind farm (see Figure 10). Site 5232 was fully documented by Athens (2002), and a preservation plan has been prepared and implemented for this site (Tomonari-Tuggle and Rasmussen 2005). Athens describes the *heiau* and summarizes the findings of work conducted at Site 5232 thusly:

> The *heiau*, situated on the lee side of a small hill [Pu'u Lū'au] at an elevation of 686 m, consists of two adjacent stone enclosures joined by a massive central wall. One of the enclosures is distinguished by a "notch" on one side. Notched enclosures are a common design trait for religious architecture on Maui. The site also has several terraces. Excavation inside the notched enclosure revealed a dense deposit of charcoal associated with use of the *heiau*. An AMS radiocarbon determination on charcoal from a short-lived wood taxon (*Chamaesyce* sp.) indicates that the *heiau* likely dates within the range of AD 1670-1770. This date is in agreement with dates of other notched *heiau*, suggesting that the notched enclosure design is a late prehistoric architectural development. Several pieces of branch coral were recovered from the charcoal deposit, further confirming the religious nature of the site (branch coral was commonly brought to *heiau* as offerings). No food (marine shell or animal bone) or tool (basalt or volcanic glass flake debris, abraders) remains were found either in the excavation or on the surface of the site. A sample of the charcoal was identified for its wood species; the findings suggest the environment in the vicinity of the *heiau* was not forested. [2002:iii]

During the current inventory survey Site 5232 was relocated and examined. Photographs were taken (Figures 11, 12, 13, and 14), and the area surrounding the *heiau* was thoroughly inspected for any additional features, portable artifacts, and/or trails. It was found that the work previously conducted at the site by Athens (2002) was accurate and complete, and no additional findings were noted in the vicinity of Site 5232. It was noted however,—and not previously mentioned—that the orientation of the *heiau* is such that the southwestern corner is oriented toward the tallest point on the Island of Kaho'olawe. This may be an important aspect of Site 5232, suggesting that it perhaps functioned as a navigation *heiau* (Kaho'olawe has known associations with Hawaiian navigation).

Figure 11. SIHP Site 5232, view to west.

Figure 12. SIHP Site 5232, view to west of the southern *heiau* enclosure.

Figure 13. SIHP Site 5232, view to west of the northern *heiau* enclosure.

Figure 14. SIHP Site 5232, view to west of the notched northeastern corner of the *heiau*.

SIHP Site 6218

Site 6218 is a windbreak shelter located along the western edge of Manawainui Gulch, approximately 450 meters south of the existing wind farm (see Figure 10). The site consists of six large cobbles and small boulders that have been placed in a line upon the western edge of a raised, decomposing bedrock outcrop to create a crude windbreak shelter (Figure 15). The cobbles and boulders used for the windbreak were taken from ground surface to the west of the outcrop, leaving a sheltered cleared area in that location that measures 4.3 meters by 2.4 meters. The six cobbles and boulders are placed in a line, 1.2 meters long, that stands one to two courses high, or 0.6 meters above the outcrop surface and 1.2 meters above ground surface to the west of the outcrop. The bedrock outcrop to the east of the feature is raised an additional 1.0 meter above the aligned cobbles. This bedrock outcrop would have played a primary role in blocking the prevailing trade winds. The rocks on the outcrop may have simply been those that were removed from ground surface to create the cleared area, as they would not be necessary in the lee of the outcrop to block the wind. The cleared area consists of cobble free soil that is defined by bedrock to the north and loose cobbles to the south and west.

Site 6218 is an extremely crude construction that is obviously intended to block the prevailing, often strong, winds in the area. It would have required very little time or effort to construct, and may have been used only once. No indicator of time of construction is present at Site 6218, and realistically it could have been constructed by anyone at any time. However, the site is located near a metal waterline that was laid in the 1940s, and one possibility is that the windbreak was a rest area constructed by the ranch hands working on that project.

Figure 15. SIHP Site 6218, view to east.

SIHP Site 6219

Site 6219 is a cairn located in the southern portion of the project area roughly 550 meters south of the existing wind farm (see Figure 10). The cairn is constructed of two boulders stacked one on top of the other on top of a third naturally occurring bedrock boulder (Figure 16). Small stones are present beneath the two stacked boulders to help keep them balanced a top one another. The cairn attains a maximum height of 1.4 meters above the surrounding ground surface and 0.9 meters above the bedrock boulder it is resting on. This cairn could have been erected at anytime for any purpose, but it likely would have required the effort of two people to build, as the stacked boulders are large and would have been difficult for a single person to lift into place. It is possible that the cairn marks the route of a former trail, although no such route was observed across the rocky terrain.

SIHP Site 6220

Site 6220 is a small cairn located in the southern portion of the project area roughly 600 meters south of the existing wind farm (see Figure 10). The cairn is constructed of three small cobbles stacked one on top of a large bedrock boulder (Figure 17). Each cobble measures roughly 10 centimeters in diameter, and altogether the cairn stands 27 centimeters above the surface of the boulder. This cairn could have been erected at anytime for any purpose, but it is likely that it was constructed during recent times, as the cobbles are rather precariously balanced and would fall over easily if disturbed. It is possible that the cairn marks the route of a former trail, although no such route was observed across the rocky terrain.

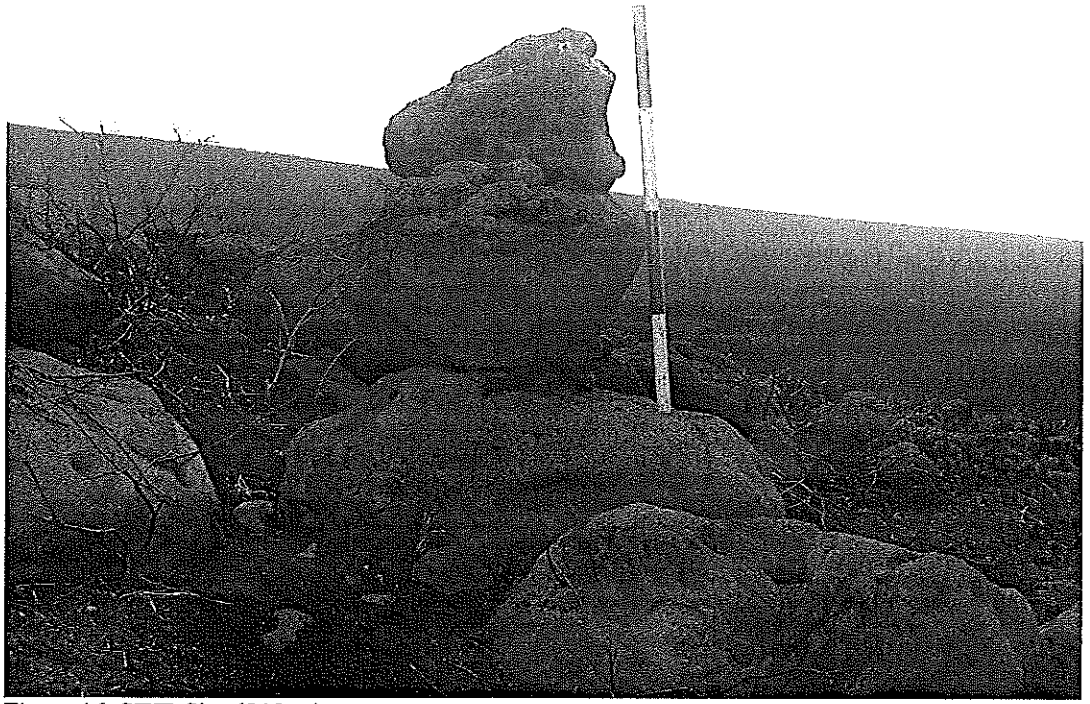


Figure 16. SIHP Site 6219, view to east.

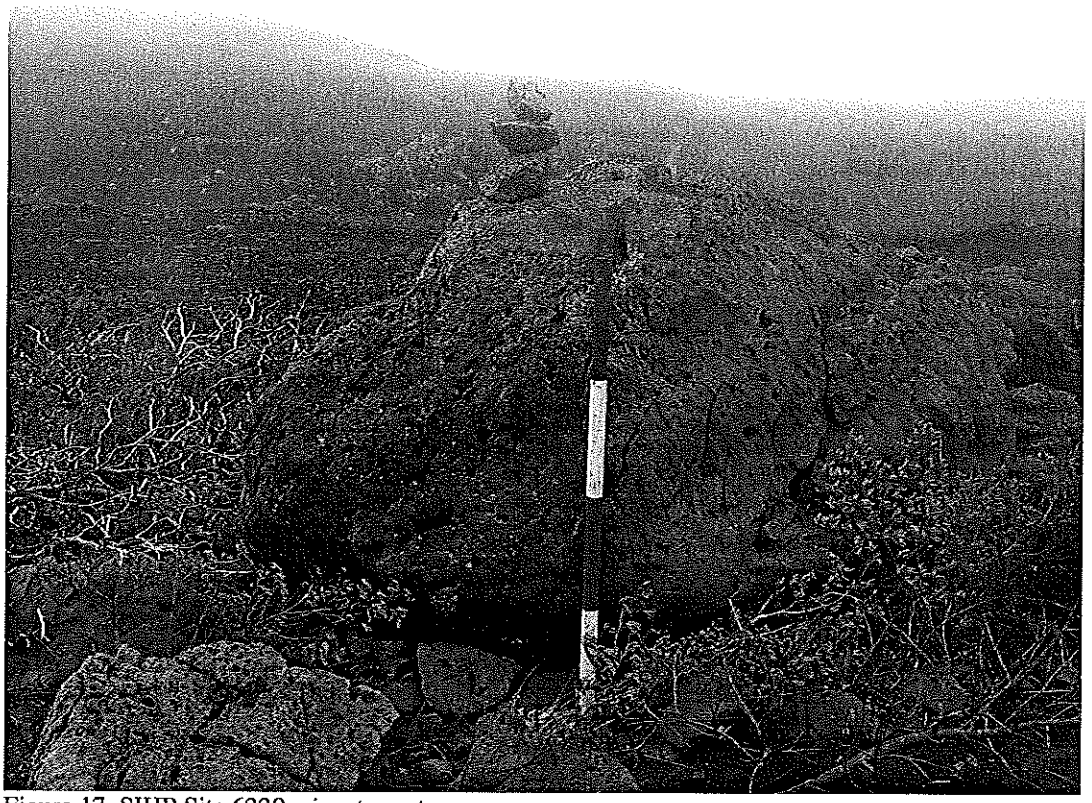


Figure 17. SIHP Site 6220, view to east.

SIHP Site 6221

Site 6221 is a cairn located in the southern portion of the project area roughly 1,000 meters west-southwest of the existing wind farm, and 50 meters south of the MECO transmission lines that cross the southern portion of the project area (see Figure 10). The cairn is constructed of approximately fifteen medium sized cobbles that are loosely stacked/piled on and against two small bedrock boulders (Figures 18 and 19). Site 6221 stands 0.9 meters above the surrounding ground surface and measures 1.0 meter in diameter. This cairn could have been erected at anytime for any purpose. It is possible that the cairn marks the route of a former trail, although no such route was observed across the rocky terrain.

Figure 18. SIHP Site 6221, view to southeast.

Figure 19. SIHP Site 6221, view to southwest.

SIHP Site 6222

Site 6222 consists of a concrete water trough (Feature A) and the remnants of two recently burned wooden structures (Feature B), possibly troughs, located in the southwestern portion of the current project area (see Figure 10). The features of this site are located within a level soil area at the base of a steep south-facing slope. They are roughly 120 meters apart, but are connected by an old metal waterline that passes beneath one of the former wooden structures of Feature B and feeds Feature A. An inscription in the concrete of Feature A reads "12/17/43", revealing that construction of the concrete portion of the water trough was completed on December 17, 1943.

The waterline that connects these two features begins far *mauka* of Site 6222, and four other concrete water troughs are present along the same waterline in the vicinity of the wind farm. The waterline runs south along the western edge of the existing wind farm from Site 5402, a previously recorded water trough near the northern end of the existing wind farm that was constructed on December 8, 1943 (see Clark and Rechtman 2005). Just beyond the southern edge of the wind farm, within the current project area, the line branches, with one branch running to Site 6222, and the other one crossing Manawainui Gulch to a trough that has not been previously studied on the eastern side of the gulch. The line changes directions at Site 6222 and then continues south to a fourth trough located slightly south of the Lahaina Pali Trail. Examination of this trough during the current study revealed that it was constructed on December 21, 1943. Unlike the other troughs, this trough also contained the inscription "HONOULA RANCH", suggesting that this water system (and by association Feature B of Site 6222) was part of that ranch, which was operating in Ukumehame in the 1940s. The waterline no longer carries water.

A water worn coral fragment and a bottle were found on ground surface between Features A and B of Site 6222. The clear glass soda bottle is machine-made and it reads "STAR ICE SODA WORKS, WAILIKU, MAUI". A second bottle, a machine-made, aqua glass, one-gallon jug, that read "MAUI SAKE BREWERY Co., LTD.", was discovered in the vicinity of Feature B (Figure 20). Both of these bottles were manufactured during the middle part of the 20th century, and are likely associated with the Historic ranch use of Site 6222. The locations of these bottles, along with the locations Features A and B of Site 6222 are depicted in Figure 21, and detailed descriptions of each of these features follow below.

Figure 20. Historic bottles discovered at SIHP Site 6222, overviews.

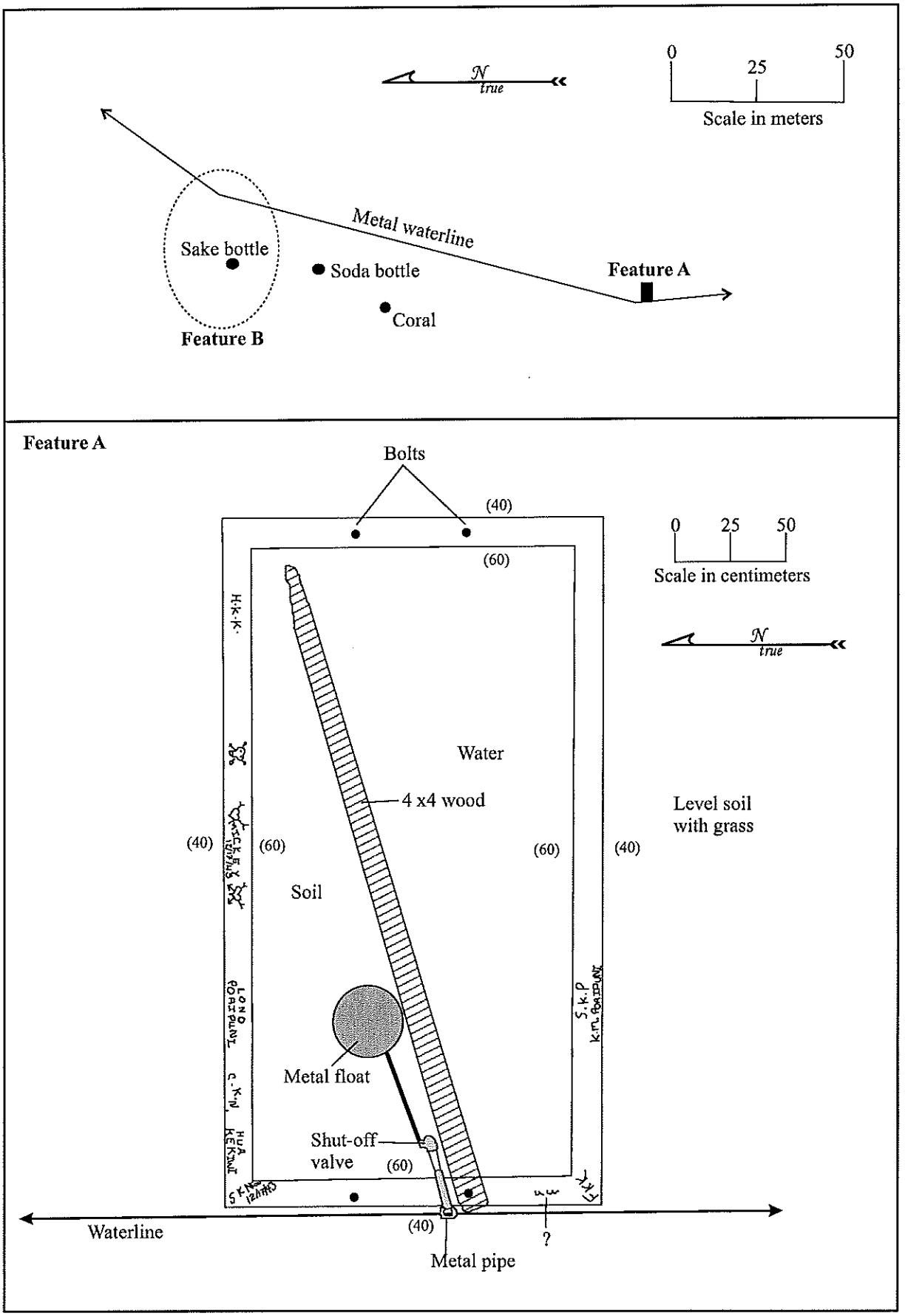


Figure 21. SIHP Site 6222 plan view and Feature A detail.

Feature A

Feature A is a concrete water trough located approximately 120 meters south/southwest of Feature B along the eastern edge of the old metal waterline (see Figure 21). The trough measures 3.05 meters long (east/west) by 1.73 meters wide (north/south) (Figure 22). It stands 0.4 meters above the surrounding ground surface on all sides, and has an interior depth of 0.6 meters. The concrete walls were poured in place using a wooden form. They measure 0.12 meters thick. Four metal anchor bolts are located in the top surface of the walls, two each at the eastern and western ends of the trough, centered and evenly spaced 0.5 meters apart. These bolts formerly anchored two wooden, 4" x 4", cross beams that would have laid flat over the trough. One of the cross beams is still attached by a bolt to the western end of the trough, but its eastern end has rotted away and fallen into the trough. The other cross beam is missing from the feature. A metal pipe runs from the old waterline, up the western exterior edge of the trough and over the lip. The pipe is attached to a shut-off valve, which is in turn attached to a metal ball float on a pivot arm. This mechanism formerly controlled the amount of water in the trough, only allowing new water to enter as the water level lowered and the lowered ball float released the shut-off valve. The mechanism no longer functions, as water is no longer carried through the old metal waterline. The interior of the trough currently contains some soil and a small amount of collected rainwater on the smooth concrete floor.

Several inscriptions are present in the concrete along the upper lip of Feature A. The inscriptions include several names and initials, presumably of the ranch hands that constructed the trough, along with the date "12/17/43" in two locations, a skull and cross bones, and two hearts with crossed arrows through them. The names and initials include "H.K.K", "MICKEY", "LONO POAIPUNI", "C.K.N.", "HUA KEKIWI", "SK Naioa" (?), "FKK", "S.K.P.", and "K. M. POAIPUNI" (Figure 23). Some of these names also show up on the other troughs present in the vicinity of the wind farm.

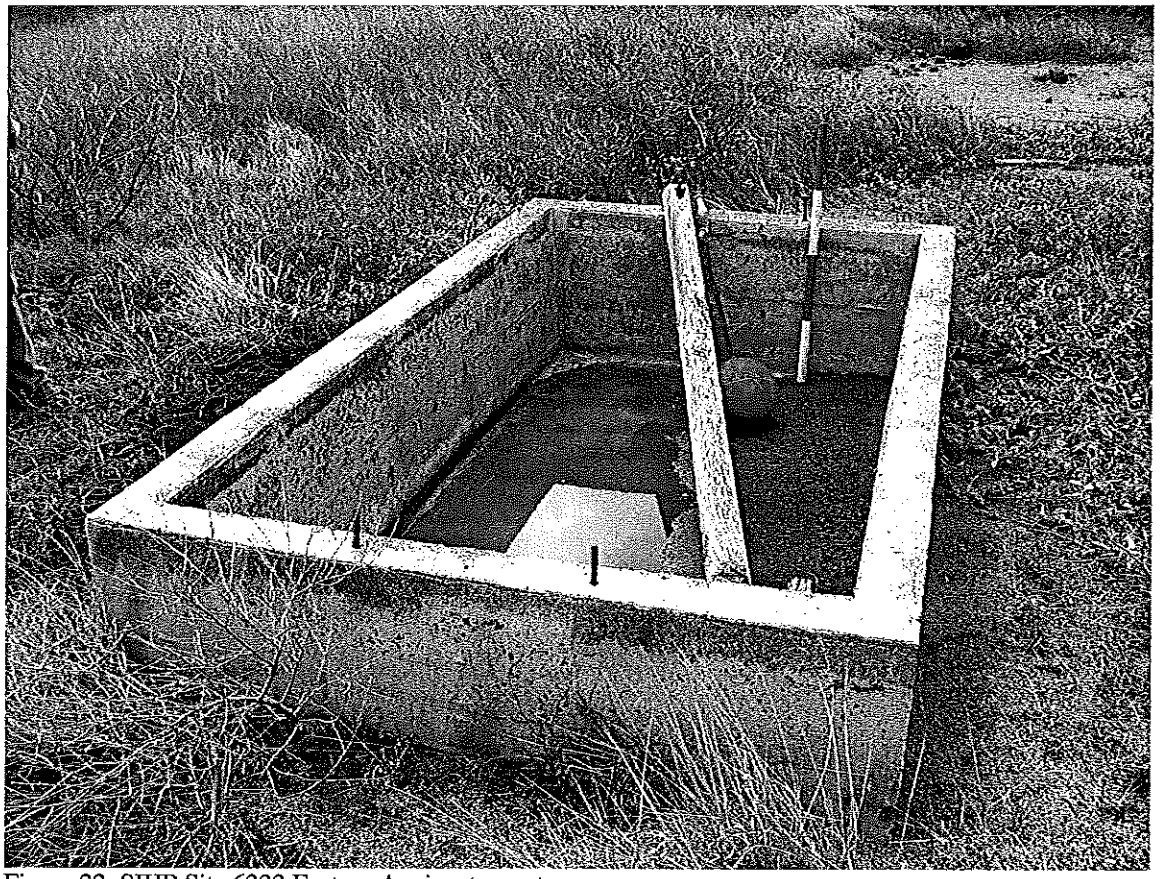


Figure 22. SIHP Site 6222 Feature A, view to west.

Figure 23. SIHP Site 6222, inscriptions in Feature A, various overviews.

Feature B

Feature B consists of the remains of two wooden structures (possibly troughs) located roughly 120 meters north/northeast of Feature A along the old metal waterline (see Figure 21). Both of the structures burned during the recent wild fire that occurred within the current project area. Currently all that remains of the wood structures are some charred fragments of milled lumber and the rusted metal hardware that held them together. The components of this feature are scattered over a roughly 30-meter by 30-meter area to the west of the old metal waterline. Based on the association of Features B with Feature A, it is likely that these wooden structures were used for ranching purposes as early as the 1940s.

The eastern most structure sits on top of the waterline (Figure 24). It is marked by a rectangular shaped discoloration on ground surface that measures 2.8 meters long (east/west) by 0.8 meters wide (north/south). This area has a reddish tint, while the surrounding ground surface is black with charcoal. The discolored area contains charred wood, six iron straps, six iron rods with treaded ends that are capped with iron nuts, and roughly fifty, large-sized, galvanized nails. It is evident from the remaining hardware that the structure was likely a wooden trough. At three separate locations, at the eastern and western ends of the trough and in the middle, two of the straps are held at each end by two different length rods. The straps would have supported the wooden side boards of the trough and the different length rods would have allowed for the top of the trough to be wider than the base. A metal T-fitting that has been capped off is present in the waterline four meters to the south of the trough, and it is possible that the fitting once contained a pipe that was formerly used to fill the trough with water.

The second wooden structure of Feature B is much less well defined than the first. It consists of several burned or partially burned 2" x 6" and 2" x 8" lengths of milled lumber, a couple iron straps, and a bent metal rod located twenty meters west of the eastern structure and spread over a ten by ten meter area. This structure could have been a trough similar to the first, but it is difficult to tell as many of the pieces are missing and most of the lumber has burned. It is likely that this structure was abandoned or dismantled prior to the recent fire, as it did not leave a discolored footprint like the other one did, and no nails were present.

Figure 24. SIHP Site 6222 Feature B, view to west of the easternmost burned structure.

SUMMARY AND CONCLUSIONS

As a result of the current inventory survey Site 5232, a *heiau* previously recorded by Athens (2002) was relocated, and five new sites including a windbreak shelter (Site 6218), three cairn (Sites 6219, 6220, and 6221), and a Historic ranching area containing the remains of a concrete trough and two recently burned wooden structures (possible troughs; Site 6222) were recorded within the project area. Identification of these resources was made easy by the recent occurrence of a wildfire that burned most of the vegetation within the project area. The *heiau* (Site 5232) was reexamined during this study, but no new work was conducted, and there are no new findings to report on with the exception of a possible functional interpretation that the *heiau* may have been intended for Precontact navigational use. This interpretation is derived from the orientation of the *heiau,* which has its corner pointing to the highest point on the Island of Kaho'olawe, an island that has traditional associations with navigation. Athens (2002) reported that the *heiau* was likely in use between A.D. 1670 and 1770. Excavations within the structure revealed the presence of charcoal and branch coral, further attesting to its ceremonial use for possible navigational purposes. This site has a previously approved and partially implemented preservation plan (Tomonari-Tuggle and Rasmussen 2005).

The windbreak shelter (Site 6218) and the cairn (Sites 6219, 6220, and 6221) are all crude constructions that could have been erected at anytime for any number of reasons. It seems clear that the windbreak shelter was designed to provide a cleared area out of the prevailing winds, but it was likely used only once, or on an occasional recurring basis. No indicators of time of construction are present at these sites, and the amount of effort employed in their construction is minimal. It is possible (although unlikely) that cairn mark a former trail route. No such trail route was observed, and the route between the carin would not be the best way to traverse the steep slopes within the project area. The only trail present in the vicinity of the project area is the Historic Lahaina Pali Trail (constructed around 1841), which passes south of the proposed wind farm development area.

The water troughs represented by Site 6222 are part of a water system developed by Honoula Ranch in Ukumehame in the 1940s. This system also included several other water troughs and metal waterlines that carried water between them. The system provided drinking water for cattle in the once extensive, but arid pastures of this upland area. Feature A of Site 6222 is a concrete water trough that was built on December 17, 1943. Feature B consists of two possible wooden troughs that burned during the recent wildfire. Cattle ranching continued within the project area until the 1990s.

SIGNIFICANCE EVALUATION AND TREATMENT RECOMMENDATIONS

The above-described archaeological resources are assessed for their significance based on criteria established and promoted by the DLNR-SHPD and contained in the Hawai'i Administrative Rules 13§13-284-6. These significance evaluations should be considered as preliminary until DLNR-SHPD provides concurrence. For resources to be considered significant they must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

A Be associated with events that have made an important contribution to the broad patterns of our history;

B Be associated with the lives of persons important in our past;

C Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;

D Have yielded, or is likely to yield, information important for research on prehistory or history;

E Have an important traditional cultural value to the native Hawaiian people or to another ethnic group of the state due to associations with traditional cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

The significance and recommended treatments for the recorded sites are discussed below and are presented in Table 1.

Table 1. Site significance and treatment recommendations.

Site #	*Site Type*	*Significance*	*Recommended Treatment*
5232*	*Heiau*	D, E	Preservation
6218	Windbreak shelter	D	No further work
6219	Cairn	D	No further work
6220	Cairn	D	No further work
6221	Cairn	D	No further work
6222	Historic ranching	D	No further work

*Site 5232 has a previously accepted significance evaluation and treatment recommendation from Athens (2002).

Site 5232 is considered significant under Criterion D because of its important research potential, and under Criterion E because of its important traditional cultural value. This site was previously recommended for preservation (Athens 2002), and a preservation plan has already been prepared and partially implemented for it (Tomonari-Tuggle and Rasmussen 2005). As recommended in that plan, an archaeological monitor should be present during any future development activities that occur within 500 feet of the *heiau*.

The five remaining sites (Sites 6218 to 6222) are all considered significant under Criterion D for information they presented relative to past use of the project area. It is argued that research potential has been exhausted at these sites, and they are therefore recommended for no further work. The low-density development of the wind farm, however, should result in the preservation of these sites. Only Site 6221, a cairn, is located in an area that may be impacted by grubbing and grading for the preparation of one of the proposed tower locations. The other four sites are far enough removed from the proposed development that they should not be impacted.

REFERENCES CITED

Athens, J.

2002 *An Upland Heiau Site.* Ukumehame Ahupua'a, Maui. International Archaeological Research Institute, Inc., Honolulu. Prepared for GE Wind Energy, LLC, Tehachapi, California.

2004 Supplemental Archaeological Survey for Access Road, Wind Turbine Project at Kaheawa Pastures, Upland Ukumehame Ahupua'a, Maui (TMK 4-8-01:1 & 3-6-01:14). International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

Bagot, F. (ed.)

1884 *McKenney's Hawaiian Directory.* L.M. McKenney & Co., California.

Bellwood, P.

1978 *The Polynesians: Prehistory of an Island People.* Thames and Hudson, Ltd., London.

Chinen, J.

1961 *Original Land Titles in Hawaii.* Privately published.

Clark, M., and R. Rechtman

2005 An Archaeological Inventory Survey of the Proposed Kaheawa Wind Farm Project Area (Portions of TMK:2-3-6-01:14 and 2-4-8-01:1), Ukamehame Ahupua'a, Lahaina abd Wailuku Districts, Island of Maui. Rechtman Consulting, LLC Report RC-0328. Prepared for Kaheawa Wind Power, LLC, Makawao, HI.

Devereux, T., I. Masterson, M. Heidel, V. Creed, L. Pyle, and H. Hammatt

1999 Archaeological Inventory Survey and Subsurface Testing of a 440 Acre Parcel. Ahupua'a of Ukamehame, District of Lahaina, Island of Maui (TMK 4-8-02:09). Cultural Surveys Hawaii. Prepared for Sugar Way Ltd.

Duvauchelle, E.

1858 Letter from E. Duvauchelle to William Webster. July 16. In the Interior Department Land Files of the Hawaii State Archives.

Enos, W. and J. Sylva

1865 Letters from Wm. Enos and Joseph Sylva to John O. Domini. May 16. In the Interior Department Land Files of the Hawaii State Archives.

Fleming, M.

1933 *Old Trails of Maui.* Wailuku, Maui. Prepared for the William and Mary Alexander Chapter, Daughters of the American Revolution.

Foote, D., E. Hill, S. Nakamura, and F. Stephens

1972 *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii.* United States Department of Agriculture, in conjunction with the University of Hawaii Agricultural Extension. U.S. Government Printing Office, Washington, D.C.

Fornander, A.

1969 *An Account of the Polynesian Race: Its Origin and Migrations.* Tokyo: Charles E. Tuttle Co., Inc.

Hammatt, H., I. Masterson, and T. Devereux
1996 Archaeological Inventory Survey of Access Roads Adjacent to the Maalaea-Lahaina Third 69KV Transmission Line Corridor. Cultural Surveys Hawaii. Prepared for Dames and Moore and Maui Electric Co.

Handy, E.S.C., E.G. Handy and M. Pukui
1991 *Native Planters in Old Hawaii: Their Life, Lore and Environment.* B.P. Bishop Museum Bulletin 223. Bishop Museum Press, Honolulu. (Revised edition)

Hommon, R.
1986 Social Evolution in Ancient Hawai'i. IN Kirch, P. (ed.), *Island Societies: Archaeological Approaches to Evolution and Trans-formation*: 55-88. Cambridge: University Press.

Hono-ko-hau Study Advisory Commission
1974 The Spirit of Ka-Loko Hono-Ko-Hau. National Park Service, U.S. Department of the Interior.

Kamakau, S.
1976 The Works of the People of Old, Na hana a ka Po'e Kahiko. *B.P. Bishop Museum Special Publication* 61. Bishop Museum Press, Honolulu.

1992 *Ruling Chiefs of Hawaii.* The Kamehameha Schools Press, Honolulu (revised ed.).

Kent, N.
1983 *Hawaii: Islands Under the Influence.* University of Hawai'i Press, Honolulu.

Kirch, P.
1984 *The Evolution of the Polynesian Chiefdoms.* Cambridge University Press, New York.

1985 *Feathered Gods and Fishhooks: An Introduction to Hawaiian Archaeology and Prehistory.* University of Hawaii Press, Honolulu.

1990 Monumental Architecture and Power in Polynesian Chiefdoms: A Comparison of Tonga and Hawaii. *World Archaeology* 22(2).

Kuykendall, R., and A. Day
1976 *Hawaii: A History From Polynesian Kingdom to American Statehood.* Prentice-Hall, Inc., Englewood Cliffs.

Magnuson, C.
2003 Supplemental Archaeological Survey of Turbine Pad Alignments, Kaheawa Pastures, Upland Ukumehame Ahupua'a. International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

Oliver, D.
1961 *The Pacific Islands.* University of Hawaii Press, Honolulu.

Pogue, J.
1978 *Mooleo Hawaii.* Hale Paipalapala Aupuni, Honolulu (Revised Edition).

Rasmussen, C.
2005a Supplemental Archaeological Reconnaissance Survey of the Southern Portion of the New Low Impact Road for the Wind Turbine Project at Kaheawa Pastures, Upland Ukumehame Ahupua'a, Maui (TMK 3-6-01:14). International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

2005b Supplemental Archaeological Reconnaissance Survey within the SMA Zone for the Wind Turbine Project at Ukumehame Ahupua'a, Maui (TMK 3-6-01:14). Draft. International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

2005c Field Inspection Letter for the SMA Portion of the New ow Impact Road for the Wind Turbine Project at Kaheawa Pastures, Ukumehame Ahupua'a, Maui. Letter report. International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

Robins, J., W. Folk, and H. Hammatt
1994 An Archaeological Inventory Survey of an Approximately 14.7 Mile Proposed Transmission Line, from Ma'alaea to Lahaina, Maui, Hawai'i, Cultural Surveys Hawaii, Kailua, Hawaii. Original 1991, Revised 1994.

Tomonari-Tuggle, M.
1995 A Cultural Resource Management Plan for the Lahaina Pali Trail. International Archaeological Research Institute, Inc., Honolulu. Prepared for Na Ala Hele Program, DOFAW and Tri-Isles RC&D Council, Inc., Wailuku.

1998 An Archaeological Reconnaissance Survey for 27 Wind Turbines in the Ukumehame Uplands, Island of Maui. International Archaeological Research Institute, Inc., Honolulu. Prepared for Warren S. Bollmeier II, WSB Hawaii, Kaneohe.

Tomonari-Tuggle, M. and C. Rasmussen
2005 Preservation Plan for Site 50-50-09-5232, and Upland Heiau in Ukumehame Ahupua'a, Island of Maui (TMK 4-8-01:1). International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

Tomonari-Tuggle, M., and H. Tuggle
1991 Archaeological Survey of Two Demonstration Trails of the Hawaii Statewide Trail and Access System: Lahaina Pali Trail, Island of Maui and Kaiolohia-Kahue Trail, Island of Lana'i. International Archaeological Research Institute, Inc., Honolulu. Prepared for Na Ala Hele Program, DOFAW.

Walker, W.
1931 Archaeology of Maui. Manuscript. Department of Anthropology, B.P. Bishop Museum, Honolulu.

APPENDIX C. KWP II VISUAL IMPACT ANALYSIS

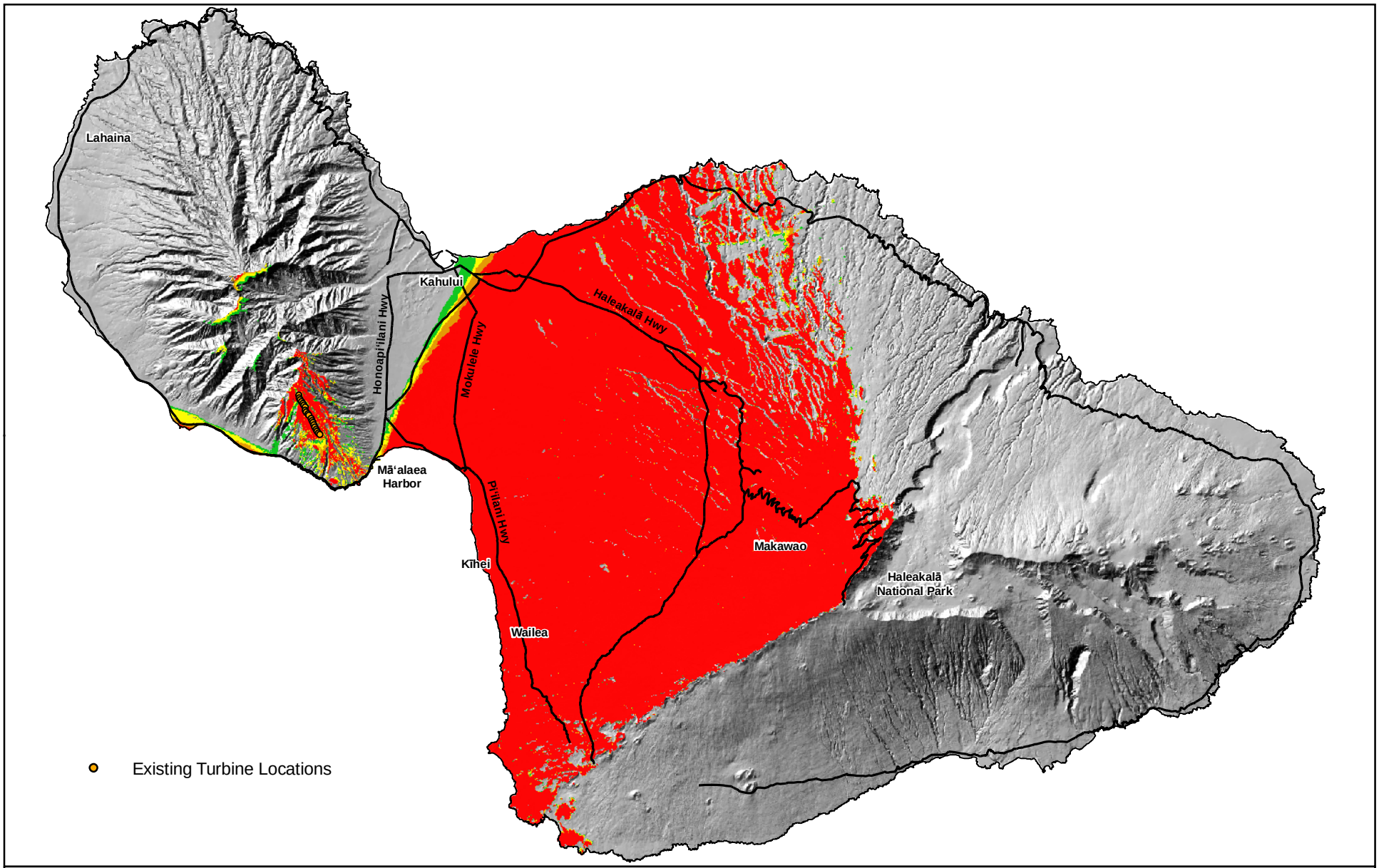
KWP II VISUAL IMPACT ANALYSIS

The graphics that are contained in this Appendix were prepared using the ESRI® ArcView® Spatial Analysis Extension software. PSI began by procuring publicly available elevation data for the island of Maui from the USGS National Elevation Dataset (http://seamless.usgs.gov/website/seamless/viewer.htm). These data consist of rasters with pixel sizes of 0.00028 degrees of latitude and longitude (~10,000 ft.^{2}). U.S.G.S. notes that the estimated vertical accuracy of these elevation data varies between approximately 23 feet (7m) to 49 feet (15m) depending upon the quality of the image and the roughness of the terrain.

In the next step, PSI took the specified bitmap of elevations on the island of Maui and the locations and heights of the features to be considered (in this case the highest point of the turbine blade tips at 327 feet and the top of the tubular turbine support towers at 212 feet) and the height of the observer (~6 feet).

Having thus collected data about topography, object height (i.e. turbines and towers), and viewer height (in feet above sea level), color coded viewshed rasters were created for the various combinations of existing and proposed turbines (i.e. Preferred Alternative and Alternative 2; see Figure 1.2).

The calculated viewsheds for the proposed new WTGs were compared with those for the existing turbines to determine the change in viewshed that would be created from the new turbines. This process produced two viewshed maps for each of the existing turbines and proposed siting areas. These showed the visibility of the towers and the rotor tips for the existing KWP I turbines and for each of the proposed KWP II sites. To present this information graphically, these rasters were then superimposed on a topographic hillshade map, using colors to distinguish areas of greater and lesser visibility. Colors indicate the range of visibility: areas in red indicate areas of total visibility, areas of orange, yellow, and green less so, and areas shown without a color fill are in locations where turbines would not be visible.



Prepared For:
Kaheawa Wind Power II

Prepared By:
PLANNING SOLUTIONS

Sources:
-KWP II
-State of Hawaii GIS
-USGS DEM

Number of Visible Turbines:

0
1 - 3
4 - 6
7 - 9
10+

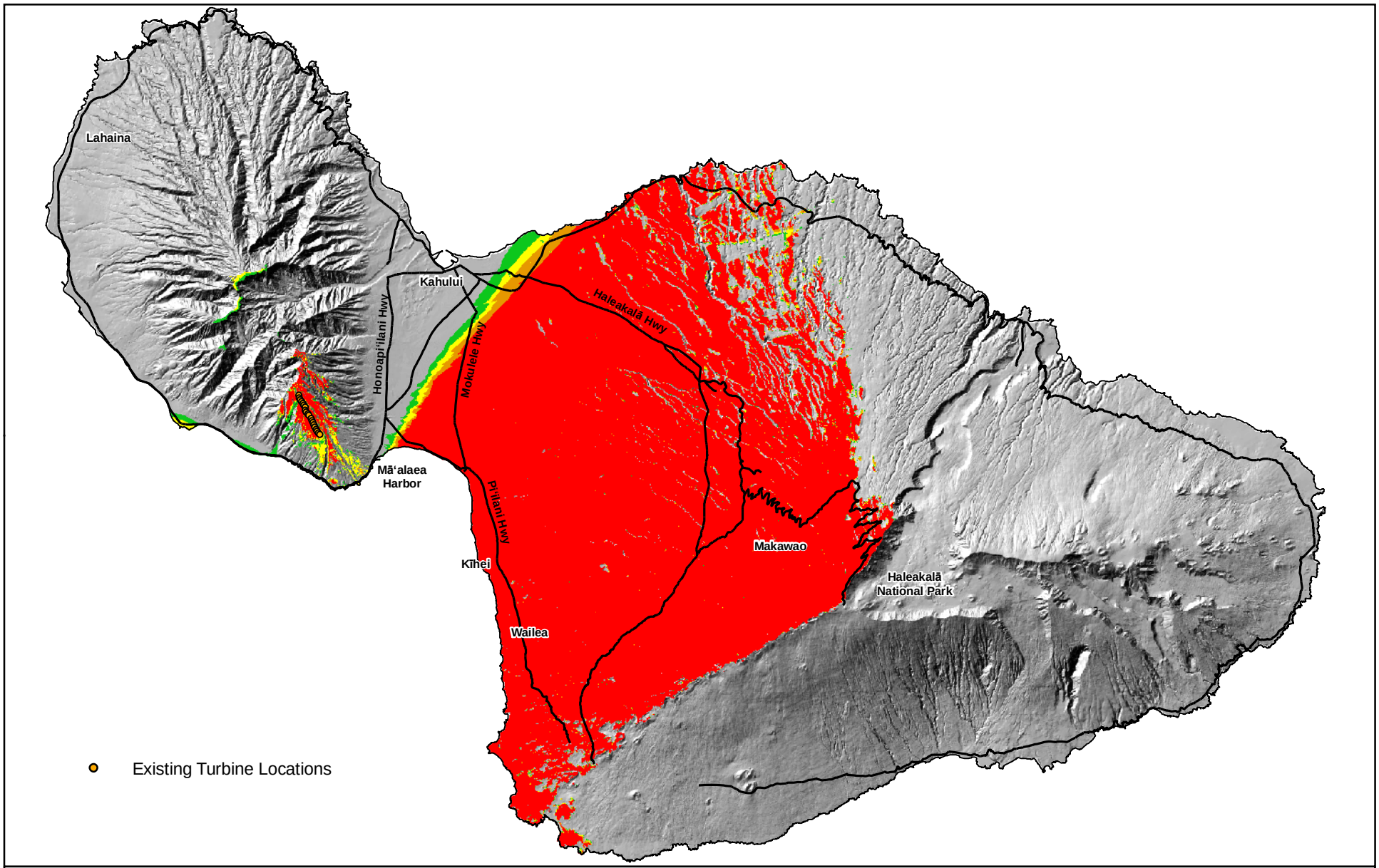
0 5 10
Miles

Figure:

Viewshed: Existing Rotor Tips

Kaheawa Wind Power II

Existing Tips 2009-08-20.mxd



Prepared For:
Kaheawa Wind Power II

Prepared By:
PLANNING SOLUTIONS

Sources:
-KWP II
-State of Hawaii GIS
-USGS DEM

Number of Visible Turbines:

0
1 - 3
4 - 6
7 - 9
10+

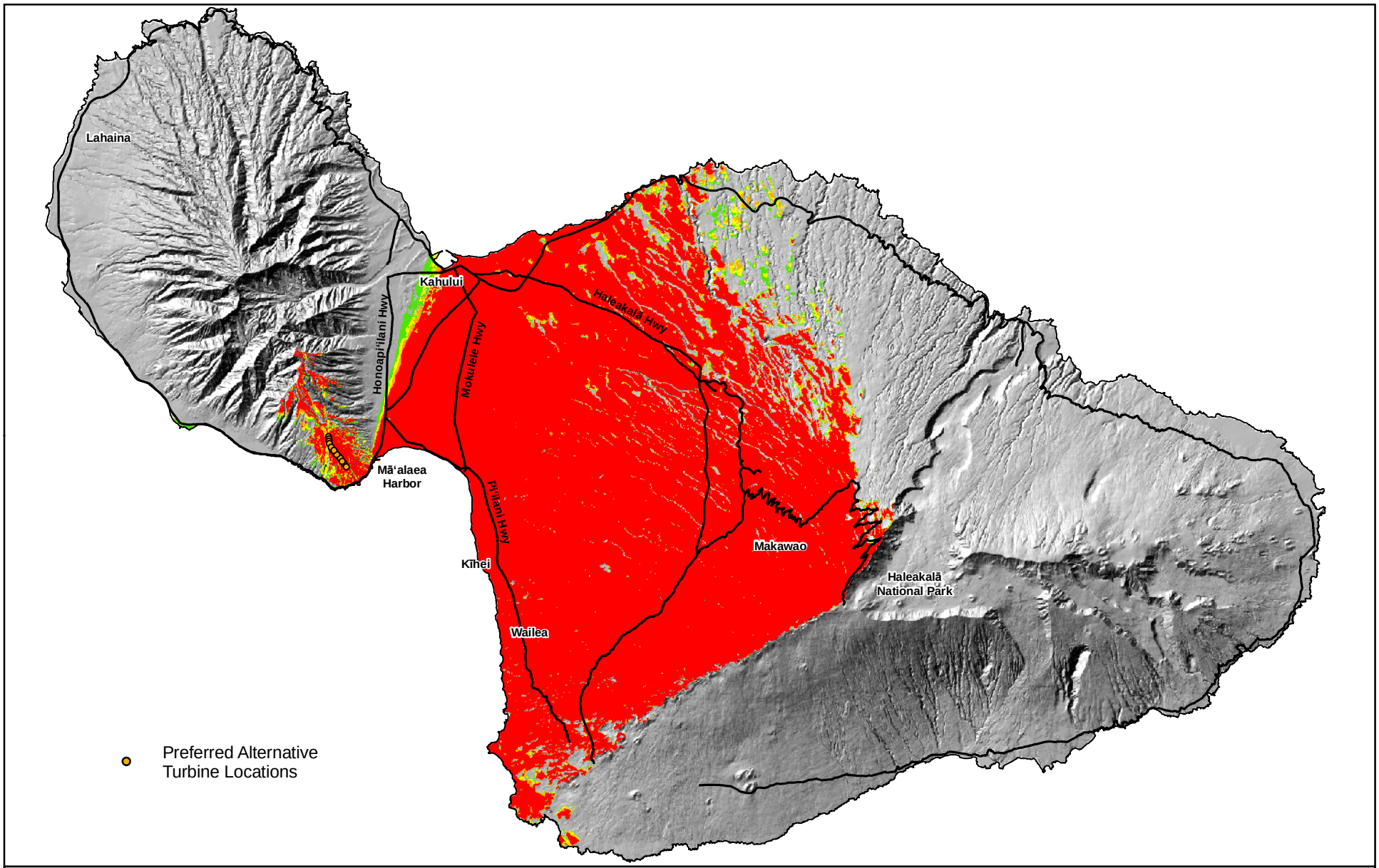
0 5 10
Miles

Figure:

Viewshed: Existing Towers

Kaheawa Wind Power II

Existing Towers 2009-08-20.mxd



Prepared For:
Kaheawa Wind Power II

Prepared By:
PLANNING SOLUTIONS

Sources:
-KWP II
-State of Hawaii GIS
-USGS DEM

Number of Visible Turbines:

0
1 - 3
4 - 6
7 - 9
10+

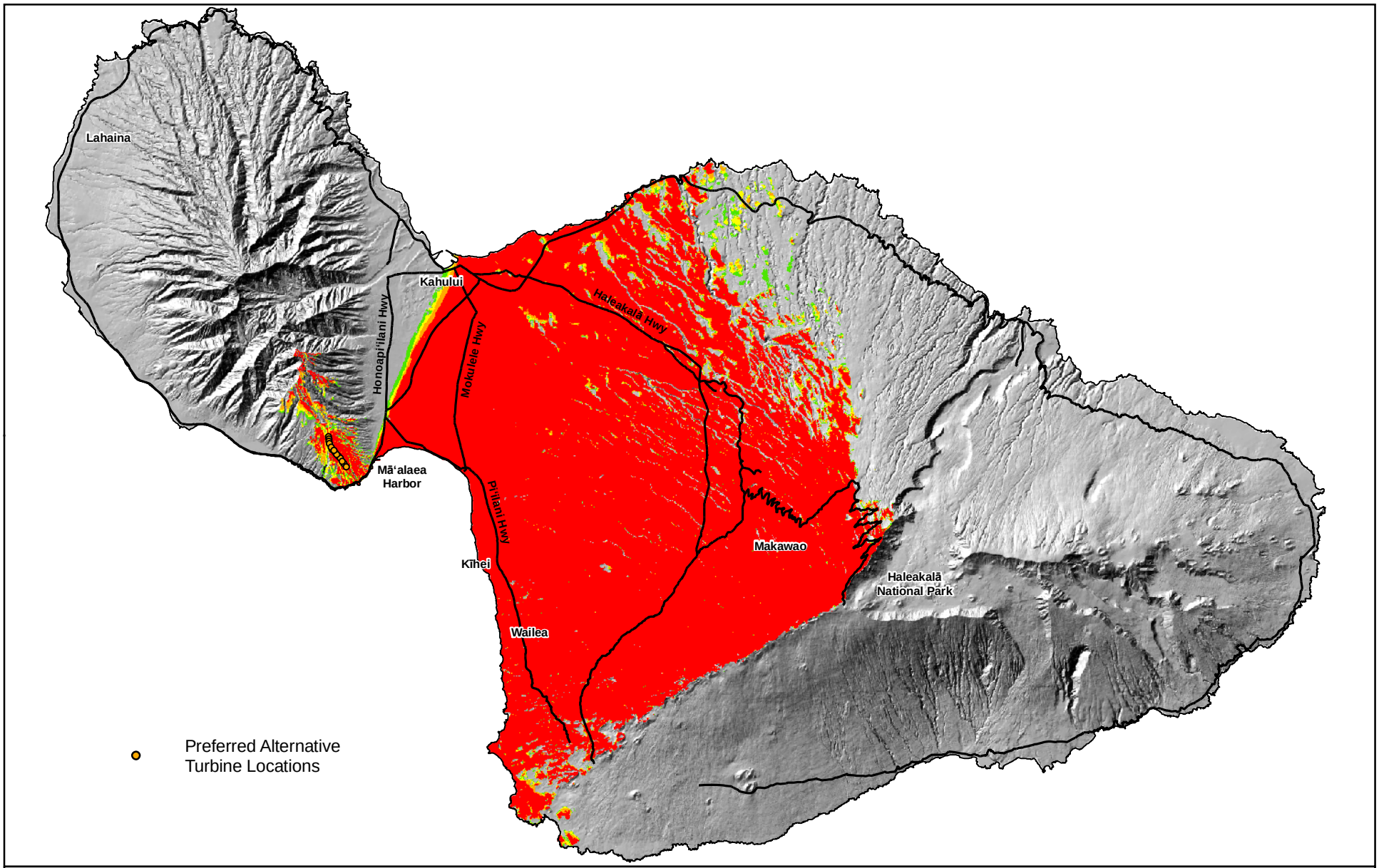
0 5 10
Miles

Figure:

Viewshed: Preferred Alternative Rotor Tips

Kaheawa Wind Power II

Preferred Alternative Tips 2009-10-15.mxd



Prepared For:
Kaheawa Wind Power II

Prepared By:
PLANNING SOLUTIONS

Sources:
-KWP II
-State of Hawaii GIS
-USGS DEM

Number of Visible Turbines:

0
1 - 3
4 - 6
7 - 9
10+

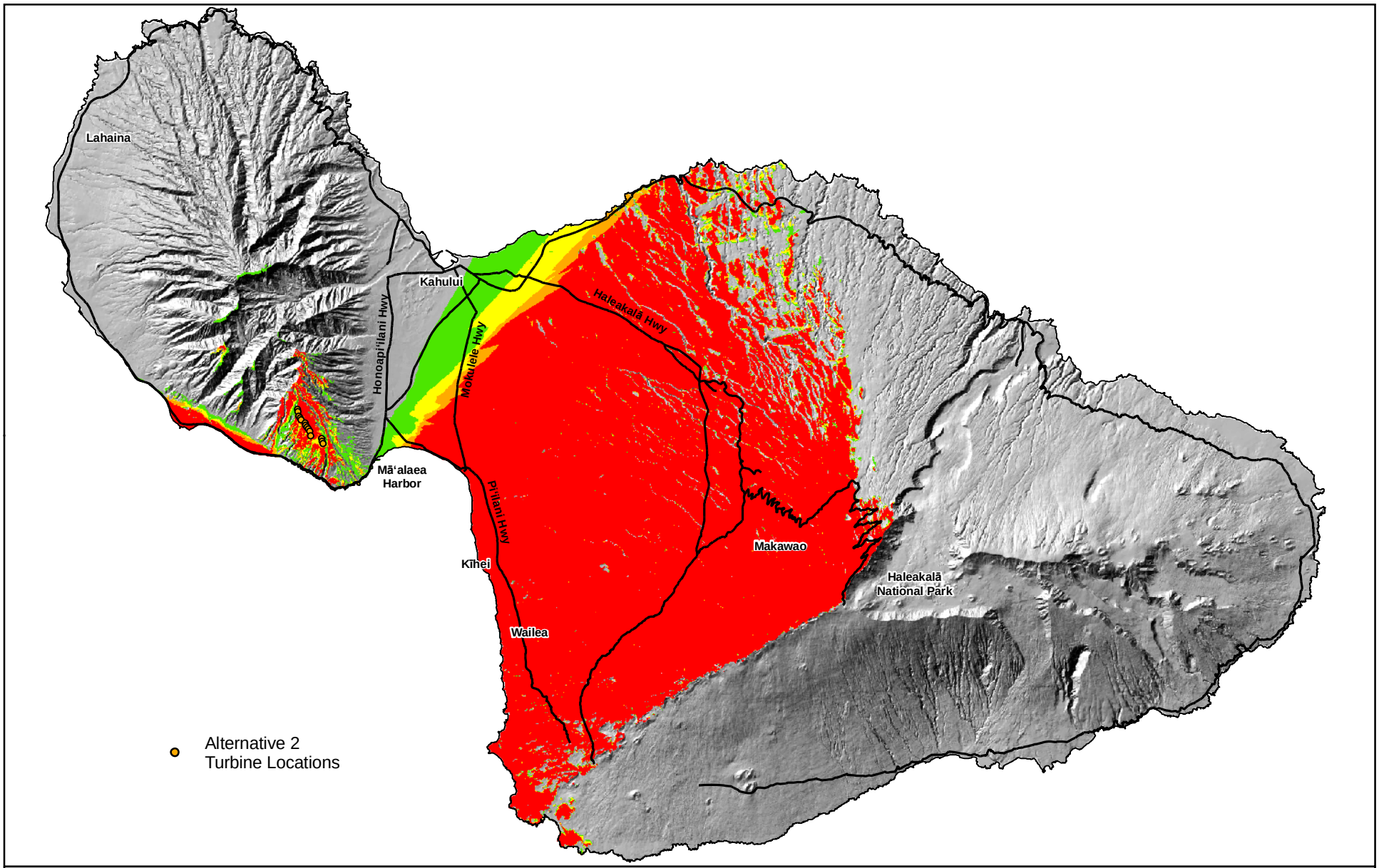
0 5 10
Miles

Figure:

Viewshed: Preferred Alternative Towers

Kaheawa Wind Power II

Preferred Alternative Towers 2009-10-15.mxd



Prepared For:
Kaheawa Wind Power II

Prepared By:
PLANNING SOLUTIONS

Sources:
-KWP II
-State of Hawaii GIS
-USGS DEM

Number of Visible Turbines:

0
1 - 3
4 - 6
7 - 9
10+

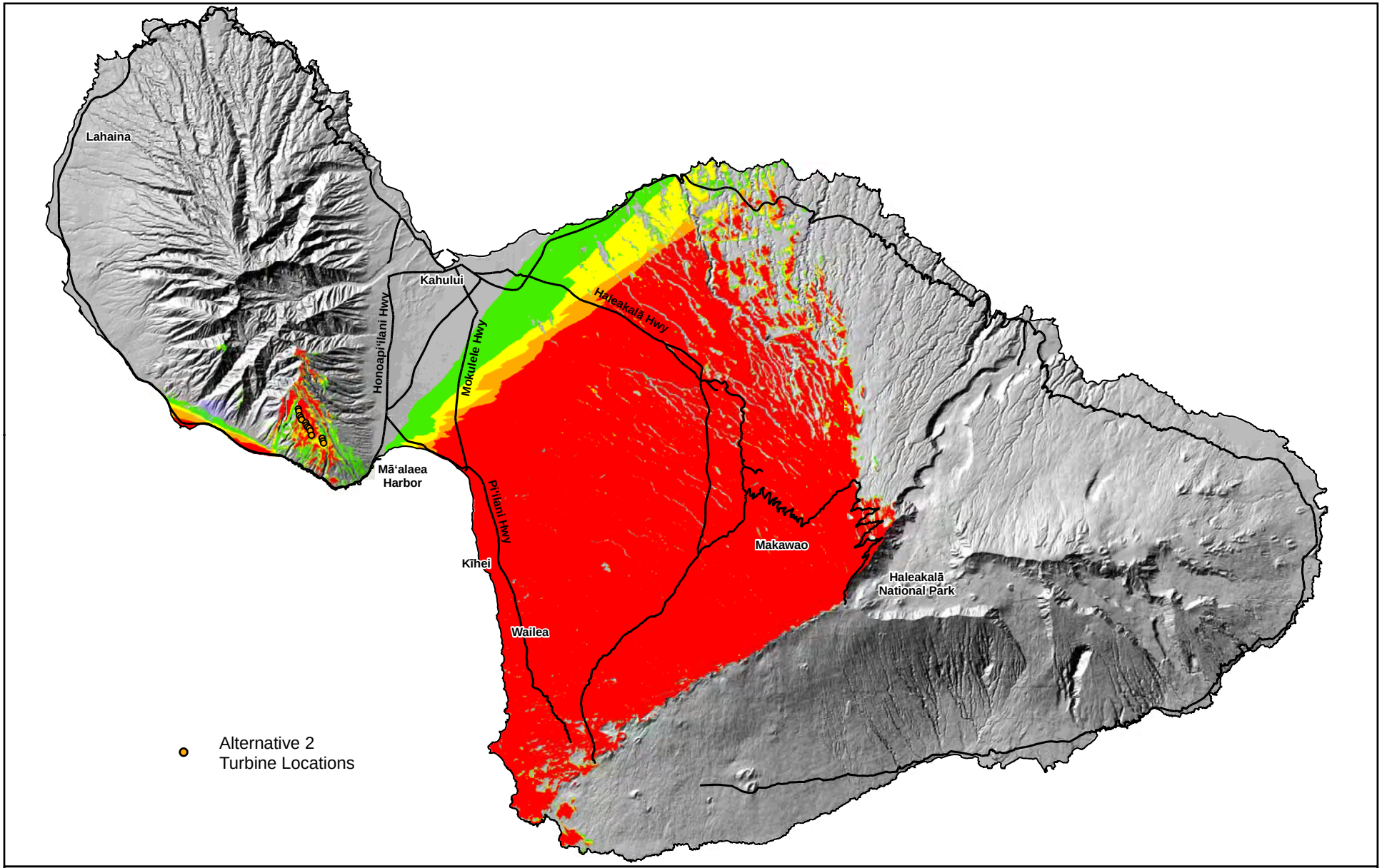
0 5 10
Miles

Figure:

Viewshed: Alternative 2 Rotor Tips

Kaheawa Wind Power II

Alternative 2 Tips 2009-10-15.mxd



Prepared For:
Kaheawa Wind Power II

Prepared By:
PLANNING SOLUTIONS

Sources:
-KWP II
-State of Hawaii GIS
-USGS DEM

Number of Visible Turbines:

0
1 - 3
4 - 6
7 - 9
10+

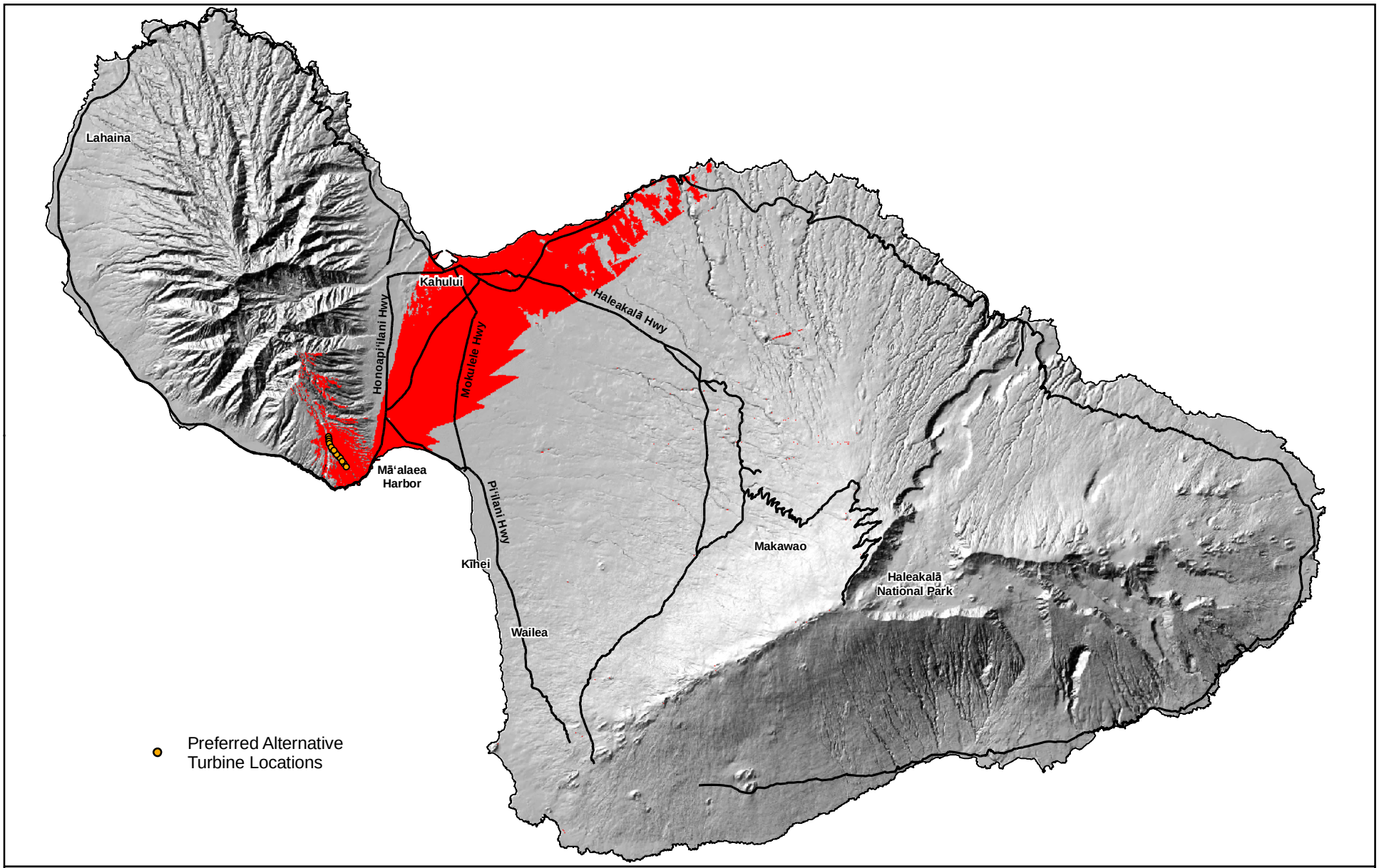
0 5 10
Miles

Figure:

Viewshed: Alternative 2 Towers

Kaheawa Wind Power II

Alternative 2 Towers 2009-10-15.mxd



Prepared For:
Kaheawa Wind Power II

Prepared By:
PLANNING SOLUTIONS

Sources:
-KWP II
-State of Hawaii GIS
-USGS DEM

Legend:

Areas of Increased Visibility; these are areas where the Preferred Alternative will increase the number of rotors visible over Alternative 2.

0 5 10
Miles

Figure:

Viewshed: Areas of Increased Visibility

Kaheawa Wind Power II

Areas of Increased Visibility 2009-10-15.mxd

APPENDIX D. KAHEAWA WIND POWER II POST-CONSTRUCTION REVEGETATION PLAN FOR PREFERRED ALTERNATIVE AND ALTERNATIVE 2

KAHEAWA WIND POWER (KWP) II

POST-CONSTRUCTION REVEGETATION PLAN

October 2009

I. Introduction and Summary

Kaheawa Wind Power II, LLC (KWP II) proposes to construct and operate a new 21-megawatt (MW) wind energy generation facility at Kaheawa Pastures on lower Kealaloloa Ridge in the southwestern portion of the Island of Maui, Hawai'i. The proposed project is situated on approximately 276 acres (112 ha) of State Conservation District land located immediately southeast of the existing 30-MW Kaheawa Wind Power (KWP) project (Hobdy 2009).

The land area to be disturbed during construction of the KWP II facility is former pasture that was converted from native plant communities well over 100 years ago. It is currently dominated by low, wind-blown grasses and shrubs and scattered small trees in the gullies. The area is subject to periodic burning, which suppresses native plants and favors the spread of non-native, fire-tolerant grasses. Few native plant species occur in the project area (Hobdy 2009).

Approximately one to two-thirds of the project area to be disturbed during construction will be revegetated upon completion of earthwork. Areas suitable for stabilization by revegetation include cut and fill slopes and turbine pads.

This plan describes methods and monitoring and success criteria for revegetation of areas temporarily disturbed during the construction of KWP II. The objective of revegetation is to stabilize disturbed areas immediately following construction to prevent erosion. Most elements of this plan involve the application of Best Management Practices and are derived from experiences and lessons learned at the adjacent KWP project area, which underwent construction in early 2006.

II. Existing Conditions at the Project Area

The proposed KWP II project area is located in an area known locally as Kaheawa Pastures, on the southern slope of the mountains of West Maui between 200 and 2000 ft elevation (61 and 610 m). The project area lies on lower Kealaloloa Ridge between Manawainui Gulch on the west and Malalowaia'ole Gulch on the east. It is located in the General subzone of the State Conservation District, southeast of the existing KWP facility.

Average annual rainfall at the proposed project site ranges from 12inches (30.5 cm) per year at the Honoapi'ilani Highway/site access road intersection to 20 inches (50.8 cm) per year at the uppermost portion of the project area. Most of the rainfall occurs during winter months (80+ percent from November through April).

A botanical survey of the KWP II project area was conducted by Robert Hobdy in August 2009. This survey identified 62 plant species, of which 47 are introduced to the Hawaiian Islands. No state or federally threatened, endangered, or candidate species of plants were found during the surveys (Hobdy 2009).

The vegetation at KWP II is mostly comprised of low, wind-blown grasses and shrubs, with occasional small trees in the gullies. The most abundant species in the project area is buffelgrass (*Cenchrus ciliaris*). Natal redtop (*Melinis repens*), 'ilima (*Sida fallax*), 'uhaloa (*Waltheria indica*), lesser snapdragon (*Antirrhinum orontium*), and Jamaica vervain (*Stachytarpheta jamaicensis*) are also common (Hobdy 2009). Of the 15 native plant species found on the site, eight are endemic and seven are indigenous to the Hawaiian Islands. Native species are most prevalent in the rocky habitat bordering Manawainui and Malalowaia'ole Gulches (Hobdy 2009).

III. Revegetation Goal

The goal of revegetation at KWP II is to address the immediate requirement of stabilizing exposed soils and preventing erosion following construction activities at KWP II, in accordance with erosion and sedimentation control Best Management Practices (BMPs) and National Pollutant Discharge Elimination System (NPDES) stormwater discharge permitting requirements.

IV. Revegetation Methods

KWP II will work alongside the State Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW) specialists to ensure that revegetation methods consider and incorporate all wildlife, forestry, fire and rangeland concerns and are in alignment with the management provisions of the Conservation District. All revegetation material brought to the project area (e.g. seed mixes, sand, gravel, rock, and mulch) will be certified as weed free by the Hawai‘i Department of Agriculture (HDOA) prior to entering the project area.

Site Preparation:

KWP II will work with construction contractors to ensure that slopes are not excessively compacted so as to inhibit establishment of vegetation. No other site preparation (e.g. weeding, adding soil amendments, etc.) is anticipated to be necessary prior to revegetation.

Hydroseeding:

KWP II proposes to hydroseed disturbed areas along the edges of turbine pads and along road cuts and fill slopes with annual ryegrass (*Lolium multiflorum*). Annual ryegrass was selected for erosion control because it provides rapid initial vegetation cover and forms an extensive, dense, yet relatively shallow root system (Valenzuela and Smith 2002). This species is expected to gradually die back and allow natural recruitment of neighboring species or species present in the seed bank. Hydroseeding with annual ryegrass will require supplemental irrigation for a 90-day period and monitoring to ensure establishment of stabilizing cover.

Outplanting:

If it is determined that excessively steep areas require additional erosion control, annual ryegrass may be combined with outplanting of hardy native seedlings, as feasible. Native species that may potentially be used during revegetation include ‘a‘ali‘i (*Dodonaea viscosa*), pili grass (*Heteropogon contortus*), and ‘ilima (*Sida fallax*). These relatively fast-growing and easily propagated species provide excellent root structure for maintaining surface substrate retention, as well as provide a native seed source for the project area. The specific species, sizes, and quantities of native outplantings will be determined based on site-specific factors such as slope, erosion potential, and the size of the area. However, due to the disturbed condition of the project area and the lack of rare or sensitive native plant species or habitats on or near the project area (Hobdy 2009), native plant restoration is not considered a goal of this revegetation plan.

Hard materials:

In addition, some portion of the disturbed area may be stabilized with hard materials (e.g. rip-rap, compacted gravel) rather than vegetation in order to ensure stability or increase searchability of turbine plots for downed wildlife. These BMPs will be evaluated in consultation with the State DLNR and the U.S. Fish and Wildlife Service (USFWS), and implemented according to site-specific considerations.

V. Timeline

Construction of the access roads and turbine foundations is anticipated to begin shortly after issuance of the Federal Incidental Take Permit (ITP) and State Incidental Take License (ITL). Revegetation of temporarily disturbed area with annual ryegrass will begin as soon as possible immediately after

construction of the access roads and turbine foundations, and in accordance with the project's NPDES permit and construction Best Management Practices (BMPs). . If native species are included in revegetation, outplanting will occur immediately after hydroseeding with annual ryegrass to take advantage of irrigation.

VI. Maintenance, Monitoring & Success Criteria

Regular irrigation and monitoring will be necessary at KWP II to ensure that immediate revegetation measures are successful. Young grasses are especially vulnerable to root damage in the absence of rain or watering. All hydroseeded areas will be monitored and irrigated for a 90-day period following hydroseeding. The revegetation contractor shall provide sufficient irrigation during this period to assure adequate survival.

Revegetation will be considered successful if it can be demonstrated that more than 75% of the bare areas, fill slopes, and road cut segments that receive treatment have established cover within one year following treatment. If initial applications appear to be only partially successful, subsequent hand and/or hydro-seeding applications or additional temporary measures (e.g. matting or logs) may be installed to ensure adequate coverage and erosion control.

VII. Literature Cited

Hobdy, R.W. 2009. Botanical Resources Survey for the Kaheawa Pastures Energy Project, Ukumehame, Maui, Hawaii. Prepared for First Wind Energy, LLC.

Valenzuela, H. and J. Smith. 2002. Green Manure Crops: Annual Ryegrass. College of Tropical Agriculture and Human Resources (CTAHR).

Figure 1. Mechanized hydroseeding along a bare road cut during immediate site revegetation and soil stabilization efforts following construction at KWP.

Figure 2. Several native plant species successfully outplanted on a turbine fill slope at KWP as part of long-term revegetation efforts.

KAHEAWA WIND POWER II: DOWNWIND AND DOWNSTRING ALTERNATIVE POST-CONSTRUCTION REVEGETATION/RESTORATION PLAN

October 2009

I. Introduction

Kaheawa Wind Power II, LLC (KWP II) proposes to construct and operate a new 21-megawatt (MW) wind energy generation facility at Kaheawa Pastures above Mā‘alaea in the southwestern portion of the Island of Maui, Hawai‘i. The proposed project is situated on approximately 333 acres (135 ha) of State Conservation District Land immediately adjacent to the existing 30-MW Kaheawa Wind Power (KWP) project operated and owned by Kaheawa Wind Power LLC (KWP LLC) (KWP II 2009).

The land area to be disturbed during construction of the KWP II facility is former pasture that was converted from native plant communities well over 100 years ago, and is currently dominated by a mixture of native and non-native grasses and low shrubs with scattered small trees. The area is prone to periodic wildfires, which suppress native plants and favor the spread of non-native, fire-tolerant grasses. Native plants are limited to a few scattered individuals. A recent botanical inventory indicates that native plant species are spread throughout the project area, mixed among the grasses, but are less prevalent at the lower, drier parts of the property where fires have occurred more recently (Hobdy 2009).

Approximately one to two-thirds of the area to be disturbed during construction will be revegetated upon completion of earthwork. Areas suitable for stabilization by revegetation include cut and fill slopes and turbine pads. However, some portion of these areas may be stabilized with hard materials (e.g., rip-rap, compacted gravel) rather than vegetation in order to ensure stability or increase searchability of turbine plots for downed wildlife.

This plan describes the goals, methods, monitoring, and success criteria for revegetation of areas temporarily disturbed during the construction of KWP II at the downwind/downstring alternative location. This plan is intended to meet the dual goals of 1) stabilizing disturbed areas immediately following construction, and 2) re-introducing and establishing several native plant species throughout the site as a longer-term effort. Most elements of this plan involve the application of Best Management Practices (BMPs) and are derived from experiences and lessons learned at the adjacent KWP project site, which underwent construction in early 2006, and which has a comparable plant ecological history.

II. Existing Conditions

The proposed KWP II downwind/downstring alternative project area is located in an area known locally as Kaheawa Pastures, on the southern slope of the mountains of West Maui between 1,440 and 2,880 ft elevation (439 and 878 m). The project area is approximately 4 miles (6.4 km) mauka (inland) of McGregor Point. It is located in the General subzone of the State Conservation District to the west of the existing KWP facility.

Average annual rainfall at the proposed project site ranges from less than 15 inches (38 cm) per year at the Honoapi‘ilani Highway/site access road intersection to slightly over 40 inches (102 cm) per year at the uppermost portion of the existing wind facility (3,200 ft or 975 m). Most of the rainfall occurs during winter months (80+ percent from November through April).

Botanical surveys of the proposed KWP II downwind/downstring alternative area were conducted by Robert Hobdy in October 2006 and again in January 2009. The second survey was conducted to document re-growth following a wildfire in September 2006 that burned about 80 percent of the 333 acre (135 ha) project area (Hobdy 2006). Hobdy (2009) identified 86 plant species, twenty of which are native to the Hawaiian Islands. He describes the vegetation as mostly low wind-blown (non-native) grasses and shrubs with occasional patches of small trees. No state or federally threatened, endangered, or candidate species were found during his surveys.

III. Background of Revegetation Efforts at KWP

Because of the proximity and similarity of the landscape at the two facilities, the proposed KWP II facility will rely heavily on the lessons learned at KWP. The amended Conservation District Use Permit (CDUP MA-3103) granted to KWP by the Board of Land and Natural Resources (BLNR) on 24 June 2005 contained the following conditions related to revegetation:

20. *"All cleared areas shall be revegetated in a manner consistent with other permit conditions, with specific consideration given to the fire contingency plan and the Habitat Conservation Plan. Any necessary revegetation shall be completed within thirty days of the completion of specific project components that resulted in ground clearing, using native species found in the area;"*

37. *"The applicant shall ensure that operations and maintenance staff do not damage native plants. If construction or operation required the removal of native plants, the plants will be removed, relocated and replanted. The applicant shall pay for the cost of this effort;"*

38. *"The applicant shall work with plant experts to introduce appropriate native plant species back into the Kaheawa Pastures;"*

Similar conditions were required in the National Pollutant Discharge Elimination System (NPDES) General Permit for the KWP project area:

- *"Temporary soil stabilization with appropriate vegetation will be applied to areas remaining unfinished for more than 30 days; and*

- *Permanent soil stabilization will be applied as soon as practical after final grading. Contractor will coordinate with the Department of Land and Natural Resources (DLNR) regarding selection of appropriate vegetation as a condition of the Conservation District Use Permit."*

After extensive research and efforts at seeking source materials, KWP biologists concluded that establishing vegetation within 30 days by seeding with native species (per Condition 20) would not be feasible due to the unavailability of native species in sufficient commercial quantities. Currently, the Hawai'i Department of Transportation is working with the Federal Highway Administration on a three-year research project to develop native grass mixes and hydro-seeding techniques for use on civil projects in Hawai'i (Dacus, personal communication). However, techniques have not yet been developed in Hawai'i for hydro-seeding or broadcasting with native seed mixes on a large scale.

In the *Response to October 27, 2005 Letter Regarding the Establishment of Stabilizing Vegetation Cover for Erosion and Sediment Control Related to Wind Farm Access Road Construction*, the State of Hawai'i Department of Land and Natural Resources (DLNR) authorized KWP's request to apply commercially available annual ryegrass (*Lolium multiflorum*) in order to comply with permit conditions of the CDUP and the NPDES permit, given the following conditions:

1. *"The permittee shall acquire commercial quantities of native pili grass bundles or other native species as soon as possible to substitute the annual rye; and*

2. *The permittee is responsible for controlling the annual rye if it starts invading adjacent State lands."*

KWP subsequently established a conservation partnership with the USDA/NRCS to obtain native pili grass (*Heteropogon contortus*) from the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) Plant Materials Center on Moloka'i. This partnership resulted in field trials to test the ability to establish pili grass at KWP using seed and bales. Following several treatments, it was determined that while it is possible to establish pili grass in limited quantities, and over several months, it probably cannot be expected to meet rapid, site-wide ground cover re-establishment requirements.

Following the trials with pili grass, KWP petitioned DLNR and the Office of Conservation of Coastal Lands (OCCL) to consider allowing manual application and hydro-seeding with a grass seed mixture to accomplish site revegetation goals. DLNR officials in the Division of Forestry and Wildlife (DOFAW) provided comments on this proposal, citing that annual ryegrass is expected to die off and provide a more suitable environment for recruitment by adjacent species. DOFAW expressed interest in limiting the amount of emergent grass in the immediate vicinity of turbines, a recommendation intended to minimize the attraction of Nēnē, which are common in the area and browse on a wide range of emergent vegetation types. KWP biologists have documented that Nēnē are prevalent in the area and currently use the areas in proximity to the turbines on a regular (i.e., almost daily) basis. Thus, revegetating bare areas with grasses is not expected to pose an additional risk of bird collisions.

At the same time, KWP biologists have had considerable success at re-introducing native plants grown in the nursery at various locations throughout the site, including along cut and fill slopes and other open earth portions of the roadsides and turbine pads. Although these plantings do not provide a uniform stabilizing cover *per se*, it does appear that they will, over several seasons, come to dominate the areas treated. Between July 2007 and June 2008, approximately 7,500 young a‘ali‘i (*Dodonaea viscosa*) were propagated from seed collected at Kaheawa and planted along cut and fill slopes and other open earth portions of the roadsides and turbine pads. An intensive outplanting effort comprising nearly 16,000 individual plants of several key native species occurred during the winter and spring of 2009 at KWP.

IV. Revegetation Goals

Permits for KWP II have not yet been granted, so for the purposes of the Environmental Impact Statement (EIS) and Habitat Conservation Plan (HCP), the goals of the revegetation plan for the KWP II downwind/downstring alternative are based on the relevant CDUP and NPDES permit conditions for KWP, as well as experiences and lessons learned at KWP.

The proposed revegetation strategy for the KWP II downwind/downstring alternative has two goals:

1. Address the immediate requirement of stabilizing exposed soils following construction activities at KWP II, in accordance with erosion and sedimentation control BMPs and NPDES stormwater discharge permitting requirements; and

2. Re-introduce native plant species in selected areas throughout the site over several years, with the goal of re-establishing native plant species in areas that have been overgrown with non-native species for a century or more.

V. Revegetation Methods

KWP II biologists will work alongside the DLNR-DOFAW specialists to ensure that revegetation methods at the downwind/downstring alternative location consider and incorporate all wildlife, forestry, fire, and rangeland concerns and are in alignment with the management provisions of the Conservation District. All revegetation material brought to the project area (e.g. seed mixes, sand, gravel, rock, and mulch) will be certified as weed free by the Hawai‘i Department of Agriculture (HDOA) prior to entering the project area.

KWP II will work with construction contractors to ensure that slopes are not excessively compacted so as to inhibit establishment of vegetation. No other site preparation (e.g. weeding, adding soil amendments, etc.) is anticipated to be necessary prior to revegetation.

<u>Hydroseeding (*Goal 1*):</u>

KWP II biologists propose to hydroseed disturbed areas along the edges of turbine pads and along road cuts and fill slopes with annual ryegrass to establish an initial cover of vegetation after ground shaping and grading activities have been completed (Figure 1). Annual ryegrass was selected for erosion control because it provides rapid initial vegetation cover and forms an extensive, dense root system (Valenzuela and Smith 2002). This species is expected to gradually die back and allow natural

recruitment of neighboring species or species present in the seed bank (DOFAW, personal communication). Hydroseeding with annual ryegrass will require supplemental irrigation for a 90-day period and monitoring to ensure establishment of stabilizing cover.

Figure 1. Mechanized hydroseeding along a bare road cut during immediate site revegetation and soil stabilization efforts following construction at KWP.

Erosion Mats and Hard Materials (*Goal 1*):

Excessively steep areas may require additional erosion control to achieve the immediate goal of stabilizing exposed soils and preventing erosion. For example, certain sections of the site may require the use of organic coir or jute mats and/or coir logs to reduce water flow velocity and hold soils and seed material during periods of seasonal rainfall. The mats or logs will be secured in place along steep fill slopes and grades to provide temporary erosion control during the initial establishment period and further contribute to ground cover establishment. In addition, some portion of the disturbed area may be stabilized with hard materials (e.g., rip-rap, compacted gravel) rather than vegetation in order to ensure stability and facilitate monitoring of turbine plots for downed wildlife. These BMPs will be evaluated in consultation with the State DLNR and the U.S. Fish and Wildlife Service (USFWS), and implemented according to site-specific considerations.

Outplanting (*Goal 2*):

To accomplish the long-term goal, KWP II biologists propose to re-introduce native plants in discrete locations within the downwind/downstring alternative area over several years, with the intent of eventually re-establishing some of the key elements of the plant communities that historically existed on the site (Figure 2). This phase will involve collecting native seeds and cuttings in the area, propagating these species at local nurseries, and subsequently outplanting these species at the site.

Native species that may potentially be used during this phase include ʻaʻaliʻi (*Dodonaea viscosa*), pili grass (*Heteropogon contortus*), ʻūlei (*Osteomeles anthyllidifolia*), and ʻilima (*Sida fallax*). These relatively fast-growing and easily propagated species provide excellent root structure for maintaining surface substrate retention, as well as provide a native seed source for the project area. The specific

species, sizes, and densities of native outplantings will be determined based on site-specific factors such as slope, erosion potential, and the size of the area.

Because this phase will occur after the immediate revegetation phase, many of these plantings will be installed in or adjacent to areas that were previously stabilized with the annual ryegrass mixture and temporary measures (e.g., coir mats and logs). In certain cases, it may be necessary to remove or control undesirable non-native species, either manually or with the assistance of an approved herbicide. Any use of herbicides would be done only in consultation with DLNR, and only in accordance with applicable restrictions on handling and use.

KWP II biologists plan to approach this phase of the site revegetation plan in a manner that emulates the successful native plant reintroduction efforts at KWP. KWP II will work in collaboration with KWP to share resources and coordinate logistics.

Figure 2. Several native plant species successfully outplanted on a turbine fill slope at KWP as part of long-term revegetation efforts.

VI. Timeline

Construction of the access roads and turbine foundations is anticipated to begin shortly after issuance of the Conservation District Use Permit (CDUP), Federal Incidental Take Permit (ITP) and State Incidental Take License (ITL). Revegetation of temporarily disturbed area with annual ryegrass will begin as soon as possible during and immediately after construction of the access roads and turbine foundations. Outplanting with native species will occur during the first several years of the project. Some species will be outplanted immediately after hydroseeding with annual ryegrass to take advantage of irrigation.

VII. Monitoring and Success Criteria

Regular irrigation and monitoring will be necessary at KWP II to ensure that immediate revegetation measures are successful. Young grasses and seedlings are especially vulnerable to root damage in the absence of rain or watering. All hydroseeded areas will be monitored and irrigated for a 90-day period following hydroseeding. The revegetation contractor shall provide sufficient irrigation during this period to assure adequate survival.

This phase of the project will be considered successful if it can be demonstrated that >75% of the bare areas, fill slopes, and road cut segments that receive treatment have established cover within one year following treatment. If initial applications appear to be only partially successful, subsequent hand and/or hydro-seeding applications or additional temporary measures (e.g., matting or logs) may be installed to ensure adequate coverage and erosion control.

The longer term revegetation efforts at the KWP II downwind/downstring alternative location are expected to be very successful given the success at KWP. A well-established seed collection and propagation program exists in cooperation with local nurseries, other native plant specialists, contract landscape specialists, and volunteers. Plants will be outplanted and maintained, monitored, and documented using resources available at KWP II and in collaboration with community and conservation groups. This effort will be considered to be successful if a minimum of 10,000 plant specimens are installed during the first three years following construction, with an average survival rate of greater than 75% (i.e., a minimum of 7,500 surviving plants), for all plants one year after installation, as determined by representative sampling of planted areas. If mortality exceeds 25%, replacement plantings will be installed as needed to achieve the 75% minimum.

VIII. Literature Cited

Hodby, R.W. 2006. Botanical Resources Survey. Kaheawa Pastures Wind Energy Project II, Ukumehame, Maui, Hawaii. Prepared for Kaheawa Windpower, LLC.

Hodby, R.W. 2009. Post-Fire Botanical Survey and Assessment. Kaheawa Wind Power II, Ukumehame, Maui, Hawaii. Prepared for Kaheawa Wind Power II LLC.

Kaheawa Wind Power II, LLC (KWP II). 2009. Draft HCP for KWP II.

Valenzuela, H. and J. Smith. 2002. Green Manure Crops: Annual Ryegrass. College of Tropical Agriculture and Human Resources (CTAHR).

APPENDIX E. CULTURAL IMPACT ASSESSMENT FOR PREFERRED ALTERNATIVE AND ALTERNATIVE 2

RC-0590

A Cultural Impact Assessment for the Proposed Kaheawa Wind Power (KWP) Phase 2 Project Area

(TMKs: 2-3-6-001:por. 014 and 2-4-8-01: por. 001)

Ukumehame Ahupua‘a
Wailuku and Lahaina Districts
Island of Maui

DRAFT VERSION

PREPARED BY:

Kanoelehua Wilson Ah Sam, B.A.,
and
Robert B. Rechtman, Ph.D.

PREPARED FOR:

Kelly Bronson
Kaheawa Wind Power II LLC
810 Richards Street, Suite 650
Honolulu, HI 96813

October 2009

RECHTMAN CONSULTING, LLC
507-A E. Lanikaula St. Hilo, Hawaii 96720
phone: (808) 969-6066 fax: (808) 443-0065
e-mail: bob@rechtmanconsulting.com
ARCHAEOLOGICAL, CULTURAL, AND HISTORICAL STUDIES

A Cultural Impact Assessment for the Proposed Kaheawa Wind Power (KWP) Phase 2 Project Area
(TMKs: 2-3-6-001:por. 014 and 2-4-8-01:por. 001)

Ukumehame Ahupua‘a
Wailuku and Lahaina Districts
Island of Maui

RECHTMAN CONSULTING

EXECUTIVE SUMMARY

On behalf of Kaheawa Wind Power II LLC, Rechtman Consulting, LLC prepared a Cultural Impact Assessment (CIA) associated with the proposed expansion of the existing Kaheawa Wind Power (KWP) wind farm operation in Ukumehame Ahupuaʻa, Wailuku and Lahaina Districts, Island of Maui (TMKs: 2-3-6-001:por. 014 and 2-4-8-001:por. 001). Kaheawa Wind Power II LLC (KWP II LLC) is an entity formed by Hawaiʻi Holdings, LLC, which is comprised of First Wind (formerly UPC Wind Partners, LLC), a Boston-based wind energy company, and Makani Nui Associates, LLC, a Maui-based partnership. KWP II LLC plans on erecting fourteen new power generating wind turbines on Honuaʻula Ridge (two alternative locations are proposed), increasing the power output of the existing adjacent wind farm operation from 30 to 51 megawatts. The land encompassed by the current project area is owned by the State of Hawaiʻi and is administered through the Department of Land and Natural Resources (DLNR); it is designated as conservation land. The CIA is intended to accompany an Environmental Impact Statement (EIS) compliant with Chapter 343 HRS, as well as fulfilling the requirements of the County of Maui Planning Department and the Department of Land and Natural Resources (DLNR) with respect to permit approvals for land-altering and development activities. This study has been prepared pursuant to Act 50, approved by the Governor on April 26, 2000; and in accordance with the Office of Environmental Quality Control (OEQC) *Guidelines for Assessing Cultural Impact*, adopted by the Environmental Council, State of Hawaiʻi, on November 19, 1997.

KWP II LLC is considering two alternative layouts for the new wind power operation. The overall project area is located on the southern slopes of West Maui Mountains stretching in elevation from approximately 400 to 2,900 feet above sea level. One of the alternative locations is south and west of the existing wind farm (KWP I) between Pāpalaua Gulch (to the west) and Manawainui Gulch (to the east) in an area commonly referred to as Pōhakuloa and traditionally referred to Honuaʻula. A prominent hill named Puʻu Lūʻau is present in the east-central portion of the project area. The terrain consists of what is commonly referred to as tableland. Typical of the south rift of the West Maui volcano, this land consists of high, inter-valley ridges separated by steep-sided, dry gulches that descend the steep, southwest facing slope to the ocean (Tomonari-Tuggle 1998). The other alternative location is *makai* of and on the same ridgeline as KWP I, extending between roughly 2,000 and 400 elevation above sea level.

While the physical study area is limited to the portion of Ukumehame Ahupuaʻa that encompasses Honuaʻula Ridge, in an effort to provide a comprehensive and holistic understanding of the current study area, the CIA examines the entire *ahupuaʻa* (including its coastal and off-shore resources) and its relationship to neighboring lands within the larger region. The archival-historical research and oral-historical interviews that are included in this study were performed in a manner consistent with federal and state laws and guidelines for such studies. The primary objective of the oral-historical component of this study is to identify the existing knowledge about former land use, traditions, practices, and cultural sites of the study area. Some of the research for this current study is derived from the archaeological studies that have been conducted within the current study area and the neighboring Kaheawa Wind Power I area (Athens 2002, 2004; Clark and Rechtman 2005, 2006; Rasmussen 2005a, 2005b, 2005c; Rechtman et al. 2009). For the current CIA study, expanded archival research was conducted and additional oral-historical work has been completed. New interviewees included, but were not limited to, Kupuna Paolo Kamakehau Fujihiro, Kumu Hokulani Holt, and Kupuna Walter Kanamu. All of the interview participants (past and present) have shared their personal knowledge of the land and practices of this portion of west Maui.

This CIA contains a description of the general project area and the proposed development activities, a presentation of prior archaeological and cultural studies, and a discussion of the cultural and historical background for Ukumehame Ahupuaʻa and the neighboring lands, which was generated based on archival research. It is a comprehension of this background information that facilitates a more complete understanding of the potential significance of any resources that might exist within the study area. While there are no on-going cultural practices identified for either alternative proposed area, there are two traditional cultural properties identified; and prior archaeological studies have documented three significant archaeological site, which merit preservation. These resources are described, potential impacts are discussed, and appropriate mitigation measures are outlined.

The OEQC guidelines identify several possible types of cultural practices and beliefs that are subject to assessment. These include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs. The guidelines also identify the types of potential cultural resources, associated with cultural practices and beliefs that are subject to assessment. Essentially these are natural features of the landscape and historic sites, including traditional cultural properties. The origin of the concept of traditional cultural property is found in National Register Bulletin 38 published by the U.S. Department of Interior-National Park Service. "Traditional" as it is used, implies a time depth of at least 50 years, and a generalized mode of transmission of information from one generation to the next, either orally or by act. "Cultural" refers to the beliefs, practices, lifeways, and social institutions of a given community. The use of the term "Property" defines this category of resource as an identifiable place. Traditional cultural properties are not intangible, they must have some kind of boundary; and are subject to the same kind of evaluation as any other historic resource, with one very important exception. By definition, the significance of traditional cultural properties should be determined by the community that values them.

As the OEQC guidelines do not contain criteria for assessing the significance for traditional cultural properties, this study adopts the state criteria for evaluating the significance of historic properties, of which traditional cultural properties are a subset. A further analytical framework for addressing the preservation and protection of customary and traditional native practices specific to Hawaiian communities resulted from the *Ka Paʻakai O Kaʻāina* v Land Use Commission court case. The court decision established a three-part process relative to evaluating such potential impacts: first, to identify whether any valued cultural, historical, or natural resources are present; and identify the extent to which any traditional and customary native Hawaiian rights are exercised; second, to identify the extent to which those resources and rights will be affected or impaired; and third, specify any mitigative actions to be taken to reasonably protect native Hawaiian rights if they are found to exist.

As a result of archaeological studies that were conducted for the two proposed alternative KWP II project areas, three sites was identified that had the potential to be impacted by the proposed development. SIHP Site 5232 is an upland *heiau* located in the east-central portion of the proposed *mauka* alternative KWP II area along the western edge of the existing wind farm. It is suggested by both the archaeological studies and the oral-historical inference that this *heiau* was linked to navigational activities, perhaps associated with travel between Maui and Kahoʻolawe. Site 5232 is considered significant under Criterion D because of its important research potential and under Criterion E because of its important traditional cultural value. This site was recommended for preservation (Athens 2002; Clark and Rechtman 2006), and a site preservation plan has already been prepared, approved, and partially implemented (Tomonari-Tuggle and Rasmussen 2005). As recommended in that plan, an archaeological monitor will be present during any future development activities that would occur within 500 feet of the *heiau*. The Lahaina Pali Trail traverses the proposed *makai* alternative KWP II area and is considered significant under Criterion D for the information yielded relative to middle and late nineteenth century transportation patterns and evolving modes of transportation. This historic site falls under the jurisdiction of the DLNR-*Na Ala Hele* Program and a management plan has already bee prepared and partially implemented for this site. The trail has already been breached by the KWP I access road and the proposed KWP II project will not create any further direct impact to this site, although the location of the towers in the *makai* alternative may present an indirect visual impact. SIHP Site 5648 is a complex of thirty features indicative of temporary habitation and may represent recurrent use shelters associated with former trail routes. The use of these features likely dates from both Precontact and Historic times. The most intensive habitation may have occurred between 1841 and 1891 when the Lahaina Pali Trail and its Māʻalaea branch were still in use. This site is within the proposed *makai* alternative KWP II area and is considered significant under Criterion D for both the information it has yielded and the potential information it is likely to yield if future work were to be conducted. The locations of the proposed wind generating towers and the associated infrastructure in the *makai* alternative are being designed to avoid all of the features of this site. While it is possible that data recovery might enhance our knowledge relative to the age and specific function of the various features of Site 5648, such mitigation work is not necessary given the current proposed project layout within the *makai* alternative. Therefore, if the *makai* alternative is selected, a preservation plan for this site will be prepared and submitted to DLNR-SHPD for review and approval. If in the future, it is necessary to impact one or more of the site's features, DLNR-SHPD should be contacted to address possible mitigation of impacts through data recovery.

Archival research and oral-historical information indicate that there are two potential traditional cultural properties associated with the current project area. The exposed red dirt Honua‘ula Ridge is considered to have function as a visual marker, or *ko‘a*, associated with local navigational practices. While the placement of wind towers does not go unnoticed, the actual effects the towers have on obscuring this natural navigation aid can be considered negligible in that the ability to use this landscape feature is not diminished by their presence.

The second potential traditional cultural property is more general in nature and includes the greater project area and beyond, identifying it as a *kulamanu*, a place where birds (namely *nēnē*, *pueo*, and *‘ua‘u*) have historically gathered (and continue to gather) before mass movements to other part of Maui and to Kaho‘olawe. The results of multi-year studies in the area suggest that such mass movements no longer occur, but that it remains an important area for nēnē. The US Fish and Wildlife Service has recognized this area as a significant bird habitat resource and have directed KWP II LLC to abide by a habitat conservation plan in an effort to protect and perpetuate indigenous and endangered avian species.

In general, interviewees expressed a preference for the proposed *makai* alternative for the KWP II project, citing that is was further from the culturally important *kulamanu* and the *wao akua*. Kupuna Paolo Kamakehau Fujihiro also expressed his belief that the wind is better on the lower slopes.

Finally, the CIA makes three recommendations with respect to maintaining an on-going commitment to the preservation and enhancement of cultural properties and practices. One, that the wind farm does not expand in a *mauka* direction above the upper limits of the existing towers into what is culturally considered *wao akua*, or divine space. Two, that KWP II LLC continues and expands upon their existing education outreach programs, particularly in areas related to *malama ‘āina* (land and resource management), *ho‘okele wa‘a* (navigation and voyaging), and *papahulilani* (Hawaiian study of atmosphere). And three, that KWP II LLC work with cultural practitioners and genealogical descendants of the area to establish a Kupa ‘Āina Council as an advisory group for the project area to help with educational and resource conservation planning as well as community outreach. KWP II LLC has agreed to implement the recommendations of this CIA.

Contents

Figures

Table

INTRODUCTION

On behalf of Kaheawa Wind Power II, LLC, Rechtman Consulting, LLC prepared a Cultural Impact Assessment (CIA) associated with the proposed expansion of the existing Kaheawa Wind Power (KWP) wind farm operation in Ukumehame Ahupuaʻa, Wailuku and Lahaina Districts, Island of Maui (TMKs: 2-3-6-001:por. 014 and 2-4-8-001:por. 001) (Figure 1). Kaheawa Wind Power II LLC (KWP II LLC) is an entity formed by Hawaiʻi Holdings, LLC, which is comprised of First Wind (formerly UPC Wind Partners, LLC), a Boston-based wind energy company, and Makani Nui Associates, LLC, a Maui-based partnership. KWP II LLC plans on erecting fourteen new power generating wind turbines on Honuaʻula Ridge (two alternative locations are proposed; Figures 2 and 3), increasing the power output of the existing adjacent wind farm operation from 30 to 51 megawatts. The land encompassed by the current project area is owned by the State of Hawaiʻi and is administered through the Department of Land and Natural Resources (DLNR); it is designated as conservation land. The CIA is intended to accompany an Environmental Impact Statement (EIS) compliant with Chapter 343 HRS, as well as fulfilling the requirements of the County of Maui Planning Department and the Department of Land and Natural Resources (DLNR) with respect to permit approvals for land-altering and development activities. This study has been prepared pursuant to Act 50, approved by the Governor on April 26, 2000; and in accordance with the Office of Environmental Quality Control (OEQC) *Guidelines for Assessing Cultural Impact*, adopted by the Environmental Council, State of Hawaiʻi, on November 19, 1997.

KWP II LLC is considering two alternative layouts for the new wind power operation. The overall project area is located on the southern slopes of West Maui Mountains stretching in elevation from approximately 1,300 to 2,900 feet above sea level. It is located south and west of the existing wind farm (KWP I) between Pāpalaua Gulch (to the west) and Manawainui Gulch (to the east) in an area commonly referred to as Pōhakuloa and traditionally referred to Honuaʻula. A prominent hill named Puʻu Lūʻau is present in the east-central portion of the project area. The terrain consists of what is commonly referred to as tableland. Typical of the south rift of the West Maui volcano, this land consists of high, inter-valley ridges separated by steep-sided, dry gulches that descend the steep, southwest facing slope to the ocean (Tomonari-Tuggle 1998). The other alternative location is *makai* of and on the same ridgeline as KWP I, extending between roughly 2,000 and 400 elevation above sea level.

While the physical study area is limited to the portion of Ukumehame Ahupuaʻa that encompasses Honuaʻula Ridge, in an effort to provide a comprehensive and holistic understanding of the current study area, the CIA examines the entire *ahupuaʻa* (including its coastal and off-shore resources) and its relationship to neighboring lands within the larger region. The archival-historical research and oral-historical interviews that are included in this study were performed in a manner consistent with federal and state laws and guidelines for such studies. The primary objective of the oral-historical component of this study is to identify the existing knowledge about former land use, traditions, practices, and cultural sites of the study area. Some of the research for this current study is derived from the archaeological studies that have been conducted within the current study area and the neighboring Kaheawa Wind Power I area (Athens 2002, 2004; Clark and Rechtman 2005, 2006; Rasmussen 2005a, 2005b, 2005c; Rechtman et al. 2009). For the current CIA study, expanded archival research was conducted and additional oral-historical work has been completed. New interviewees included, but were not limited to, Kupuna Paolo Kamakehau Fujihiro, Kumu Hokulani Holt, and Kupuna Walter Kanamu. All of the interview participants (past and present) have shared their personal knowledge of the land and practices of this portion of west Maui.

This CIA contains a description of the general project area and the proposed development activities, a presentation of prior archaeological and cultural studies, and a discussion of the cultural and historical background for Ukumehame Ahupuaʻa and the neighboring lands, which was generated based on archival research. It is a comprehension of this background information that facilitates a more complete understanding of the potential significance of any resources that might exist within the study area. While there are no on-going cultural practices identified for the project area, there are two traditional cultural properties identified; and prior archaeological studies have documented one significant archaeological site, which merits preservation. These resources are described, potential impacts are discussed, and appropriate mitigation measures are outlined.

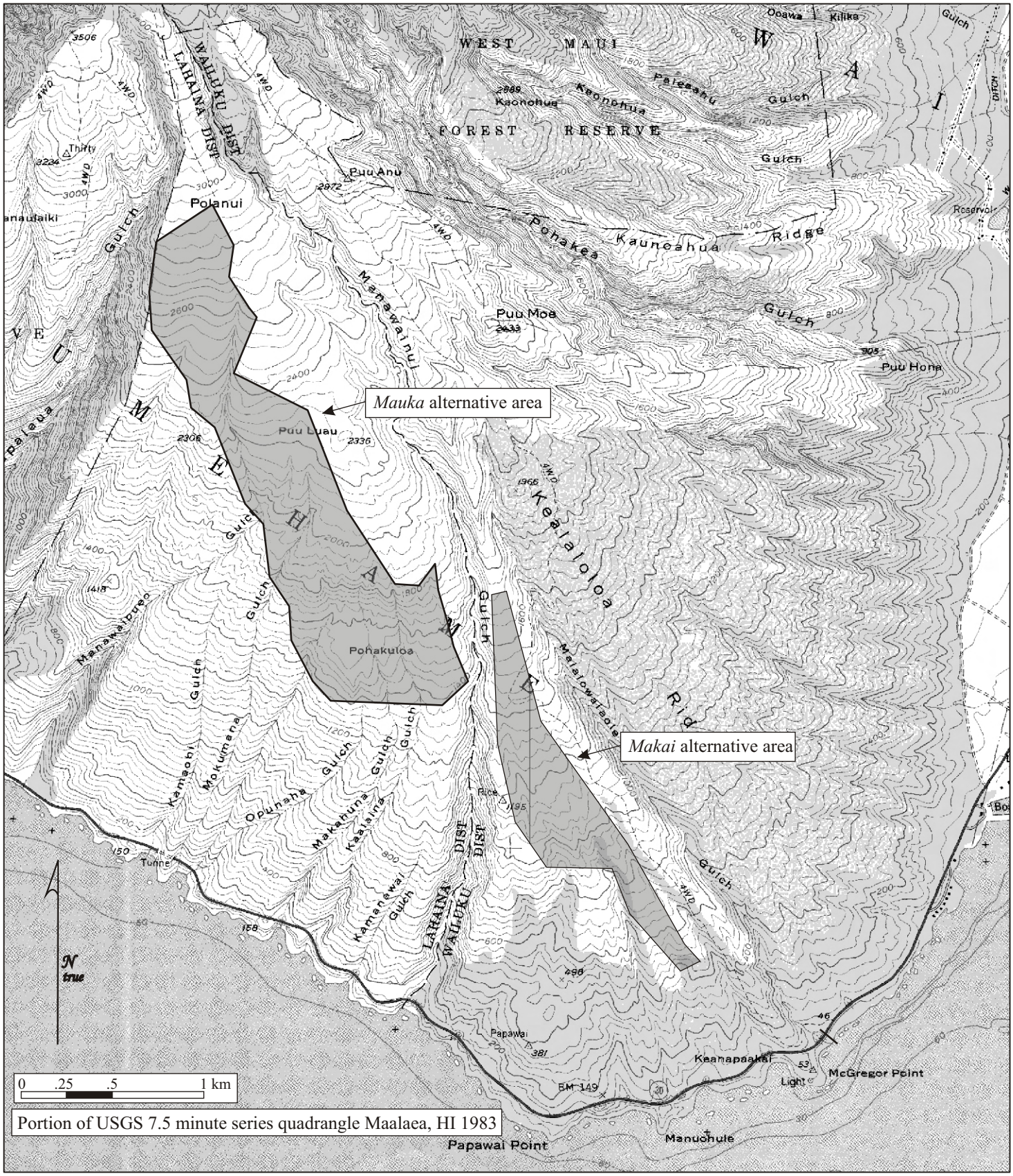


Figure 1. Proposed alternative locations for KWP II..

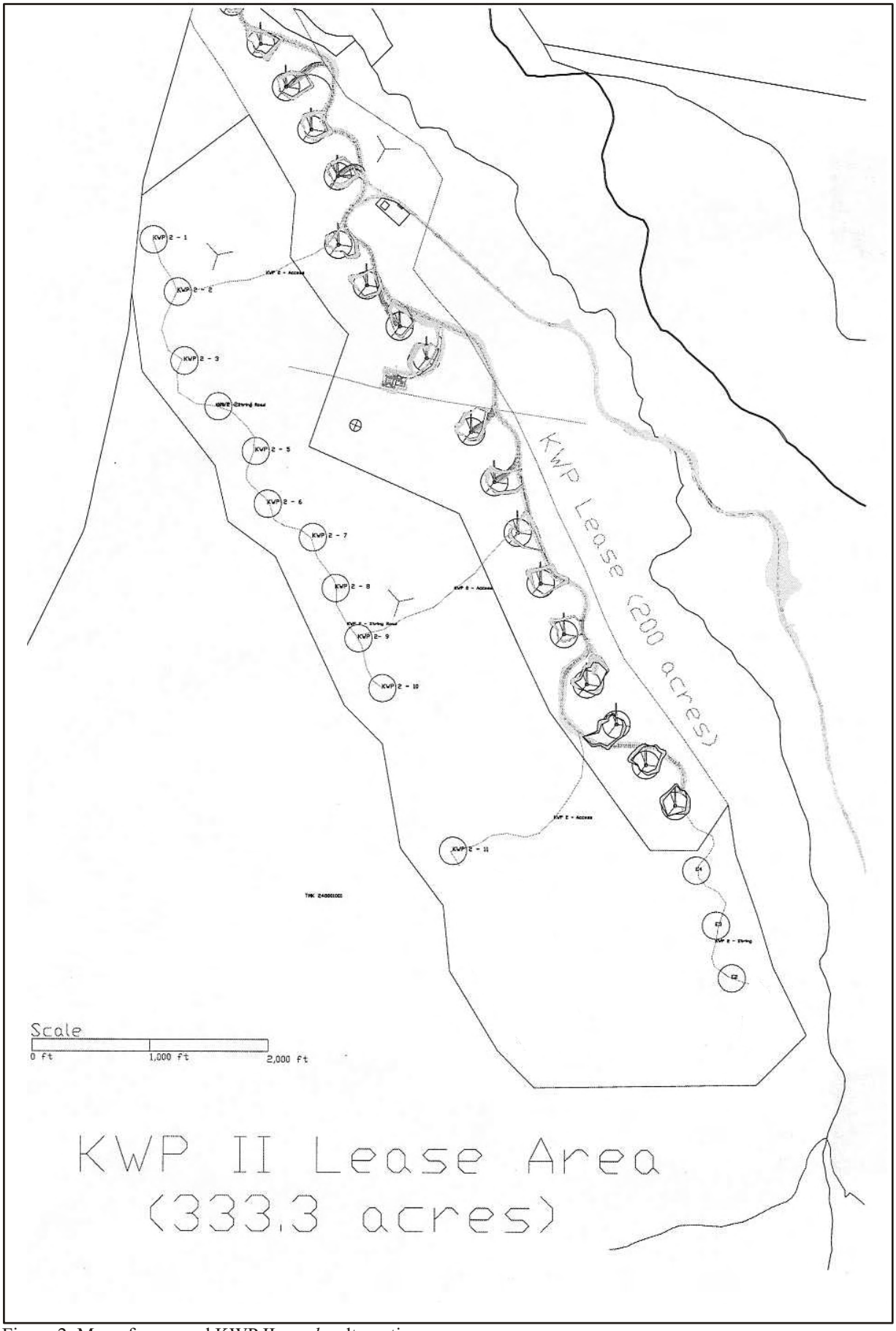


Figure 2. Map of proposed KWP II *mauka* alternative area.

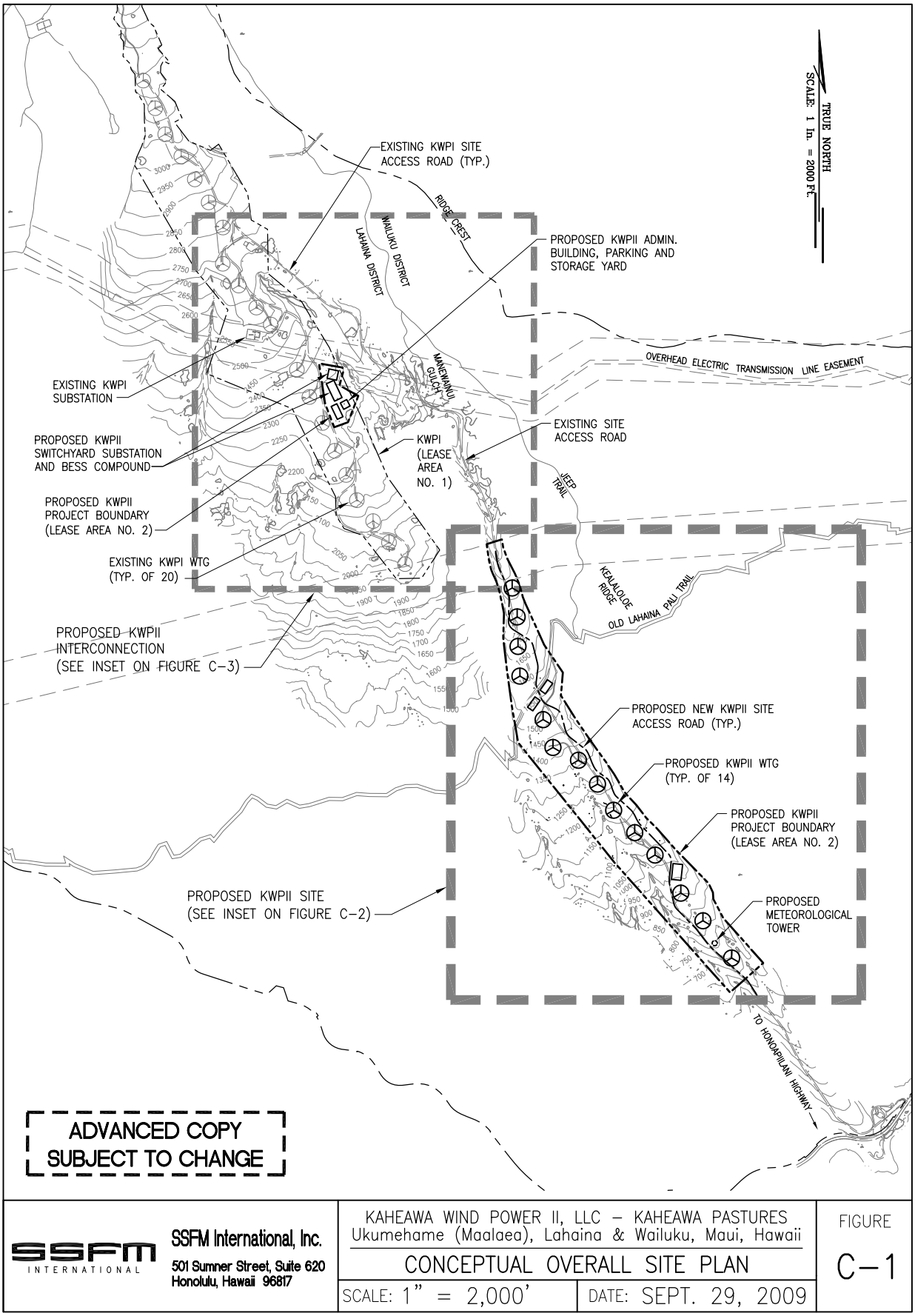


Figure 3. Map of proposed KWP II *makai* alternative area.

Natural Setting of the Project Area

Ukumehame Ahupuaʻa incorporates a network of gulches with both perennial and seasonal water flow yielding a combined average flow rate of 12.7 cubic feet per second per year (Wilcox and Edmunds 1990:39). Annual rain fall for the area ranges from 750 millimeters at lower elevations to 1,500 millimeters at upper elevations (Giambelluca et al. 1986:112). The gulches toward the western end of the *ahupuaʻa* open onto a large alluvial apron where the Precontact coastal populations of Ukumehame were concentrated, in the vicinity of the current Ukumehame Beach Park. Much of upland Ukumehame is rocky terrain with numerous boulder outcrops. The most prominent gulch in the vicinity of the study area is Manawainui Gulch, which is the current boundary between the Lahaina and Wailuku Districts.

KWP II proposes two alternative layouts for the expanded wind operation (see Figure 1). The *mauka* alternative (see Figure 2) stretches from an elevation of approximately 1,300 to 2,900 feet above sea level. It is located south and west of the existing wind farm (KWP I) between Pāpalaua Gulch (to the west; Figure 4) and Manawainui Gulch (to the east) in an area commonly referred to as Pōhakuloa ("long ridge") (see Figure 1). A prominent hill named Puʻu Lūʻau is present in the east-central portion of this area. The terrain consists of what is commonly referred to as tableland. Typical of the south rift of the West Maui volcano, this land consists of high, inter-valley ridges separated by steep-sided, dry gulches that descend the steep, southwest facing slope to the ocean (Tomonari-Tuggle 1998). The *makai* alternative (see Figure 3) occupies the same ridgeline as KWP I extending between roughly 2,000 and 400 elevation above sea level, with Manawainui Gulch along its western boundary (Figure 5).

Lava composition for the Ukumehame area is primarily the Wailuku Volcanic Series (Macdonald et al. 1983); although some evidence of the Honolua Volcanic Series has also been found (Devereaux et al. 1999). There are three soil zones in the overall project area (Tomonari-Tuggle 1998). The upper edge of the area is Olelo silty clay, which is well-drained upland soil formed in "material derived from basic igneous rock" and occurring on narrow to broad ridge tops (Foote et al. 1972:101). The central portion of the project area, inland of Puʻu Lūʻau, consists of Maiwa silty clay loam, which is a well-drained upland soil developed in volcanic ash and weathered igneous rock (Foote et al. 1972:102-103). The top of Puʻu Lūʻau and scattered areas along the upper edge of Manawainui gulch are deflated, with exposed dirt and boulders and cobbles. The area below the *puʻu* is steep, rocky, and punctuated by numerous boulder outcrops. The adjacent gulches are classified as rough broken and stony land in very steep gulches, and as rock land where exposed rock covers 25 to 90 percent of the surface (Tomonari-Tuggle 1998). Figures 6 and 7 are illustrative of the study area terrain.

Numerous native plant species were traditionally found in the general project area including *ʻōhiʻa lehua* (*Metrosideros polymorpha*), *ʻaʻaliʻi* (*Dodonaea viscosa*), *naio* (*Myoporum sandwicence*), *ʻiliahi* (*Satalum ellipticum*), *koʻokoʻolau* (*Bidens menziesii*), *pili* (*Heterpogon contortus*), *kukui* (*Aleurites moluccana*), *ʻilima* (*Sida fallax*), *ʻūlei* (*Osteomeles anthyllidifolia*), *pūkiawe* (*Syphelia* sp.), and *ʻākia* (*Wikstroemia thymelaeaceae*). Other predominant foliage includes lantana (*Lantana camara*), molasses grass (*Melinis minutiflora*), *kiawe* (*Prosopis pallida*), *koa-haole* (*Leucaena leucocephala*), and ironwood trees (*Casuarina equisitfolia*). A special variety of *ʻiliahi* (*Santalum ellipticum*) was known to exist on the slopes of Ukumehame two ridges to the west of the current project area at about the 3,000 foot elevation (see oral interview section of the current report). Kaheawa Wind Power is actively conducting native vegetation restoration projects within the study area. Native birds found in or around the general project area include *ʻUaʻu* (Procellariidae), *Pueo* (*Asio flammeus sandwichensis*), *Nēnē* (*Branta Sandwicensis*).

Figure 4. Pāpalaua Gulch along the western boundary of the *mauka* alternative area, view to southwest.

Figure 5. Manawainui Gulch along the western boundary of the *makai* alternative area, view to southwest.

Figure 6. Typical terrain in the *mauka* alternative area, view to southeast.

Figure 7. Typical vegetation cover in the *makai* alternative area, view to northeast.

PRIOR STUDIES

Archaeological studies for the area first began during the early 1900s. Winslow M. Walker was hired by Bishop Museum to conduct a general survey of Maui Island. During this initial survey he located three *heiau* in the *ahupuaʻa* of Ukumehame (Walker 1931). These *heiau* were believed to be Hikiʻi Heiau (SIHP Site 50-50-08-02), Ukumehame Heiau (SIHP Site 50-50-08-03), and Kawaialoa Heiau (SIHP Site 50-50-08-04). All three *heiau* were previously identified by John F.G. Stokes in 1916 (Thrum 1918). Walker mentioned that each *heiau* also contained graves of then recent origin. These three *heiau* were later included in the Hawaiʻi Register of Historic Places in 1973 during a follow-up survey conducted by the Department of Land and Natural Resources, State Parks Division (State Historic Preservation Division files). Walker also noted at least forty-five features situated along the coast between Māʻalaea and what is known as McGregor Point (Tomonari-Tuggle 1991:14).

More recently, nine previous archaeological studies were conducted for the KWP Phase 1 project area. These studies included a reconnaissance survey of twenty-seven wind turbine locations (Tomonari-Tuggle 1998), a study of an upland *heiau* site (Site 5232; Athens 2002) and a preservation plan for that *heiau* (Tomonari-Tuggle and Rasmussen 2005), a supplemental survey of the wind turbine pad alignments (Magnuson 2003), a supplemental survey for a proposed access road (Athens 2004), a reconnaissance survey of the southern portion of a new low impact road (Rasmussen 2005a), a supplemental reconnaissance survey within the SMA zone for a proposed staging area (Rasmussen 2005b, 2005c), and an inventory survey of the entire proposed development area (Clark and Rechtman 2005). Six of these studies included portions of the current project area (Athens 2002; Clark and Rechtman 2005; Magnuson 2003; Rasmussen 2005a; Tomonari-Tuggle 1998; Tomonari-Tuggle and Rasmussen 2005). In addition to these studies, an archaeological survey report (Tomonari-Tuggle and Tuggle 1991) and a cultural resource management plan (Tomonari-Tuggle 1995) were prepared for the Lahaina Pali Trail, a portion of which crosses through the current project area; an inventory survey was conducted for MECO transmission lines that mark the *mauka* terminus of the *makai* portion of the current project area (Hammatt et al. 1996; Robins et al. 1994); and two inventory surveys for the alternative proposed locations for KWP II (Clark and Rechtman 2006; Rechtman et al 2009). The findings of each of the previous archaeological studies are summarized below and their locations are shown in Figure 8.

Tomonari-Tuggle and Tuggle (1991) conducted an archaeological survey of two demonstration trails for the Hawaiʻi statewide trail and access system. One of the demonstration trails was the Historic Lahaina Pali Trail, a portion of which runs *makai* of the current project area. This trail was constructed around 1841 to accommodate horse traffic between the towns of Lahaina and Wailuku. Tomonari-Tuggle (1995) later prepared a cultural resource management plan for the trail as well. The trail is currently open to the public as part of the *Na Ala Hele* Statewide Trail and Access System. Tomonari-Tuggle and Tuggle describe the trail thusly:

> The Lahaina Pali trail extends 4.5 miles across the lower southern slopes of West Maui Mountains. At its west end, the trail is anchored inland of the Honoapiliʻilani Highway just east of Ukumehame State Beach Park. Its east end is located just inland of the pineapple fields near Maʻalaea Harbor. The trail covers an elevation range from about 100 feet to 1600 feat above sea level. (1991:5)

During the survey of the Lahaina Pali Trail Tomonari-Tuggle and Tuggle (1991) recorded eighteen archaeological sites (Sites 2816 to 2833) along its route, but they did not assign a Site number to the trail itself. Sixteen of the sites were related to the construction and use of the trail or the old coastal road. These sites included alignments, enclosures, walls, petroglyphs, terraces, and C-shaped structures. The two sites not related to the trail included a midden scatter (Site 2816) and a rock shelter (Site 2833). Both of these sites were determined to be of likely Precontact Hawaiian origins. One of the recorded sites (Site 2821) is located directly south of the *mauka* alternative area. Tomonari-Tuggle describes Site 2821 thusly, and makes the following recommendations:

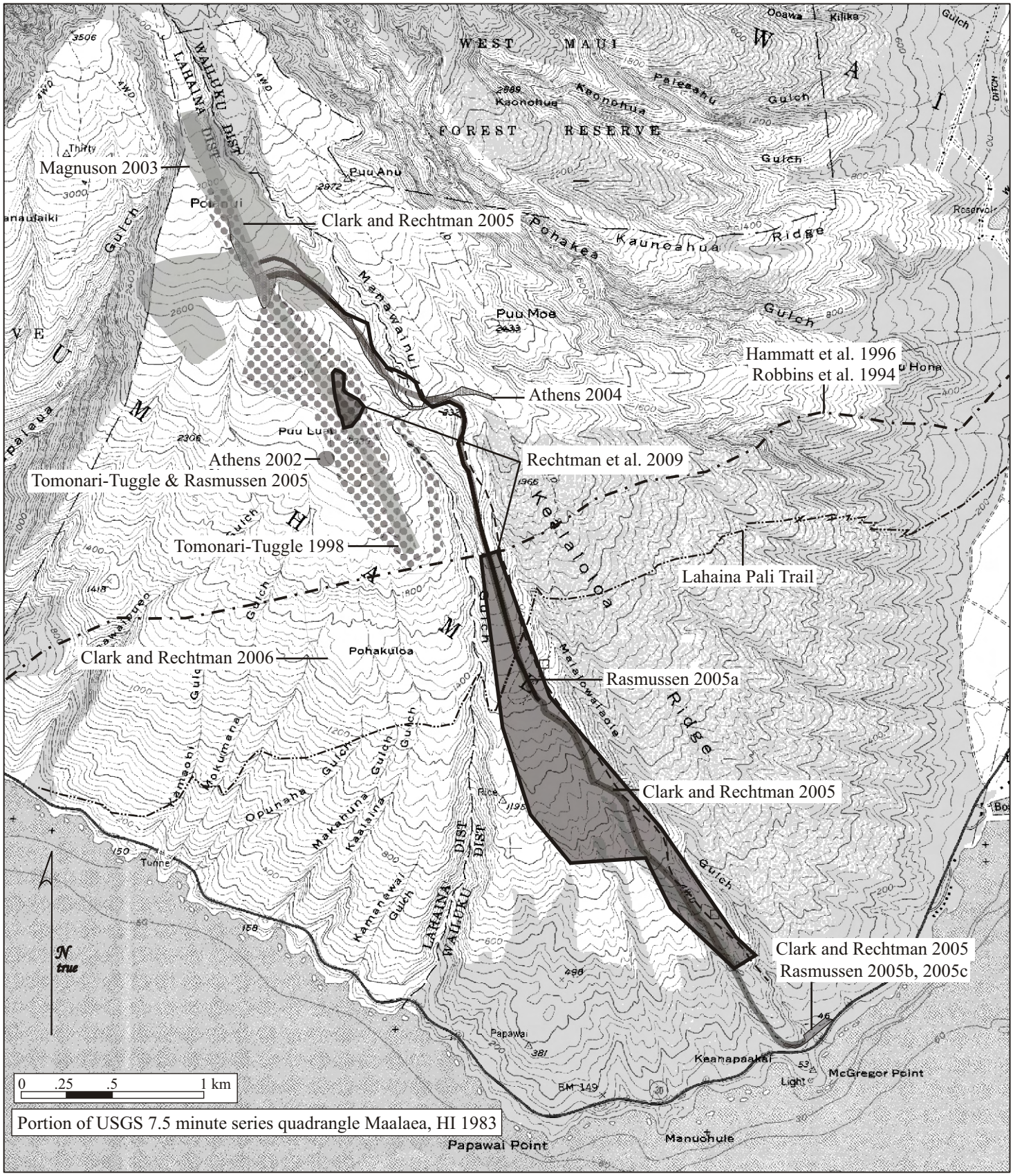


Figure 8. Prior archaeological studies in the general project area.

> Probable historic period petroglyphs on large boulder outcrops adjacent to the trail between Ōpūnahā and Makahuna Gulches. There is a quantity of bottle glass and Chinese crockery on the makai edge of the trail and on top of the outcrops on the mauka side of the trail. The outcrops do not have a definite overhang but are high enough to provide afternoon shade, making this an inviting place to rest along the trail. Therefore, there is potential for negative impact on this site. A surface collection of all artifacts, detailed mapping of petroglyphs, and survey of the area *mauka* among the rocks is recommended. The location is also recommended for interpretation. [1995:16]

Another of the recorded sites (Site 2825) is located *mauka* of the trail within Manawainui Gulch along the western edge of the current project area. Tomonari-Tuggle describes Site 2825 as a:

> …complex of petroglyphs and retaining walls; petroglyphs are historic names scratched into boulder outcrop adjacent to trail and about 8 m above trail; one inscription in upper set is the date "1874"; stacked boulder retaining walls up to 1.5 m high, built into natural outcropping on E side of gulch; possible cupboard in outcrop, 1x.50m, top of cliff overhang is 1 m above cupboard surface; stacked boulder wall continues discontinuously upstream about 70 m to an old fencepost. (1995:44)

Robins et al. (1994) conducted an archaeological inventory survey of a then proposed 14.7-mile long Maui Electric Company transmission line corridor from Mā‘alaea to Lahaina. The alignment of the transmission lines crosses the current project area at an elevation of approximately 1,880 feet above sea level. A later survey for access roads leading to the transmission lines was conducted by Hammatt et al. (1996). While these two surveys did locate a number of sites including Historic irrigation ditches, a Historic dam, Historic cattle walls, and Precontact temporary shelters, wind breaks, enclosures, and agricultural features, no archaeological resources were encountered in the vicinity of the current project area.

Archaeological studies of the previously developed portion of the Kaheawa Wind Power project area began in 1998 with a reconnaissance survey of twenty-seven proposed wind turbine locations (Tomonari-Tuggle 1998). This survey took place at elevations ranging from roughly 2,000 to 2,900 feet above sea level. The survey area included a 200-foot wide by roughly 1.5-mile long corridor following a line of five anemometer towers and a potion of Manawainui Gulch extending inland from the MECO transmission line inland approximately 3,000 feet. The only cultural sites observed during the reconnaissance survey were a concrete water trough and a metal waterline. Tomonari-Tuggle concludes that:

> 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 the pipeline, there are no remains of cattle ranching, the only identified use of this area in historic and modern times. (1998:15)

In 1999 a brush fire burned a portion of the wind farm project area, removing some dense brush from the southwestern edge of Pu‘u Lū‘au, and revealing the presence of an upland *heiau* in Ukumehame Ahupua‘a (Site 50-50-09-5232). The location of the *heiau* places it within the current project area, slightly to the west of the area studied by Tomonari-Tuggle (1998). Mr. Ed Lindsey, a cultural monitor for the wind farm project, discovered the site in late 1999 and notified Dr. Melissa Kirkendall, the then staff archaeologist at the Maui Branch office of the SHPD (Athens 2002:1). After a field visit by SHPD staff members, it was recommended that a qualified archaeologist document the *heiau* in detail. In 2002 IARII conducted archaeological investigations at the *heiau* that included site mapping, photographs, and subsurface testing (Athens 2002).

According to Athens (2002), the *heiau* consists of two adjacent stone enclosures joined by a massive central wall, with one of the enclosures displaying a notch on one side. Excavation inside the notched enclosure revealed a dense deposit of charcoal associated with use of the *heiau*. An AMS radiocarbon determination on charcoal from a short-lived wood taxon (*Chamaesyce* sp.) indicated that the *heiau* likely dated to AD 1670-1770. Several pieces of branch coral were also recovered from the *heiau*, further confirming the religious nature of the site. No food (marine shell or animal bone) or tool (basalt or volcanic glass flake debris, abraders) remains were found either in the excavation or on the surface of the site.

Tomonari-Tuggle and Rasmussen (2005) prepared a preservation plan for the *heiau* (on behalf of the Michael Gresham of Makani Nui Associates, LLC). They reported that informant information indicated a connection between the *heiau* and Manawaipueo, a gulch that begins a short distance below the site. The plan calls for several short-term preservation measures including a temporary buffer of 100 to 200 feet around the entire site (this buffer was to be marked by 4 to 6 foot high construction fencing prior to any construction activities), monitoring by a qualified archaeologist during any construction activities that take place within 500 feet of the *heiau*, for a pre-construction briefing to be conducted by a qualified archaeologist with the project manager, construction supervisors, and crews prior to any ground alteration activity, and that a report be prepared detailing these short-term preservation measures and submitted to SHPD (Tomonari-Tuggle and Rasmussen 2005:11-14). Long-term preservation measures called for in the plan include the creation of permanent signage and markers around the site, education for individuals and organizations having access to the project area, and community involvement in the maintenance and protection of the site (Tomonari-Tuggle and Rasmussen 2005:14-15). The long-term preservation of this site would be the responsibility of the State. All of the short-term preservation measures proposed by Tomonari-Tuggle and Rasmussen (2005) were followed during the construction of the existing wind farm, but the long-term preservation measures have not yet been implemented.

In 2003, IARII conducted a supplemental archaeological survey of a revised alignment for wind turbine pad locations that included a portion of the current project area (Magnuson 2003). This supplemental survey included three 200-foot wide corridors for two possible turbine rows and an access road connecting them. The survey corridor extended a total distance of 2,130 meters from elevations of 2,400 to 3,100 feet above sea level. As a result of the survey one site, a watering trough previously noted by Tomonari-Tuggle (1998), was relocated, mapped in detail, photographed, and assigned an SIHP site number (Site 50-50-09-5402). Based on inscriptions in the concrete of the trough, it appears that Site 5402 was built in 1943 (Magnuson 2003:3).

In 2004, IARII conducted a supplemental archaeological survey for an access road leading to the existing wind farm (Athens 2004). The survey area consisted of a 75-meter wide corridor stretching 2.5 kilometers northwest from an existing jeep road across Manawainui Gulch to the previously surveyed wind farm area. As a result of the survey two small rock piles that probably served as cairns (Sites 50-50-09-5625 and 50-50-09-5626) were located and recorded. Site 5625 was located on a natural bench immediately upslope of a small unnamed cinder cone within a dense growth of ironwood samplings, and Site 5626 was situated on the edge of a small ridge descending into Manawainui Gulch from its western edge (Athens 2004:2). Athens (2004:3) concluded that the two stacked rock piles, probably cairns, were fully documented, and no further archaeological documentation was needed. In addition to these sites, a single brass 45-70 cartridge casing manufactured by Winchester Repeating Arms Company between 1866 and 1932 was also discovered along the western edge of Manawainui Gulch (Athens 2004:3).

In 2005, IARII conducted a supplemental archaeological reconnaissance survey of a new proposed low impact road leading to the existing wind farm (Rasmussen 2005a). This survey area consisted of a corridor approximately 75 meters wide that extended from roughly 1,400 to 2,300 feet above sea level (Rasmussen 2005a:6). The corridor commenced at an existing access road, followed a narrow ridge to the northwest, and eventually crossed Manawainui Gulch and joined up with the wind turbine locations. As a result of the reconnaissance survey three previously unrecorded archaeological sites thought to be of traditional Hawaiian origins were discovered (Sites 5648, 5649, and 5650). Two of the recorded sites (Sites 5648 and 5650) were located outside (to the west of) the actual road survey corridor.

Site 50-50-09-5648, located between ca. 1,280 and 1,420 feet above sea level, consisted of six C-shaped rock shelters (Features 1, 2, 5, 6, 7, and 9), a possible C-shaped rock structure (Feature 4), one modified outcrop (Feature 10), and a cupboard (Feature 3). Marine shell was observed near Feature 4. Based on the presence of the shell and the formal attributes of the features, Site 5648 was interpreted as being used for habitation, perhaps related to the Lahaina Pali Trail, or an earlier trail (Rasmussen 2005a:7). Site 50-50-09-5649, located between ca. 1,880 and 1,980 feet above sea level, consisted of a rock cairn (Feature 11) and modified outcrop (Feature 12). Site 50-50-5650, located at the top of an unnamed cinder cone at an elevation of ca. 2,300 feet above sea level, consisted of four rock cairns (Features 13 to 16). Rasmussen concluded that, "the location (on top of a *pu'u*) and type of features present (cairn with linear stones that may be fallen upright stones) suggest that this site may have a ceremonial function" (2005a:8).

Later in 2005, IARII conducted a supplemental archaeological reconnaissance survey of a roughly 1.75-acre SMA area located along the northern (*mauka*) edge of Honoapili'ilani Highway (Rasmussen 2005b). As a result of that survey three archaeological sites were recorded. In the Rasmussen (2005b) report the sites are referred to with temporary site numbers, but in a letter dated February 11, 2005 the sites are referred to with SIHP site numbers (Rasmussen 2005c). The three recorded sites included a Historic road remnant (Site 50-50-09-5652), a traditional Hawaiian habitation area comprised of several rough features on a small knoll north of the staging area (Site 50-50-09-5654), and set of concrete steps with the date 1908 inscribed into one of the steps (Site 50-50-09-5654). According to Rasmussen (2005b) only Site 5652 was located within the SMA project area, and according to Rasmussen (2005c) all three sites were located outside of the project area. Nevertheless, Rasmussen (2005c:2) suggests that measures be taken to protect the sites during any construction activities in the area, and recommended that a full archaeological inventory survey be conducted of the access road leading to the proposed wind farm area prior to any development.

Following all of the preliminary work conducted by IARII, Rechtman Consulting, LLC conducted an archaeological inventory survey of the entire Kaheawa Wind Power I project area (Clark and Rechtman 2005). As a result of the inventory survey seven previously identified archaeological sites and two newly identified sites were recorded. The previously identified sites included the Historic Lahaina Pali Trail, a section of Historic highway (Site 4696), a concrete watering trough (Site 5402), a lone cairn (Site 5625), a cairn and a modified outcrop located next to one another (Site 5649), a terraced section of old road (Site 5652), and the remains of a Historic structure (Site 5654). The newly identified sites included a possible privy (Site 5714) and a Historic hoist location (Site 5715). Two isolated finds, consisting of marine shell fragments and an adze fragment, were also discovered. Five other archaeological sites previously recorded by IARII outside the boundaries of the current project area were also relocated. These sites included an upland *heiau* (Site 5352) located within the current project area, a lone cairn (Site 5626), a Precontact habitation complex located between 1,280 and 1,420 feet above sea level (Site 5648), a grouping of four cairns atop an unnamed *pu'u* (Site 5650), and a Precontact habitation complex located at approximately 70 feet above sea level (Site 5653). Clark and Rechtman summarized their findings as follows:

> A review of archival resources and previous archaeological studies, combined with the findings of the current inventory survey, indicates that Precontact use of the project area centered around coastal habitation and the exploitation of marine resources, as indicated by Site 5653. A network of trails may have connected the coastal habitation area with inland resource areas (Devereux et al. 1999). Site 5648 may have been a Precontact habitation area located along one of these trails, or perhaps an early Historic site related to the use of the Lahaina Pali trail (Rasmussen 2005a). If a Precontact *mauka/makai* trail route traversed the current project area, then it likely accessed inland resource areas, and may have connected to trails leading to other areas of West Maui. No evidence of a Precontact trail was observed during the current survey, and it is likely that if one did exist, it was destroyed by the McGregor Point jeep road (Devereux et al. 1999). In late Precontact times trails likely ran to Site 5352, an inland *heiau* located on Pu'u Lū'au (Athens 2002). Isolated marine shell fragments and an adze fragment observed within the wind turbine survey corridor may have been dropped along such a trail route leading to or from the *heiau*.

> Sites related to Historic use of the current project area are far more numerous than Precontact ones. Recorded Historic sites indicate that the area along the old Highway alignment (Site 4696) was the primary focus of Historic use. The date "1908" within the concrete stairs at Site 5654, indicates that a Historic structure was in use on the ridge to the west of Malalowaiole Gulch around that time period. Site 5652, a terraced roadbed may have run from Site 4696 to the structure. A possible privy (Site 5714) and a Hoist location (Site 5715) were also located in the area. All of these sites may relate to the use of the current project area for cattle ranching purposes. The land in the vicinity of the current project area was leased for ranching purposes and used as pasture from the late 1850s to the early 1990s (Tomonari-Tuggle 1998). The only site recorded in the extreme inland portions of the current project area was a concrete watering trough constructed in 1943 (Site 5402).
>
> In addition to these sites the Lahaina Pali trail crosses the current project area. This Historic trail was constructed around 1841 for horse travel between Wailuku and Lahaina. The trail fell into disuse approximately fifty years later with the construction of a carriage road (Site 4696) along the coast in Ukumehame Ahupuaʻa (Tomonari-Tuggle and Tuggle 1991). The trail brought numerous Historic travelers across the lower slopes of the West Maui Mountains, and it continues to bring modern day visitors to the area as part of the *Nā Ala Hele* Statewide Trail and Access System. (Rechtman and Clark 2005:40)

In 2006, Rechtman Consulting, LLC conducted an inventory survey of the 333-acre area for one of the alternative KWP II layouts (the *mauka* portion of the current study area) (Rechtman 2006). During this survey, in addition to the previously recorded *heiau* (SIHP Site 50-50-09-5232), five new sites were identified including a windbreak shelter (50-50-09-6218), three cairns (50-50-09-6219, 50-50-09-6220, 50-50-09-6221), and a Historic Period ranching area (50-50-09-6222) (Figure 9). No further work was the approved treatment for the newly recorded sites; the *heiau* is to be preserved in accordance with the SHPD-approved preservation plan (Tomonari-Tuggle and Rasmussen 2005).

In 2009, Rechtman Consulting, LLC conducted an inventory survey for the *makai* proposed alternative of KWP II (the *makai* portion of the current study area) (Rechtman et al. 2009). As a result of that study, the Lahaina Pali Trail and a possible remnant section of its Māʻalaea branch were identified as was the previously recorded Site 5648, along with a concrete water trough (Site 6665) (Figure 10). The Lahaina Pali Trail and the Māʻalaea branch of this trail were constructed in 1841 and remained in use until 1891. At Site 5648, twenty new features were documented; bringing the total number of features at this site to thirty. The features are indicative of temporary habitation and may represent recurrent use shelters associated with trail routes. The use of these features likely dates from both Precontact and Historic times. The most intensive habitation may have occurred between 1841 and 1891 when the Lahaina Pali Trail and its Māʻalaea branch were still in use. Site 6665 is a concrete water trough that was built on December 14, 1943. This water trough is part of a water system developed by Honoula Ranch in Ukumehame in the 1940s. As documented in Clark and Rechtman (2005 and 2006), this system also included other water troughs (Sites 5402 and 6222), interconnected by metal pipes that supplied water. This system provided drinking water for cattle in the once extensive, but arid pastures of this upland area.

There have also been several other studies conducted in the general Ukumehame area. These include a reconnaissance survey for the coastal portion of TMK: 2-4-8-02:40 (Neller 1982), an inventory survey on TMK: 2-3-6-01:14 to the east of the current project area (Moore and Kennedy 1995) and data recovery excavation at SIHP Sites 4148 and 4139 on the same parcel (McGerty et al. 1998), and an inventory survey on TMK: 2-4-8-02:09 (Devereaux et al. 1999). Other cultural sites recorded in the Māʻalaea area include the "King's Table", a *piko* stone and what is described as a grinding stone (SIHP Site 1440) and a petroglyph site (SIHP Site 1169) consisting of sixty images carved into eleven large boulders (Devereaux et al. 1999).

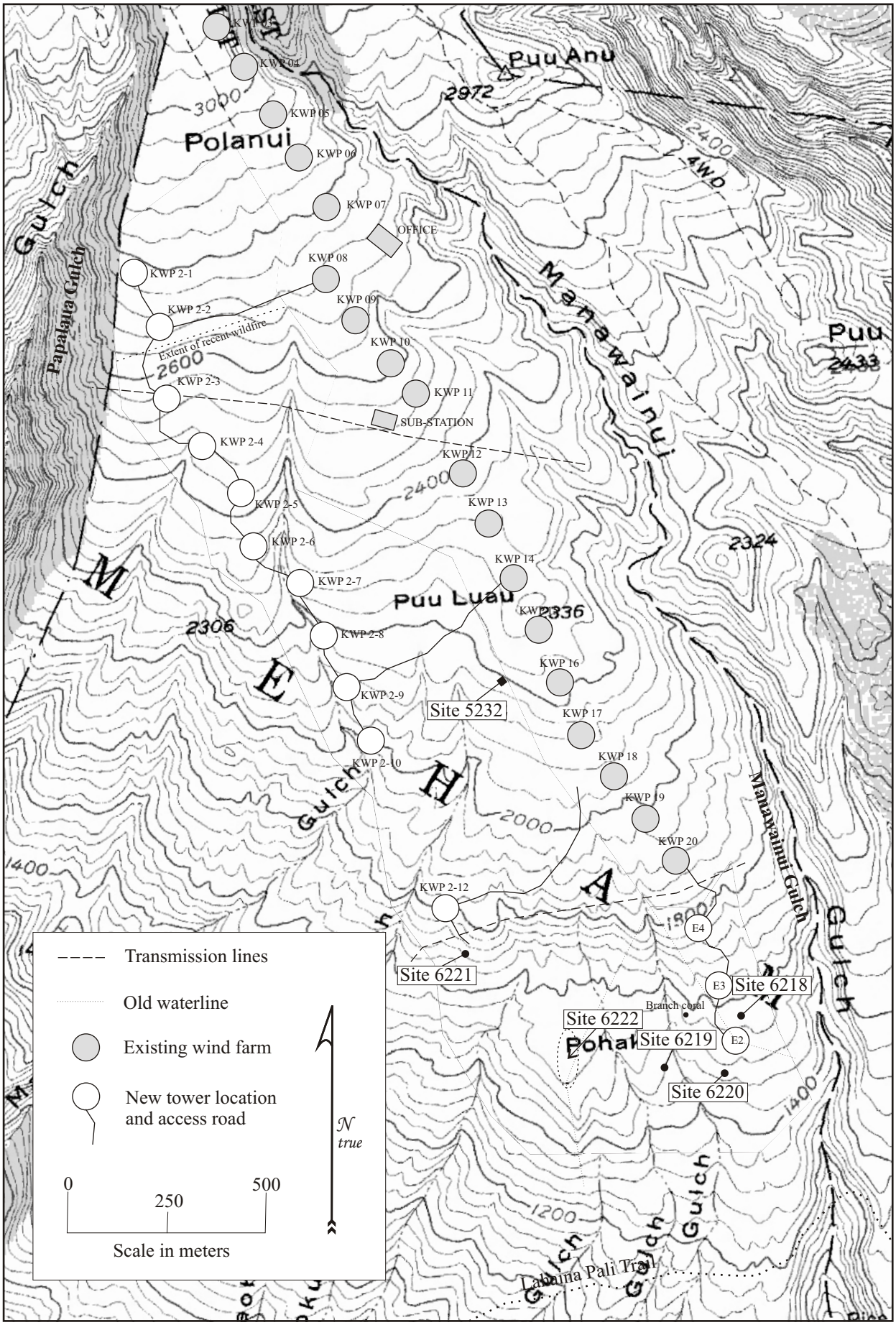


Figure *9*. Distribution of archaeological sites within the KWP II *mauka* alternative area.

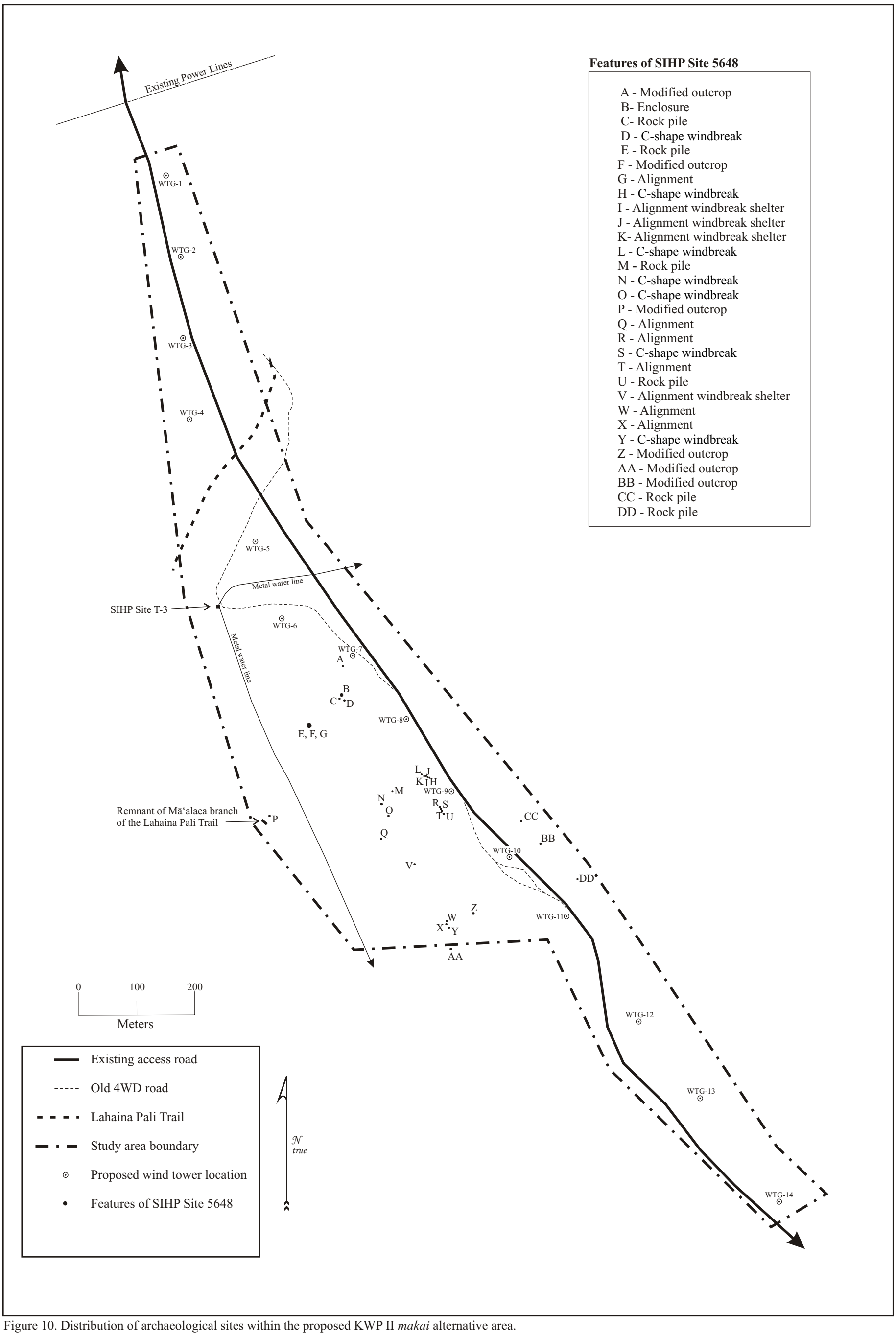


Figure 10. Distribution of archaeological sites within the proposed KWP II *makai* alternative area.

CULTURE-HISTORICAL BACKGROUND

Natural and Cultural Resources in a Hawaiian Context – Ka‘ao Hawai‘i

From a Hawaiian perspective, natural and cultural resources are one and the same. Hawaiians see themselves and all things in the universe (animate and inanimate) as being born from the same source. That this belief is pervasive is evidenced by a review of the genealogical account known as the *Kumulipo*, one of many genealogical accounts of the Hawaiian people. The *Kumulipo* catalogues the longest genealogical time frame; this oral tradition contains 2,102 lines of genealogical accounts. From the *Kumulipo* most islands' genealogies can claim an ancestor:

Ka Pule Ho‘ola‘a Ali‘i: He Kumulipo No Ka‘i‘imamao a iā Alapa‘iwahina. (The Kalākaua Text)

0001 *O ke au i kahuli wela ka honua*
O ke au i kahuli lole ka lani
O ke au i kakaiaka ka la
E hoomalamalama i ka malama
O ke au o Makalii ka po
O ka walewale hookumu honua ia
O ke kumu o ka lipo i lipo ai
O ke kumu o ka po i po ai
O ka lipolipo, o ka lipolipo
0010 *O ka lipo o ka la, o ka lipo o ka po*
Po wale hoi
Hanau ka po
Hanau kumulipo i ka po, he kane
0014 *Hanau poele i ka po, he wahine*

0001 It was the time when the earth was hot
It was the time when the heavens reversed
It was the time when the sun was dimmed
The moon was the only light
It was the time when Makali‘i reigned in the night
It was the time of primordial ooze
The source of the darkness that produced darkness
The source of the night that manifested night
The profound darkness of the southern skies
0010 The shadows of day, and the darkness of night
In the absolute darkness of night
The night gives birth
Kumulipo is born, a man
0014 Pō‘ele is born, a woman
(Translation Kanoelehua Wilson Ah Sam)

The next 586 lines of the *Kumulipo* describe the creation of life on sea and land. The oral account catalogues all things that fly and crawl; all things that live nocturnally, and that live in the daylight. Each creature is a descendant of the first; each living thing is genealogically catalogued in detail. That was the time of the gods. To the Hawaiian the elements are the gods. The wind is an embodiment of the gods, the cliff face is an embodiment of the gods, the fish and birds are embodiment of gods. Hawaiians refer to these embodiments as *kinolau* (Pukui & Elbert 2003).

After life was established the first person was born a woman named La‘ila‘i who in turn had several children with Kāne and Ki‘i. Following their unions the *Kumulipo* recounts another 1,006 genealogical entry lines, until the birth of Kumuhonua, a progenitor of Hawaiians (Kamakau 1991:131). Approximately fifteen generations later Kahahikoluamea and Kūpūlanakeau were noted to have lived on Kamawaelualani, an older name for Kaua‘i. Wākea their son lived with his *wahine* Papa at Loloimehani, an older name for O‘ahu (Kamakau 1991:131). The names of the islands as we know them today are said to come from the children of Papa and Wākea.

The time of Papa and Wākea mark a very auspicious time in Hawaiian history. According to the Kumulipo, we see how Wākea set about ordering Hawaiian society of his time. Indeed many Hawaiians consider the generation of Papa and Wākea to be "the beginning of Hawaiian time" (Kameeleihiwa 1992:23). As the Kumulipo relates:

1790 *Hoololo ka hanauna a ia wahine*
Haae wale ka hanauna lolo
O Papahulihonua
O Papahulilani
O Papanuihanaumoku
O Papa i noho ia Wakea
Hanau Haalolo ka wahine
Hanau inaina ke keu
Hoopunipuni ia Papa e Wakea
Kauoha i ka la i ka malama
1800 *O ka po io Kane no muli nei*
O ka po io Hilo no mua ia
Kapu kipaepae ka hanuu
Ka hale io Wakea i noho ai
Kapu ka ai lani makua
Kapu ka ape ka maneoneo
Kapu ka akia ka awaawa
Kapu ka auhuhu ka mulemulea
Kapu ka uhaloa no ke ola loa
Kapu ka laalo ka manewanewa
Kapu ka haloa ku ma ka pea
1810 *Kanu ia Haloa ulu hahaloa*
O ka lau o Haloa i ke ao la
Puka

1790 The generation of this woman are manifested
Producing forth the generation of intellect
The priest of Papahulilani
The priest of Papahulihonua
The priest of Papahanaumoku
Papa joined with Wākea
Ha‘alolo was born, a woman
Jealousy is born in addition
Wākea deceives Papa
He systemizes the sun, the moon
The night of Kāne is the last night
1800 The night of Hilo is the first
The platform and alter is made sacred
Of the residence of Wākea
The sacredness of royal incest pairing is established
The ‘ape plant is made sacred, it itches
The ‘akia plant is made sacred, it is poisonous
The ‘auhuhu plant is made sacred, it is bitter
The ‘uhaloa plant is made sacred, it is a remedy
The taro tops are made sacred, it is harsh
The taro stalks are made sacred that grow near the women's house
1810 Hāloa is buried, a long taro stalk grew forth
The descendants of Hāloa are brought into consciousness
Coming forth
(Translation by Kanoelehua Wilson Ah Sam)

Wākea was said to have lived fifty-seven generation before the time of Abraham Fornander (Fornander VI 1919:233). According to Fornander's calculations, this would place the time of Wākea to be around A.D. 150. The next sixteen generations after Wākea share similar genealogical names with those of the Tahitian genealogies. Fornander concluded that these 480 years or so of shared genealogy mark the years of initial migrations and settlements of the Hawaiian Islands. This would place these first years of voyaging between A.D. 150 and A.D. 630. Even if we were to recalculate this time frame using 25 years per generation rather than the 30 year standard used by Fornander, the timing still mirrors that of Kirch's (1985) model of settlement in the Hawaiian Islands. Kirch refers to this period as the Settlement Period; it is believed to have occurred between A.D. 300-600.

Modern day archaeology supports this settlement model. Pollen studies from the ʻEwa plain area are consistent with settlement dates between A.D. 145–600 (Kirch 1989:24) and dates from the Waimanalo area point to even earlier periods (Cordy 2000: 107). Most likely settlement of the Hawaiian Islands did not occur at one time or in one place (Cachola-Abad 1992). Migrations of this sort likely continued for centuries lending to the various accounts of who the first Hawaiians were. What is sure is that the Hawaiian ancestors slowly populated the Hawaiian Islands from Haʻehaʻe where the sun rises in the east to Lehua where the sun sets in the west over several generations. According to Malo (1827), these migrations eventually established chiefly genealogies for each of the islands, as he states in an early manuscript:

> *Eia hoʻi ko Maui nahae ʻana o ko lākou moʻokuʻauhau mai nā makaʻāinana a nā aliʻi. ʻO ka moʻokuʻauhau maiā Hanalaʻaiki mai ko Hanalaʻanui*
>
> Here is the account of Maui's genealogical split between chiefs and commoners. This is the genealogy of Hanalaʻaiki and Hanalaʻanui.

According to this manuscript the social classes and chiefly genealogical lines were established during the generation of Hanalaʻaiki and Hanalaʻanui.

ʻIhikapalaumaēwa is said to be an older name of the Island of Maui (Kamakau 1991:129). The name Maui itself is said to come from the chief Mauiloa. He is an ancestor of Piʻilani, a famous chief of Maui (Malo 1827). The inception of the *ʻaha aliʻi* or royal court with class distinction was said to have been established by a Maui chief by the name of Haho (Fornander 1996:26). It is thought that this may have occurred out of a necessity to protect boundaries and rulership rights.

Lonoapiʻilani and Kihapiʻilani were two sons of Piʻilani. After their fathers death, Lonoapiʻilani became *aliʻinui* of Maui and Kihapiʻilani was made *aliʻinui* of Molokaʻi, Lanaʻi, and Kahoʻolawe. War was declared between the two brothers; the reasons for the war, however, are often disputed (Kamakau 1870). Kihapiʻilani sought the aid of ʻUmi on Hawaiʻi Island to defeat Lonoapiʻilani. Lonoapiʻilani was killed and buried in Hana, Maui (Manu 1884). It is said that the term "*Nā Hono A Piʻilani*" comes from Kihapiʻilani's defeat of his brother declaring him chief of Maui, Molokaʻi, Lanaʻi, and Kahoʻolawe (Manu 1884).

Kihapiʻilani's son, Kamalalawalu, followed his father, becoming the next *aliʻinui* of Maui. Kamalalawalu married the daughter of Lonoapiʻilani, Piʻilaniwahine. Their eldest son was Kauhiakama who succeeded his father (Fornander 1996:207). Kamalalawalu is famous for his exploits against Lonoikamakahiki, having attempted a raid on Kohala on Hawaiʻi Island, where he was eventually killed by the forces of Lonoikamakahiki.

Kauhiakama followed the same fate as his father. Towards the end of his reign he staged a campaign against Oʻahu, where he was killed (Fornander 1996:208). Several generations of peace passed till the reign of Kekaulike, the great-great-grandson of Kauhiakama. Kekaulike is said to have staged several battles with the warring chiefs of Hawaiʻi Island. Kekaulike eventually died the same year that Kamehameha was born, sometime around 1736-1740 (Fornander 1996:211).

Upon Kekaulike's death, his son Kamehamehanui becomes his successor. Kauhiaimokuakama, the eldest son of Kekaulike and Kahawalu and half brother to Kamehamehanui, challended Kamehamehanui's authority. The first battle was fought and Kamehamehanui fled to Hawaiʻi Island with the aid of Alapaʻinui. Alapaʻinui left behind extensive forces from Honokawai to Ukumehame, with his headquarters in Lahaina (Fornander 1996). With Peleioholani's help from Oʻahu, Kauhiaimokuakama was able to hold off Alapaʻi and Kamehamehanui's forces ending the battle with great losses to both sides. Kauhiaimokuakama was killed as a result of this battle.

Kahekili becomes *ali‘inui* upon the death of his brother Kamehamehanui. Toward the end of 1782, the O‘ahu chief Kaopulupulu dies, leaving Kahahana as the only competition on the Island of O‘ahu. Kahekili seizes this opportunity and stages war against Kahahana and eventually succeeds in killing him, securing O‘ahu under his rule (Fornander 1996).

Dissent between Hawai‘i Island and Maui continued through the times of Kalani‘ōpu‘u and Kahekili until Kamehameha is able to achieve a definitive victory in the battle of ‘Iao known as Kepaniwai. This eventually led to the rule of the Kamehameha Dynasty and the establishment of the Hawaiian Kingdom.

Mālama ‘Āina – Management of the Land and Natural Resources

The land and natural resources of Hawai‘i were customarily managed through a hierarchal system that established land divisions and assigned chiefs to manage those divisions. The division were as such: *mokupuni* – entire island; *‘āpana* – major land districts; *moku o loko* – smaller land divisions within *‘āpana*; *‘okana/kalana* – districts within moku o loko; *ahupua‘a* – divisions within the districts; *‘ili ‘āina* – smaller land section within *ahupua‘a*; *mo‘o‘āina/pauku‘āina* – smaller properties within *‘ili ‘āina*; and *kihapai* – the smallest land section (Malo 2006). The Island of Maui, for example, traditionally consisted of twelve *moku o loko* or inner districts of Ka‘anapali, Lahaina, Hamakua Poko, Hamakua Loa, Ko‘olau, Hana, Kipahulu, Kaupō, Kahikinui, Honua‘ula, and Kula. The Wailuku district is traditionally referred to as *Nā Wai ‘Ehā* representing the four *ahupua‘a* Wailuku, Waikapu, Wai‘ehu and Waihe‘e. Ukumehame Ahupua‘a is located within the traditional district of Lahaina. Today, however, Ukumehame Ahupua‘a straddles the modern boundary of Lahaina and Wailuku.

Ahupua‘a represented traditional boundary areas of resources to the people living within them. Most *ahupua‘a* were established based on the availability of resources in the area, thus some *ahupua‘a* are much larger than others. *Ahupua‘a* were managed by *konohiki* who reported directly to an *ali‘i ‘ai ahupua‘a*. This ali‘i was responsible for the resources within his *ahupua‘a*. He in turn reported to an *ali‘i ‘ai moku* who was responsible to the *ali‘inui*. It is most likely within this context that the *ahupua‘a* of Ukumehame was managed.

Ukumehame – Its Land and People

It is unknown when Ukumehame Ahupua‘a was first settled, but it is said that it was during the time of Kapaka‘ili‘ula and Ka‘ikipa‘ananea, Ukumehame and Olowalu were the favored residencies of royalty (*Nūpepa Kū‘oko‘a*. 16 March 1865).

Ukumehame is noted for the strong winds that come from the uplands and blow to the sea. It is said that the winds originate from a place called Lihau a peak located in the West Maui Mountains (Ke Kumu Hawai‘i 1837: 5). One *kama‘āina* of Olowalu wrote this of the winds of Ukumehame and the surrounding *wahi pana*:

> *Hoomanu‘a i ke one o Awalua, konohikilua ka lā iā Olowalu, i ka lā‘i ka makani kahi ‘ao‘ao, Na Ukumehame ka nau o ka makani.*
>
> Pile the sands of Awalua, the sun is measured in Olowalu, during the day the wind is on one side, but to Ukumehame the wind escapes (Kalei 1894a; translated by Kanoelehua Wilson Ah Sam).

The last line could also be translated as: *Ukumehame is the land where the wind bites*. The same *kupa ‘āina* wrote again about these famous winds recounting another *mele* that was taught at the *Kula o Kamaomao*:

> *Olowalu ka leo a ka makani ia Ukumehame,*
> *Pohapoha ka ihu o ka wa‘a i na ale a ke Kaumuku*
> *Huleilua i na nalu o Launiupoko*
> *Keikei Lahaina i ka ua Paupili*
>
> The voice of the wind roars at Ukumehame,

The noses of the canoes burst through the swells of Kaumuku,
Turned this way and that in the surf of Launiupoko,
Lahaina stands proud in the Paupili rain.
(Kalei 1984b; translated by Kanoelehua Wilson Ah Sam).

Once again we see an unmistakable relationship between the winds that come off the gorges at Ukumehame and the condition of the sea. These winds are so strong that they whip the ocean swells into whitecaps.

A *kanikau* (chant of lamentation) for Edwin Miner (*Ka Hoku O Ka Pakipika* Book 1, Number 1. 26 September 1861. Page 3), traces the landscape of Maui from Kahului to Ukumehame. In this *mele* we see again references to the wind and landscapes of Ukumehame Ahupuaʻa:

Hele aku la oe i ke ala ula a Kanaloa
Mai ka ihona loa o Manawainui
He nui hoi au he hiwahiwa na ka makua
Kuu minamina pau ole ia oe e
Aloha ino, aloha e
Kuu makuakane mai ka makani kulai hale o Ukumehame

You have followed the red path of Kanaloa
From the steep descents of Manawainui
Now I am older, still cherished by the parents
My loving regard for you will never end
My great love,
My dear father from the winds that blow over houses of Ukumehame
(translated by Kanoelehua Wilson Ah Sam)

The *kanikau* was written by Mrs. Apia Miner on August 29, 1861 for her father. In it, Manawainui is noted for its "*ihona loa*" or steep descent reflecting the landscape of this large gorge that borders the current project area on the Kīhei (east) side. Ukumehame is noted for its strong wind "*makani kulai hale*" that knocks over houses. Other notable winds of Ukumehame include ʻOlaukoa (Nakuʻina 2005) and Mumuku (Ashdown n.d.).

It is important to note this relationship of the upper regions of Ukumehame that lie in Maui Komohana and the ocean that lies between its coastline and the surrounding islands. Kai-o-Haui is the name of the sea from Māʻalaea to Lahaina (T. Kelsey in Sterling 1998:17). So strong was the wind at times, that it would shred the sails of vessels trying to traverse the coastline by sea as S.E.K. Papaʻai documented in an article about his tour of Maui (Nūpepa Kūʻokoʻa 1868). He writes:

Ke holo nei ka moku a kūpono i Ukumehame, nānā aku i ka makani wili koʻokai i ka moana, kahea mai ʻia ke Kāpena i nā sela a pūʻā i nā peʻa, e hao mai ana ka makani pau nā peʻa i ka nahaehae.

The ship sailed on until reaching just outside of Ukumehame, watching the strong whirling winds whipping the seas, the captain called out to the sailors to furl the sails, the wind was gusting and the sails were torn. (translated by Kanoelehua Wilson Ah Sam)

The strength of the wind and its affect on the ocean connected to Ukumehame was critical for the natives of the area to understand. Ukumehame was a fertile *ahupuaʻa* that supported a large population. Food resources came from both the local fisheries and the long narrow stretches of *loʻi* that lined the deep valleys and ravines of Ukumehame (Kawelo 1861). The distribution of Land Commission Awards made during the *Māhele* within Ukumehame Ahupuaʻa reflects this settlement pattern. Although the *ahupuaʻa* was retained as Crown Lands, forty-four *kuleana* claims were made for land in Ukumehame Ahupuaʻa (see discussion below), all within the agriculturally productive gulches located to the west of the current project area. Only ninteen of the claims were awarded (Devereux et al. 1999:12). A smaller settlement area was

also located at Mā‘alaea to the east of the current project area. Kalo terraces (*lo‘i kalo*) within the *ahupua’a* of Ukumehame, Olowalu and Lahaina were reported by Walker (1931:71) during his island wide survey of Maui. These *lo‘i kalo* were situated along the gulches. Handy et al. (1991) report that heavy production of *kalo* continued in theses areas until the 1940s, and people are known to still cultivate *kalo* in the area (see Fujihiro oral interview in this study).

A. D. Kaha‘ulelio describes the different fishing *ko‘a* that lie between Ukumehame, Lahaina, Lana‘i and Kaho‘olawe (Maly and Maly 2003:122). He suggests that these *ko‘a*, which are one to two miles apart, are interrelated as the *maunu* (chum) placed at each *ko‘a* effects the others. After the *Māhele* of 1848 Ukumehame was known as a Konohiki Fishery (Maly and Maly 2003: 263).

So important were the fisheries and the ocean surrounding the area that Ukumehame became a prominent canoe landing as documented in a newspaper article depicting the voyage of A. Lahaba from Kona, Hawai‘i Island to O‘ahu in late June early July 1861. They left Kawaihae crossed the channel one evening and arrived in Keawanui (Lahaba 1861). From there they continued to sail to Honua‘ula where they furled the sails due to strong winds and paddled the distance to Ukumehame where they landed for the night before continuing up the coast. There is another mention of Ukumehame landing in an earlier article in the Hawaiian language newspaper *Lama Hawai‘i* (Keli‘i‘umi‘umi 1834). Keli‘i‘umi‘umi wrote about a death of a fisherman along the Ukumehame coastline.

In addition to the rich marine resources and domestic agriculture, the uplands of Ukumehame was likely a *kulamanu*, a gathering place of birds. Robins et al. (1994) suggest that the tablelands of Ukumehame may have been a resource area for the collection of native birds. And, W. H. Uaua wrote an article entitled *Ka Mo‘olelo Ka‘ao O Ka Ho‘ouka Kaua O Nā Pueo a Luku ‘Ia Nā Kānaka A Me Nā Ali‘i O Maui* in the Hawaiian language newspaper *Ke Au ‘Oko‘a* published June 29, 1871. This is an account of the war between *pueo* and people on the Island of Maui. Uaua describes the valley of Manawaipueo as the gathering place for the *pueo* soldiers. This legendary account is set in the time of Kanēnēnuiakawaikalu, a early *ali‘i nui* of Maui Island. It is said in the *mo‘olelo* that there were so many birds in the sky that it blocked out the sun. The area that led from Manawaipueo to Wailuku was from that point on referred to as Malukahekūawa and is today known simply as Kaheawa, the name that is now used for the pastures of the current project area. It is from this same battle that Wailuku acquired its name (Uaua 1871). Kupuna Paolo Fujihiro also mentions Manawaipueo as being a gathering place for *pueo* who would make a seasonal migration to Kaho‘olawe to feed (see Fujihiro oral interviews in this study).

The fresh water streams of Ukumehame were also an important resource. Kamakau (1866) describes that during the famous battle between Alapa‘i and Kauhi‘aimokuakama in the year 1738, the battle was so fierce (*he hulihonua ke ‘ano o ke kaua*) that the rivers of Lahaina ran dry. Alapa‘i and his soldiers were able to secure the main water sources for that portion of West Maui: Olowalu, Ukumehame, Wailuku, Honokawai; thereby securing a valuable resource that provided needed sustenance to the troops of Hawai‘i Island during their campaign on Maui.

In A.D. 1790, Kalolapupukaohonokawailani, a wife of Kalani‘ōpu‘u, was living in the *ahupua‘a* of Honua‘ula, when in February of that year the *Eleanor*, the same ship from Liverpool that brought John Young to Hawai‘i, was seen off of Olowalu and Ukumehame. The ship eventually anchored off shore of Honua‘ula. Ka‘ōpūiki was the current *kāne* of Kalolapupukaohonokawailani and he greatly desired the iron and muskets that the ship offered. One night after they were rudely turned away from trade with the ship, Ka‘ōpūiki and his men stole a dinghy from the ship and sold it for parts in Olowalu. The next day when the captain realized that one of his rowboats was missing, he ordered a cannon fired at Honua‘ula. A few men were killed including a trader named Kealoha from Wailuku. Two men were also held captive aboard the *Eleanor*, one from Honua‘ula and one from Olowalu. In order to restore peace, Kalolapupukahonokawailani declared a *kapu mau‘umae* that restricted any canoes from approaching the ship on pain of burning to death should they not heed the *kapu*. This *kapu* lasted the length of three days. Subsequently, only descendants of Kalolapupukahonokawailani are allowed to declare such a *kapu* (Kamakau 1992:45).

Ukumehame During Historic Times

In May of 1819 Kamehameha died at Kamakahonu on Hawai‘i Island. Following the death of a prominent chief, it was customary to remove all of the regular *kapu* that maintained social order and the separation of men and women and elite and commoner. Thus, following Kamehameha’s death a period of *‘ai noa* (free eating) was observed along with the relaxation of other traditional *kapu*. It was for the new ruler and *kahuna* to re-establish *kapu* and restore social order, but at this point in history traditional customs saw a change:

> The death of Kamehameha was the first step in the ending of the tabus; the second was the modifying of the mourning ceremonies; the third, the ending of the tabu of the chief; the fourth, the ending of carrying the tabu chiefs in the arms and feeding them; the fifth, the ruling chief's decision to introduce free eating (*‘ainoa*) after the death of Kamehameha; the sixth, the cooperation of his aunts, Ka-ahu-manu and Ka-heihei-malie; the seventh, the joint action of the chiefs in eating together at the suggestion of the ruling chief, so that free eating became an established fact and the credit of establishing the custom went to the ruling chief. This custom was not so much of an innovation as might be supposed. In old days the period of mourning at the death of a ruling chief who had been greatly beloved was a time of license. The women were allowed to enter the heiau, to eat bananas, coconuts, and pork, and to climb over the sacred places. You will find record of this in the history of Ka-ula-hea-nui-o-ka-moku, in that of Ku-ali‘i, and in most of the histories of ancient rulers. Free eating followed the death of the ruling chief; after the period of mourning was over the new ruler placed the land under a new tabu following old lines. (Kamakau 1992: 222)

Immediately upon the death of Kamehameha I, Liholiho was sent away to Kawaihae to keep him safe from the impurities brought about from the death of Kamehameha. After purification ceremonies Liholiho returned to Kamakahonu:

> Then Liholiho on this first night of his arrival ate some of the tabu dog meat free only to the chiefesses; he entered the *lauhala* house free only to them; whatever he desired he reached out for; everything was supplied, even those things generally to be found only in a tabu house. The people saw the men drinking rum with the women *kahu* and smoking tobacco, and thought it was to mark the ending of the tabu of a chief. The chiefs saw with satisfaction the ending of the chief’s tabu and the freeing of the eating tabu. The *kahu* said to the chief, “Make eating free over the whole kingdom from Hawaii to Oahu and let it be extended to Kauai!” and Liholiho consented. Then pork to be eaten free was taken to the country districts and given to commoners, both men and women, and free eating was introduced all over the group. Messengers were sent to Maui, Molokai, Oahu and all the way to Kauai, Ka-umu-ali‘i consented to the free eating and it was accepted on Kauai. (Kamakau 1992: 225)

When Liholiho, Kamehameha II, ate the *kapu* dog meat, entered the *lauhala* house and did whatever he desired it was still during a time when he had not reinstituted the eating *kapu* but others appear to have thought otherwise. With an indefinite period of free-eating and the lack of the reinstatement of other *kapu* extending from Hawai‘i to Kaua‘i, and the arrival of the Christian missionaries shortly thereafter, the traditional religion had been officially replaced by Christianity within a year following the death of Kamehameha I.

The first missionaries arrived in Hawai‘i in 1823. Hiram Bingham along with his associates were sent to the Sandwich Isles by the American Board of Commissioners for Foreign Missions (ABCFM) (Bingham 1969). Upon their arrival, the missionaries quickly began to emphasize the importance of a western education and began to set up several schools, in many *ahupua‘a*. On Maui the Lahainaluna Seminary was established in 1834 and is heralded as the oldest school west of the Rockies. Many young men were admitted into Lahainaluna and trained to read, write, and record the histories of their people. The accomplished Native Hawaiian scholars, David Malo and Samuel M. Kamakau, both attended this school.

Missionary school records indicate that by 1835 there were more than eighty-six students attending school in Ukumehame. During that year a *hōʻike kula*, an academic competition, was held at the Ukumehame School pitting the students of Ukumehame against those of Olowalu. One hundred seventy-three students arrived from Olowalu to take part in the *hōʼike* (*Ke Kumu Hawaiʼi* 1835).

In 1848, the Hawaiian system of land tenure was radically altered by the *Māhele ʻĀina*. This change in land tenure was promoted by the missionaries and the growing Western population and business interests in the island kingdom. Generally these individuals were hesitant to enter business deals on leasehold land. The *Māhele* (division) defined the land interests of Kamehameha III (the King), the high-ranking chiefs, and the *konohiki*. As a result of the *Māhele*, all land in the Kingdom of Hawaiʻi came to be placed in one of three categories: (1) Crown Lands (for the occupant of the throne); (2) Government Lands; and (3) *Konohiki* Lands (Chinen 1958:vii and Chinen 1961:13).

The *Māhele ʻĀina* was in no way a new concept in 1848. Indeed a *māhele ʻāina* occurred with the succession of almost every "Great Feudal Chief" (Pae ʻĀina Productions 2006:1).

> Each principal chief divided his lands anew, and gave them out to an inferior order of chiefs, or persons of rank, by whom they were subdivided again and again; after passing through the hands of four, five or six persons from the King down to the lowest class of tenants. All of the persons were considered to have rights in the lands, or the production of them. (Pae ʻĀina Productions 2006:1).

As a result of the *Māhele*, the *ahupuaʻa* of Ukumehame was awarded to Kamehameha III in 1848 as Crown Land (*Buke Māhele* 1848:200). In 1849 (December 21,1849) the "Enabling" or "Kuleana Act" Act was passed, which laid out the framework by which native tenants could apply for, and be granted fee-simple interest in "*kuleana*" lands, and their rights to the access and collection of the resources necessary to their life upon the land in their given *ahupuaʻa*. The Act reads:

> August 6, 1850
>
> An Act confirming certain resolutions of the King and Privy Council passed on the 21st day of December 1849, granting to the common people allodial titles for their own lands and house lots, and certain other privileges.
>
> Be it enacted by the Nobles and Representatives of the People of the Hawaiian Islands in Legislative Council assembled;
>
> That the following sections which were passed by the King in Privy Council on the 21st day of December A.D. 1849 when the Legislature was not in session, be, and are hereby confirmed, and that certain other provisions be inserted, as follows:
>
> **Section 1**. Resolved. That fee simple titles, free of commutation, be and are hereby granted to all native tenants, who occupy and improve any portion of any Government land, for the land they so occupy and improve, and whose claims to said lands shall be recognized as genuine by the Land Commission; Provided, however, that the Resolution shall not extend to Konohikis or other persons having the care of Government lands or to the house lots and other lands, in which the Government have an interest, in the Districts of Honolulu, Lahaina and Hilo.
>
> **Section 2**. By and with the consent of the King and Chiefs in Privy Council assembled, it is hereby resolved, that fee simple titles free of commutation, be and are hereby granted to all native tenants who occupy and improve any lands other than those mentioned in the preceding Resolution, held by the King or any chief or Konohiki for the land they so occupy and improve. Provided however, this Resolution shall not extend to house lots or other lands situated in the Districts of Honolulu, Lahaina and Hilo.

Section 3. Resolved that the Board of Commissioners to quiet Land titles be, and is hereby empowered to award fee simple titles in accordance with the foregoing Resolutions; to define and separate the portions belonging to different individuals; and to provide for an equitable exchange of such different portions where it can be done, so that each man's land may be by itself.

Section 4. Resolved that a certain portion of the Government lands in each Island shall be set apart, and placed in the hands of special agents to be disposed of in lots of from one to fifty acres in fee simple to such natives as may not be otherwise furnished with sufficient lands at a minimum price of fifty cents per acre.

Section 5. In granting to the People, their House lots in fee simple, such as are separate and distinct from their cultivated lands, the amount of land in each of said House lots shall not exceed one quarter of an acre.

Section 6. In granting to the people their cultivated grounds, or *Kalo* lands, they shall only be entitled to what they have really cultivated, and which lie in the form of cultivated lands; and not such as the people may have cultivated in different spots, with the seeming intention of enlarging their lots; nor shall they be entitled to the waste lands.

Section 7. When the Landlords have taken allodial titles to their lands the people on each of their lands shall not be deprived of the right to take firewood, *aho* cord, thatch, or ti leaf from the land on which they live, for their own private use, should they need them, but they shall not have a right to take such articles to sell for profit. They shall also inform the Landlord or his agent, and proceed with his consent. The people shall also have a right to drinking water, and running water, and the right of way. The springs of water, and running water, and roads shall be free to all should they need them, on all lands granted in fee simple. Provided, that this shall not be applicable to wells and water courses which individuals have made for their own use.

Done and passed at the Council House, Honolulu this 6th day of August 1850. [copied from original handwritten "Enabling Act" – State Archives DLNR 2-4]

The lands awarded to the *hoaʻāina* (native tenants) became known as "*Kuleana* Lands." All of the claims and awards (the Land Commission Awards or LCAw.) were numbered, and the LCAw. numbers remain in use today to identify the original owners of lands in Hawaiʻi. For Ukumehame Ahupuaʻa, there were forty claims for *kuleana* registered with the Land Commission between 1850 and 1855; only 19 of these claims were awarded (Table 1). These claims included *loʻi* lands, *wauke* patches, house plots, and *kula* lands.

Table 1. LCAw. Claims* made in the Ukumehame Ahupua‘a.

LCAw. No.	*Claimant*	*‘Ili*	*Awarded*
8191	Hilo	Kekeenui, Uwai, Ohianui, Ohia, Punanai	yes
8795	Kulou	Puaaloa	yes
8623	Kamakakehau	Puaaloa, Kaulunui, Aweoweoluna	yes
8625	Kalama	Kahananui, Kauluiki, Puaaloa, Punahoa	no
08559*M	Kanaina, C.	Puaaloa	yes
09035A	Kalua	Puaaloa	no
09035B	Kalaipaka	Kukui	no
8867	Kapaakea, T.	Makenewa, Kaulu	no
10206	Makuaole	Uwai	yes
00285	Kamakini, J.	Uwai	yes
00309*M	Malo, David		yes
00310	Pikanele, K.	Uwai, Kaulu, Kaluaokiha°	yes
00328	Kamakini		no
00505	Moehauna		no
00522	Ladana		no
00720	Kamakini, I	Kalihi	no
02715*M	Hinau		no
2959	Hika	Nohoana, Olohe	yes
03702*M	Malo, Davida	Ohiaiki, Moomuku, Alamihi, Palailaiha	yes
05124	Kalaikini	Puaaloa	no
05380	Hulu	Kaulu, Ohianui, Uwai	yes
05387	Hinau	Ohiaiki	yes
05410	Malo, David		yes
05462	Manuwai	Aweoweoluna	no
05462B	Kamanuwai		no
05829B	Kamaua, wahine	Ohiaiki	no
05829BB	Kaauwae	Makanewa 3 & 4, Punahoa, Pinanai, Ohianui, Ohiaiki, Auweoweolalo	no
05829M	Kaleleiki	Makanewa 3 & 4	no
06187	Opunui	Kamani 1 & 3, Makanewa	no
06188	Opunui & Kamakakahiki	Kaluaaha, Makanewa	no
06189	Punia		no
06408	Kalaikini, Ioba	Makanewa	yes
06423	Konanui	Kaulu, Kahananui, Aweoweoluna	no
06480	Keawe	Uwai	yes
06483	Kamaka	Pinanai, Pakala	no
06591	Pimaiwaa	Punahoa 1, Ohia, Makanewa, Kahananui	no
6709	Popolo, wahine	Haai	yes
6727B	Pahaula	Puaaloa	yes
06751	Alai	Puaaloa	yes
07779*M	Kaleleiki	Makanewa	yes

* Source: Waihona ‘Āina.

The majority of the *kuleana* claims were located to the west of Manawaipueo Gulch in the alluvial flats of Ukumehame Valley area, where coastal resources were more readily accessible than along the coastline between Manawaipueo and Mā‘alaea. Mā‘alaea itself was another highly concentrated area of habitation. These two areas of habitation are also the two known canoe landings for the *ahupua’a* of Ukumehame. It was often from these points that fishermen and travelers would depart Ukumehame. There were no

mentions of coastal trails within the claims made for the *ahupua'a* that existed between these two areas of concentrated habitation. It is assumed that travel between these sites was either by canoe or by the upland trail systems that went from Manawaipueo Gulch to Aalaloloa ridge.

Although coastal trails once ringed much of Maui, according to Handy et al. no coastal trail was present fronting the current project area because of the rough terrain, so "from ʻOlowalu [to the west of the current project area] travelers were ferried by canoe to Maʻalaea [to the east of the current project area], thence to Makena" (1991:490). The main *mauka*/*makai* trail in the vicinity of the current project area followed Kealaloloa Ridge to the east of the current project area (Devereux et al. 1999:12). Devereux et al. (1999:12) relate that the more accessible areas of the Kealaloloa Trail were probably destroyed by a present day jeep trail. This north/south trail is also referred to as the Aalaloloa Trail (Nupepa Kuʻokoʻa 1865). It is said that Eleio first met the spirit Kanikaniaula along the ridge of hills known as Aalaloloa. Kanikaniaula is said to be the first possessor of a feather cloak here in Hawaii. This cloak eventually became the property of Kakaalanaleo, the first chief of Maui and the *pae ʻāina* to wear this feather adornment (Dictionary of Hawaiian Localities 1883). The uplands of Ukumehame no doubt served as access routes to the higher elevations of West Maui Mountains and their associated land districts (Robins et al. 1994). Kupuna Paolo Fujihiro spoke of many of these trails during an oral interview on January 21, 2009, including one on the ridge of Makenewa (unidentified ridge) that was used as an escape route during the battle between Kauhiaimokuakama and Kamehamehanui.

One trail, known as the Lahaina Pali Trail, crosses *makai* of the current project area. This Historic trail was constructed around 1841 for horse traffic between the towns of Wailuku and Lahaina, with another branch connecting to Māʻalaea (Tomonari-Tuggle and Tuggle 1991). Within Ukumehame Ahupuaʻa the trail runs from the coast at Manawaipueo Gulch, inland to an elevation of 1,600 feet, and then back down towards the coast near Māʻalaea. In Historic times the trail was known as a long and treacherous route. In 1841, Laura Fish Judd, a missionary who was making the trip between Lahaina and Wailuku, called the trail "the crookedest, the rockiest ever traveled by mortals" (Judd in Tomonari-Tuggle and Tuggle 1991:12). In 1847 Chester Lyman, a visitor to Maui, reiterates this point, writing that the trail "is one of the roughest and most difficult imaginable. It is all the way zigzag and winding, up steep, rocky and barren precipices, being in places dangerous on horseback" (Lyman in Tomonari-Tuggle and Tuggle 1991:12).

Robbers were another danger encountered on the Lahaina Pali Trail, especially on the remote section of trail in the vicinity of the current project area. Tomonari-Tuggle and Tuggle (1991) record that:

> Kaiaupe was a noted female robber who lived by the pali road of Aala-loloa [Kealaloloa], Maui. She would entice men to lay with her at the edge of the pali and then kick them over the precipice with her foot. This act was known as Ka-ai-a-Kaiaupe. (T. Kelsey, from E. Sterling's notes, Maui Historical Society in Tomonari-Tuggle and Tuggle 1991:12)
>
> About 1836, when I was a young lad at Lahaina, a native employed to bring letters from Wailuku to my father, reported that he was attacked by a robber on the mountain coast route not [far] from Maʻalaea Bay. In the struggle, he bit off one of the robber's big toes. The robber at once relaxed his hold and fled. In proof of his story, the messenger exhibited the bloody toe. (Dr. D. D. Baldwin, in Tomonari-Tuggle and Tuggle 1991:12)

By the late 1850s, portions of Ukumehame Ahupuaʻa were being leased for various enterprises. An 1865 letter from William Enos and Joseph Sylva clarified a lease for the "pali of Ukumehame", which they 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 in Tomonari-Tuggle 1998:8). It appears that they had held this lease from at least the latter part of the 1850s, as an earlier letter, sent in 1858 from E. Duvauchelle to the king's land agent on Maui, William Webster, requested the Wailuku side of Ukumehame mountain, citing that Joe Sylva had related to him that he did not wish to renew his lease on this area. Nothing apparently came of the Duvauchelle letter, however, records indicate that Sylva held the lease on the land until at least 1871. Furthermore, it is apparent from the letter that the lease was for cattle ranching. Duvauchelle writes, "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 Tomonari-Tuggle 1998:8).

During historic times, Ukumehame was known for its rich pasture lands. In 1862, P. Nahaolelua, the Governor of Maui, published a warning to all who allowed their animals to graze on these "*ʻĀina o ka Mōʻī*" (Crown Lands). The segment of land ran from the cliffs of Manowainui to Waikapu. This same warning was published under the generic title "*ʻŌlelo Hoʻolaha*" from April 1862 until January 1863 in the Hawaiian language newspaper *Nūpepa Kūʻokoʻa*.

Difficulties with livestock grazing and property boundaries persisted into the next decade as articles were published warning the public to keep their animals out of pasture lands of Ukumehame. Such was the case with Kapika Kaʻupe and Kapika Kahoʻonaninani of Ukumehame; on May 4, 1879 they proclaimed a fee of $1.00 per head for any grazing animal found on a 16 acre parcel of land that they managed, and $0.50 was collected for every turkey and chicken as well (*Nūpepa Kūʻokoʻa* 1979). ʻŌpūlua as a representative of C. Kanaina, continued to publish warnings to those who chose to let their livestock roam freely upon the lands of Puaʻaloa in Ukumehame into the 1870s (*Nūpepa Kūʻokoʻa* 1876).

In 1886, the western half of Ukumehame Ahupuaʻa is listed as being leased to Olowalu Plantation Company, for sugarcane cultivation and sugar production, and the eastern half (including the current project area) is listed as leased to John Richardson and Kahahawai for cattle ranching (Tomonari-Tuggle 1998:8). The 1884 McKenney's Hawaiian Directory reveals that John Richardson was the proprietor of the Maalaea Bay Stock Ranch, with approximately 15,000 acres of pasture and mountain land, 200 head of cattle, and 100 head of horses (Bagot 1884 in Tomonari-Tuggle 1998:8). In a side note, Tomonari-Tuggle (1998:8) relates that the Maalaea Stock Ranch was listed in subsequent directories until at least 1900.

By 1889, a new carriage road was under construction from Māʻalaea to Lahaina, along the coast of Ukumehame Ahupuaʻa. With the opening of this new road, use of the mountainous Lahaina Pali Trail dwindled, and the trail eventually fell into disuse. The new road was gradually widened and straightened to accommodate vehicular use, and then oiled and paved in 1918 (Fleming 1933:22 in Tomonari-Tuggle and Tuggle 1991:13). The road was eventually abandoned in favor of the current alignment of Honoapiliʻilani Highway.

Cattle ranching continued in the vicinity of the current project area until the mid-1990s, while portions of the wetter, western half of Ukumehame Ahupuaʻa continue to be used for sugarcane cultivation. At some point in the mid-1940s the McGregor Point jeep road was bulldozed to the project area, allowing vehicular access to the *mauka* areas, and perhaps obliterating an older road or trail. The road has been subsequently maintained by ranchers, MECO, and DLNR, with newer bulldozer routes approximating the older ones. The current project area land was leased to Perreira Ranch for cattle grazing, but their lease was terminated in the mid 1990s (Tomonari-Tuggle 1998). Shortly thereafter, a lease was granted to First Wind (formerly known as UPC Wind Partners LLC) and Makani Nui Associates, LLC for the development of the Kaheawa Wind Farm (KWP I).

SUMMARY OF ORAL-HISTORY INTERVIEWS

On January 21, 2009 Kupuna Paolo Kamakehau Fujihiro, a *kupaʻāina* and lineal descendant of Ukumehame, accompanied Kumu Hōkūlani Holt, a *kupaʻāina* and *kama a Maui* lineal descendant; Noe Kalipi with First Wind; and Kanoelehua Wilson Ah Sam with Rechtman Consulting, LLC on a tour of the Kaheawa Wind Power project area. Kupuna Paolo walked the area regularly in his youth up until the 1950s. He still currently resides on the ridge of Ukumehame Valley. Kupuna Paola and Kumu Hōkūlani both agreed to have their oral accounts recorded.

While there, Kupuna Paola named ridge lines and valleys that were in the project area of Kaheawa. Starting with Manawainui, the gully to the Kīhei side of the property, Kupuna Paolo continued with a description of Honuaʻula (the ridge that the Kaheawa Wind Farm is constructed on). He described the next gulch over going toward Lahaina as Manawaipueonui followed by Papalua. A few more ridges down is Makanewa before arriving at Ukumehame Valley.

According to Kupuna Paolo, Honuaʻula is the only ridge of red dirt of its type along the Māʻalaea to Lahaina coastline. Because of its unique color, Honuaʻula served as a large *koʻa* or beacon to those who were sailing toward Ukumehame. For this reason Hikiʻi Heiau, a navigational *heiau*, was said to have been built (Hikiʻi is said to be located at about the 200 foot elevation on Honuaʻula ridge, well below the study area). The canoes would line up with Honuaʻula taking its mark from Hikiʻi Heiau and sail towards Kahoʻolawe staying to the south of the island. When they returned, they would align themselves with another navigational *heiau* named Āweoweonui which is located a few ridges over towards Lahaina, always returning from the north side of Kahoʻolawe.

Manawaipueonui Gulch borders the Kaheawa Wind Power project area to the southwest. Kupuna Paolo informed us of the significance of this *wahi pana* and its name. Manawaipueonui was a place where *pueo* (Hawaiian owls) would congregate before making their yearly migration to Kahoʻolawe, where they would feast on the mice that would come up during the dry summer months. Those *pueo* who were too old for the journey would then stay behind at Manawaipueaonui or Manawaipueoliʻiliʻi. He is unsure if this natural cycle still occurs.

There was much concern expressed by both Kupuna Paolo and Kumu Hōkūlani about the impact on the different *wao* of Ukumehame. Kumu Hōkūlani explained that the *wao akua*, a sacred place that should be respected as *kapu* to the gods and elements of Hawaiʻi, is usually defined by the naturally occurring cloud line at certain elevations. Kaheawa Wind Farm she pointed out was just bordering this *wao akua* for the Ukumehame area, and suggested that any further development upslope would be an insult to the *akua* and *kanaka* of Hawaiʻi.

Kupuna Paolo further confirmed her *manaʻo* by explaining how his *ʻohana* referred to these *wao* by the *ʻiliahi* trees that used to grow at different elevations along its slope. There is a certain variety that used to grow around the 3000 feet elevation. He has only seen a few of these trees in his life, and only one in the *ahupuaʻa* of Ukumehame. Kupuna Paolo also made mention of an *ʻuaʻu* (*Pterodroma phaeopygia sandwichensis*) colony that was located near the Kaheawa Wind Power project area. This colony, which is located several miles from the proposed KWP II *mauka* alternative project site in the West Maui Mountains, has been noted by the project biologists.

Both Kupuna Paolo and Kumu Hōkūlani were in agreement that alternative wind energy was a great benefit to all, but they both expressed the desire to see more commitment and benefits offered to the community in addition to the educational programs that already occur on site.

Another informal interview was conducted by phone with Kupuna Walter Kanamu. He is a published Hawaiian poet and songwriter, and a practitioner currently residing in Waiheʻe. He is a descendant of the Uaua family and of Kauauaamahi. His *ʻohana* historically comes from the coastline of Ukumehame to the uplands of Kanaio. During our interview on the night of January 25, 2009, Kupuna Kanamu remarked on the migrations of the *nēnē* that he believed may have originated in the Ukumehame area. From there they would fly over the mountains to the Wailuku and Waiheʻe areas, even traveling as far as Kanaio. He remarked that since the construction of the wind farm, he has noticed a decline in the numbers of *nēnē* in these areas. For an alternative explanation, based on scientific data, of the occurrence and distribution for historic and modern *nēnē* populations in the area, see the KWP II Draft EIS, Section 3.7.2.2.

Follow-up interviews were conducted with each of the participants to discuss the proposed *makai* alternative location for the establishment of KWP II. These interviews were conducted by telephone between September 17 and October 16, 2009, and in the case of Kupuna Paolo Kamakehau Fujihiro the interview was done in person. In general, the interviewees expressed a preference for the proposed *makai* alternative for the KWP II project, citing that is was further from the culturally important *kulamanu* and the *wao akua*. Kupuna Paolo Kamakehau Fujihiro also expressed his belief that the wind is better on the lower slopes.

IDENTIFICATION AND MITIGATION OF POTENTIAL CULTURAL IMPACTS

The OEQC guidelines identify several possible types of cultural practices and beliefs that are subject to assessment. These include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs. The guidelines also identify the types of potential cultural resources, associated with cultural practices and beliefs that are subject to assessment. Essentially these are natural features of the landscape and historic sites, including traditional cultural properties. In the Hawai‘i Revised Statutes–Chapter 6E a definition of traditional cultural property is provided.

> "Traditional cultural property" means any historic property associated with the traditional practices and beliefs of an ethnic community or members of that community for more than fifty years. These traditions shall be founded in an ethnic community's history and contribute to maintaining the ethnic community's cultural identity. Traditional associations are those demonstrating a continuity of practice or belief until present or those documented in historical source materials, or both.

The origin of the concept of traditional cultural property is found in National Register Bulletin 38 published by the U.S. Department of Interior-National Park Service. "Traditional" as it is used, implies a time depth of at least 50 years, and a generalized mode of transmission of information from one generation to the next, either orally or by act. "Cultural" refers to the beliefs, practices, lifeways, and social institutions of a given community. The use of the term "Property" defines this category of resource as an identifiable place. Traditional cultural properties are not intangible, they must have some kind of boundary; and are subject to the same kind of evaluation as any other historic resource, with one very important exception. By definition, the significance of traditional cultural properties should be determined by the community that values them.

It is however with the definition of "Property" wherein there lies an inherent contradiction, and corresponding difficulty in the process of identification and evaluation of potential Hawaiian traditional cultural properties, because it is precisely the concept of boundaries that runs counter to the traditional Hawaiian belief system. The sacredness of a particular landscape feature is often times cosmologically tied to the rest of the landscape as well as to other features on it. To limit a property to a specifically defined area may actually partition it from what makes it significant in the first place. However offensive the concept of boundaries may be, it is nonetheless the regulatory benchmark for defining and assessing traditional cultural properties. As the OEQC guidelines do not contain criteria for assessing the significance for traditional cultural properties, this study will adopt the state criteria for evaluating the significance of historic properties, of which traditional cultural properties are a subset. To be significant the potential historic property or traditional cultural property must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

A Be associated with events that have made an important contribution to the broad patterns of our history;

B Be associated with the lives of persons important in our past;

C Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;

D Have yielded, or is likely to yield, information important for research on prehistory or history;

E Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

While it is the practice of the DLNR-SHPD to consider most historic properties significant under Criterion D at a minimum, it is clear that traditional cultural properties by definition would also be significant under Criterion E. A further analytical framework for addressing the preservation and protection of customary and traditional native practices specific to Hawaiian communities resulted from the *Ka Paʻakai O Kaʻāina* v Land Use Commission court case. The court decision established a three-part process relative to evaluating such potential impacts: first, to identify whether any valued cultural, historical, or natural resources are present; and identify the extent to which any traditional and customary native Hawaiian rights are exercised; second, to identify the extent to which those resources and rights will be affected or impaired; and third, specify any mitigative actions to be taken to reasonably protect native Hawaiian rights if they are found to exist.

As a result of archaeological studies that were conducted for the two proposed alternative KWP II project areas, three sites was identified that had the potential to be impacted by the proposed development. SIHP Site 5232 is an upland *heiau* located in the east-central portion of the proposed *mauka* alternative KWP II area along the western edge of the existing wind farm. It is suggested by both the archaeological studies and the oral-historical inference that this *heiau* was linked to navigational activities, perhaps associated with travel between Maui and Kahoʻolawe. Site 5232 is considered significant under Criterion D because of its important research potential and under Criterion E because of its important traditional cultural value. This site was recommended for preservation (Athens 2002; Clark and Rechtman 2006), and a site preservation plan has already been prepared, approved, and partially implemented (Tomonari-Tuggle and Rasmussen 2005). As recommended in that plan, an archaeological monitor will be present during any future development activities that would occur within 500 feet of the *heiau*. The Lahaina Pali Trail traverses the proposed *makai* alternative KWP II area and is considered significant under Criterion D for the information yielded relative to middle and late nineteenth century transportation patterns and evolving modes of transportation. This historic site falls under the jurisdiction of the DLNR-*Na Ala Hele* Program and a management plan has already bee prepared and partially implemented for this site. The trail has already been breached by the KWP I access road and the proposed KWP II project will not create any further direct impact to this site, although the location of the towers in the *makai* alternative may present an indirect visual impact. SIHP Site 5648 is a complex of thirty features indicative of temporary habitation and may represent recurrent use shelters associated with former trail routes. The use of these features likely dates from both Precontact and Historic times. The most intensive habitation may have occurred between 1841 and 1891 when the Lahaina Pali Trail and its Māʻalaea branch were still in use. This site is within the proposed *makai* alternative KWP II area and is considered significant under Criterion D for both the information it has yielded and the potential information it is likely to yield if future work were to be conducted. The locations of the proposed wind generating towers and the associated infrastructure in the *makai* alternative are being designed to avoid all of the features of this site. While it is possible that data recovery might enhance our knowledge relative to the age and specific function of the various features of Site 5648, such mitigation work is not necessary given the current proposed project layout within the *makai* alternative. Therefore, if the *makai* alternative is selected, a preservation plan for this site will be prepared and submitted to DLNR-SHPD for review and approval. If in the future, it is necessary to impact one or more of the site's features, DLNR-SHPD should be contacted to address possible mitigation of impacts through data recovery.

Archival research and oral-historical information indicate that there are two potential traditional cultural properties associated with the current project area. The exposed red dirt Honuaʻula Ridge is considered to have function as a visual marker, or *koʻa*, associated with local navigational practices. While the placement of wind towers does not go unnoticed, the actual effects the towers have on obscuring this natural navigation aid can be considered negligible in that the ability to use this landscape feature is not diminished by their presence.

The second potential traditional cultural property is more general in nature and includes the greater project area and beyond, identifying it as a *kulamanu*, a place where birds (namely *nēnē*, *pueo*, and *ʻuaʻu*) have historically gathered (and continue to gather) before mass movements to other part of Maui and to

Kahoʻolawe. The results of multi-year studies in the area suggest that such mass movements no longer occur, but that it remains an important area for *nēnē*. The US Fish and Wildlife Service has recognized this area as a significant bird habitat resource and have directed KWP II LLC to abide by a habitat conservation plan in an effort to protect and perpetuate indigenous and endangered avian species.

In general, the interviewees expressed a preference for the proposed *makai* alternative for the KWP II project, citing that is was further from the culturally important *kulamanu* and the *wao akua*. Kupuna Paolo Kamakehau Fujihiro also expressed his belief that the wind is better on the lower slopes.

Finally, we make three recommendations with respect to maintaining an on-going commitment to the preservation and enhancement of cultural properties and practices. One, that the wind farm does not expand in a *mauka* direction above the upper limits of the existing towers into what is culturally considered *wao akua*, or divine space. Two, that KWP II LLC continues and expands upon their existing education outreach programs, particularly in areas related to *malama ʻāina* (land and resource management), *hoʻokele waʻa* (navigation and voyaging), and *papahulilani* (Hawaiian study of atmosphere). And three, that KWP II LLC work with cultural practitioners and genealogical descendants of the area to establish a Kupa ʻĀina Council as an advisory group for the project area to help with educational and resource conservation planning as well as community outreach.

REFERENCES CITED

Ashdown, I.
n.d. Along Hoapili‘s Trail (part 2). Typescript in Maui Historical Society.

Athens, J. Stephen
2002 An Upland Heiau Site, Ukumehame Ahupua‘a, Maui. International Archaeological Research Institute, Inc., Honolulu. Prepared for GE Wind Energy, LLC, Tehachapi California.

2004 Supplemental Archaeological Survey of Turbine Pad Alignments, Kaheawa pastures, Upland Ukumehame Ahupua‘a. International Archaeological Research Institute, Inc. Honolulu, Prepared for Kaheawa Wind Power, LLC.

Bingham, H.
1969 *A Residence of Twenty-One Years in the Sandwich Islands*. Praeger Publishers, New York, Washington & London (Reprint of 1855 edition).

Cachola-Abad, K.
1992 A Critical Evaluation of the Orthodox Dual Settlement Model for the Hawaiian Islands. Ph.D. thesis. University of Hawai‘i Manoa.

Clark, J.
2002 *Hawaiian Place Names: Shores, Beaches, and Surf Sites*. University of Hawai‘i Press: Honolulu.

Clark, M., and R. Rechtman
2005 An Archaeological Inventory Survey of the Proposed Kaheawa Wind Farm Project Area. Rechtman Consulting, LLC Report RC-0328. Prepared for Kaheawa Wind Power, LLC.

2006 An Archaeological Inventory Survey of 333 Acres for the Proposed Expansion of the Kaheawa Wind Farm (TMK:2-4-8-01: por. 001). Rechtman Consulting, LLC Report RC-0438. Prepared for Kaheawa Wind Power, LLC.

Cordy, R.
2000 *Exalted Sits the Chief: The Ancient History of Hawai‘i Island*. Mutual Publishing, Honolulu.

Devereaux, T., I Masterson, M. Heidel, V. Creed, L. Pyle and H. Hammatt
1999 Archaeological Inventory Survey and Subsurface Testing of 440 Acre Parcel. Ahupua‘a of Ukumehame, District of Lahaina, Island of Maui (TMK 4-8-02:09). Cultural Surveys Hawai‘i. Prepared for Sugar Way Ltd.

Fleming, M.
1933 *Old Trails of Maui*. William and Mary Alexander Chapter, Daughters of the American Revolution.

Foote, D., E. L. Hill, S. Nakamura and F. Stephens
1972 *Soil of Survey of the Islands of Kaua‘i, O‘ahu, Maui, Moloka‘i and Lana‘i, State of Hawai‘i*, U.S. Department of Agriculture, U.S. Government Printing Office, Washington D.C.

Fornander, A.
1919 *Fornander Collection of Hawaiian Antiquities and Folk-Lore*. Memoirs of the Bernice Pauahi Bishop Museum. Volume VI.

Giambelluca, T., M. Nullet, and T. Schroeder
1986 *Rainfall Atlas of Hawai‘i. Report R76*. Water Resources Research Center, University of Hawai‘i at Manoa, with the operation of the Department of Meteorology, University of Hawai‘i at Manoa. State of Hawai‘i, Department of Land and Natural Resources, Division of Water and Land Development.

Hammatt, H., I. Masterson, and T. Devereux
1996 Archaeological Survey of Access Roads Adjacent to the Mā‘alaea-Lahaina Third 69KV Transmission Line Corridor. Cultural Surveys Hawai‘i. Prepared for Dames and Moore and Maui Electric Co.

Handy, E.S., E.G. Handy and M. Pukui
1991 *Native Planters in Old Hawai‘i: Their Life, Lore, and Environment*. Bishop Museum Press, Honolulu.

Kalei, S.
1894a *Ka Maka‘āinana*. Book 1, Number 5, January 29.

1894b *Ka Maka‘āinana*. Book 1, Number 8. February 19.

Kamakau, S.
1870 *Ka Mo‘olelo Hawai‘i. Ke Au ‘Oko‘a*. Book 6, Number 34.

1866 *Ka Mo‘olelo O Kamehameha I. Ka Nūpepa Kū‘oko‘a.* Book 5, Number 44. November 3.

1938 *No Ka Hālāwai Ho‘omau Ma Waipi‘o. Ke Kumu Hawai‘i*. Book 4, Number 2. June 20.

1991 *Nā Mo‘olelo o ka Po‘e Kahiko*. Bishop Museum Press, Honolulu.

1992 *Ruling Chiefs of Hawai‘i*. Kamehameha Schools Press: Honolulu.

Kame‘eleihiwa, L.
1992 *Native Land and Foreign Desires, Pehea Lā E Pono Ai?* Bishop Musuem Press, Honolulu.

Kamehameha R. (Kamehameha VI)
1865 *Kānāwai Hou: Bila Ha‘awina No 1864 a me 1865*. *Nūpepa Kū‘oko‘a*. Book 4, Number 6. February 9.

Kamehameha VI
1865 *Kānāwai Hou*. *Nūpepa Kū‘oko‘a*. Book 4, Number 16. April 20.

Kaupe, Kapika & K. Kaho‘onaninani
1879 Nūpepa Kū‘oko‘a. Book 18, Number 20. May 17.

Kawelo, J.B.
1861 *Ka Hōkū o ka Pakipika*. Book 1, Number 2. October 3.

Keali‘i‘umi‘umi
1834 *Lama Hawai‘i*. Book 1. Number 25. December 26.

Kirch, P.
1985 *Feathered Gods and Fishhooks: An Introduction to Hawaiian Archaeology and Prehistory*. University of Hawai‘i Press, Honolulu.

1989 Prehistoric Hawaiian Occupation in the Anahulu Valley, O‘ahu Island: Excavations in Three Inland Rockshelters, Archeological Research Facility, Department of Anthropology, University of California at Berkeley.

Maly, K., and O. Maly
2003 Ka Hana Lawaiʻa ʻAna A Me Nā Koʻa O Nā Kai ʻEwalu. Volume II. Prepared for The Nature Conservancy.

Lahaba, A.
1861 Ka Hōkū O Ka Pakipika: Book 1, Number 2. October 3.

Macdonald, G., T. Agatin and F. Peterson
1983 *Volcanoes in the Sea. The Geology of Hawaiʻi*, Second Edition, UH Press, Honolulu.

Magnuson, C.
2003 Supplemental Archaeological Survey of Turbine Pad Alignments, Kaheawa pastures, Upland Ukumehame Ahupuaʻa. International Archaeological Research Institute, Inc. Prepared for Kaheawa Wind Power, LLC.

Malo, D.
1827 He Buke No Ka ʻOihana Kula, Davida Malo Ke Kahukula. Bishop Museum Archives.

2006 *Ka Moʻolelo Hawaiʻi*. First People's Productions, Honolulu.

Manu, M.
1884a *Ka Moʻolelo O Kihapiʻilani*. Ka Nūpepa Kūʻokoʻa, February 9.

1884b *Ka Moʻolelo O Kihapiʻilani*. Ka Nūpepa Kūʻokoʻa. July 12.

McGerty, L., A. Dunn and R. Spear
1998 Data Recovery Excavations at Portions of Sites 50-09-4138 and 4139. Ukumehame Ahupuaʻa, Wailuku District, Island of Maui, Hawaiʻi (TMK: 3-6-01-14). Prepared for Māʻalaea Triangle Partnership, Wailuku.

Moore, J. and J. Kennedy
1995 An Archaeological Survey Report for the Proposed Māʻalaea Water Tank Located at TMK:3-6-01:14 in Ukumehame Ahupuaʻa, Wailuku District, Island of Maui. Archaeological Consultants of the Pacific, Inc. Haleiwa, Hawaiʻi.

Nāhaolelua, P.
1862 Nūpepa Kūʻokoʻa. Book 1, Number 19. April 5.

Nakuʻina, M.
2005 *Moʻolelo Hawaiʻi O Pakaʻa a me Kuapakaʻa*, Kalamakū Press, Honolulu.

ʻŌpūlua
1876 *Nūpepa Kūʻokoʻa*. Book 15. Number 45.

Pae ʻĀina Productions
2006 *Mahele*: An Unedited Historical Reprint. Pae ʻĀina Productions, Honolulu.

Parke, W.
1978 *Kūʻai a ka Lunahoʻoponopono Waiwai ma ka Waiwai Paʻa*. *Nūpepa Kūʻokoʻa*. Book 17, Number 46. November 16.

Poepoe, J.
1905 *Kamehameha I, Ka Naʻi Aupuni O Hawaiʻi, Ka Liona O Ka Pakipika*. *Ka Naʻi Aupuni*. Book 1, Number 12, December 9.

Rasmussen, C.
2005a Supplemental Archaeological Reconnaissance Survey of the Southern Portion of the New Low Impact Road for the Wind Turbine Project at Kaheawa Pastures, Upland Ukumehame Ahupuaʻa, Maui (TMK 3-6-01:14). International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power LLC.

2005b Supplemental Archaeological Reconnaissance Survey within the SMA Zone for the Wind Turbine Project at Ukumehame Ahupuaʻa, Maui (TMK 3-6-01:14). Draft. International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power LLC.

2005c Field Inspection Letter for the SMA Portion of the New Impact Road for the Wind Turbine Project at Kaheawa Pastures, Ukumehame Ahuapuaʻa, Maui. Letter report. International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power LLC.

Rechtman, R., J. Dudoit, and A. Dircks Ah Sam
2009 An Archaeological Inventory Survey for the Kaheawa Wind Power (KWP) Phase 2 Project Area. Rechtman Consulting, LLC Report RC-0438B. Prepared for First Wind Energy, LLC.

Robins, J., W. Fold and H. Hammatt
1994 An Archaeological Inventory Survey of an Approximately 14.7 Mile Proposed Transmission Line, from Māʻalaea to Lahaina, Maui, Hawaiʻi, Cultural Surveys Hawaiʻi, Kailua, HI. Original 1991, Revised 1994.

Sterling, E.
1998 *Sites of Maui*. Bishop Museum Press, Honolulu.

Thrum, T.
1918 "*More Maui Heiau Sites*" Hawaiian Annual, Honolulu.

Tomonari-Tuggle, M.
1995 A Cultural Resource Management Plan for the Lahaina Pali Trail. International Archaeological Research Institute, Inc. Honolulu. Prepared for the Department of Land and Natural Resources, State of Hawaiʻi.

Tomonari-Tuggle, M., and H. Tuggle
1991 Archaeological Survey of Two Demonstration Trails of the Hawaiʻi Statewide Trail and Access System, Lahaina Pali Trail, Island of Maui / Kaiolohia Kahue Trail, Island of Lanaʻi, International Archaeological Research Institute, Inc., Honolulu.

Tomonari-Tuggle, M., & C. Rasmussen
2005 Preservation Plan for Site 50-50-09-5232, An Upland Heiau In Ukumehame Ahupuaʻa, Island of Maui. International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power LLC.

Uaua, W.
1871 *Ka Moʻolelo Kaʻao O Ka Hoʻouka Kaua O Nā Pueo A Luku ʻIa Nā Kānaka A Me Nā Aliʻi O Maui*. *Ke Au ʻOkoʻa*. Book 7, Number 11, June 29.

Walker, W.
1931 *Archaeology of Maui*. Manuscript, Bernice Pauahi Bishop Museum. Honolulu.

Wilcox, C. and S. Edmunds
1990 Hawaiʻi Stream Assessment: Hawaiʻi's Streams and their Instream and Riparian Resources: A Conservation Point of View. DRAFT. Honolulu.

APPENDIX F. EISPN COMMENTS AND RESPONSES

POLICE DEPARTMENT
COUNTY OF MAUI

CHARMAINE TAVARES
MAYOR

55 MAHALANI STREET
WAILUKU, HAWAII 96793
(808) 244-6400
FAX (808) 244-6411

THOMAS M. PHILLIPS
CHIEF OF POLICE

GARY A. YABUTA
DEPUTY CHIEF OF POLICE

OUR REFERENCE
YOUR REFERENCE

February 21, 2008

Mr. Perry J. White
Planning Solutions
Ward Plaza, Suite 330
210 Ward Avenue
Honolulu, HI 96814-4012

Dear Mr. White:

SUBJECT: Kaheawa Wind Power II: EA/EISPN

Thank you for your letter of February 12, 2008 requesting comments on the above subject.

We have reviewed the Environmental Assessment/Environmental Impact Statement Preparation Notice (EA/EISPN) and have enclosed our comments and recommendations. Thank you for giving us the opportunity to comment on the proposed project.

Very truly yours,

Assistant Chief Wayne T. Ribao
for: Thomas M. Phillips
Chief of Police

Enclosure

c: Jeffrey Hunt, Maui County Planning Department

COPY

TO : THOMAS PHILLIPS, CHIEF OF POLICE, COUNTY OF MAUI

VIA : CHANNELS

FROM : BRAD HICKLE, POLICE OFFICER III, DISTRICT VI KIHEI

SUBJECT : KAHEAWA WIND POWER PROJECT II: ENVIRONMENTAL ASSESSMENT/ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE (EA/EISPN) @ TMK (2) 4-8-001:001 AND (2) 3-6-001:014

concur:
AC Wayne Ribao
02/21/08

APPLICANT INFORMATION:

Kaheawa Wind Power II, LLC (KWP II, LLC) is submitting this Environmental Assessment/Environmental Impact Statement Preparation Notice (EA/EISPN) in order to obtain land use approvals from the State Department of Land and Natural Resources for an approximate 300- 400 acre portion of land located at TMK (2) 4-8-001:0001 and (2) 3-6-001:014 which is the Kaheawa Pastures above Maalaea, Maui, Hawaii.

IMPACT ON POLICE:

During the construction phase of Project I, uniform Off-duty Police Officers were utilized to assist with traffic control when transporting equipment and the wind towers from the harbor and to the job site in Maalaea. This union seemed to work well by minimizing potential traffic hazards to the general public. With this in mind I don't anticipate any additional impact on Police services created by the Phase II Project.

RECOMMENDATIONS:

Recommend Kaheawa Wind Power LLC continue to utilize trained traffic control personnel when transporting equipment and other supplies to the phase II job site to minimize traffic impact to the public.

Further recommend this information be returned to Mr. Perry J. White of Planning Solutions with our comments and recommendations. Thank you for the opportunity to submit our comments on this project.

Respectfully Submitted,

Officer Brad Hickle, E-9966
02/20/08 08:20 hours

Noted:
Capt 02/20/08

PLANNING SOLUTIONS

February 28, 2008

Mr. Thomas M. Phillips, Chief of Police
Police Department
County of Maui
55 Mahalani Street
Wailuku, Hawai'i 96793

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Chief Phillips:

Thank you for your February 21, 2008 letter concerning Kaheawa Wind Power II LLC's (KWP II LLC's) proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and providing written recommendations for minimizing impacts to traffic and police services. Our response to your comments is provided below. To simplify your examination, we have reproduced the text of your comments and recommendations in *italics* before our response.

Comments:

IMPACT ON POLICE:

During the construction phase of Project I, uniform Off-duty Police Officers were utilized to assist with traffic control when transporting equipment and the wind towers from the harbor and to the job site in Maalaea. This union seemed to work well by minimizing potential traffic hazards to the general public. With this in mind I don't anticipate any additional impact on Police services created by the Phase II Project.

RECOMMENDATIONS:

Recommend Kaheawa Wind Power LLC continue to utilize trained traffic control personnel when transporting equipment and other supplies to the phase II job site to minimize traffic impact to the public.

Response: Thank you for noting that the KWP I project successfully minimized traffic hazards with the assistance of uniformed off-duty police officers and providing a specific recommendation that the same methods be used for Kaheawa Wind Power II. KWP II LLC has informed us that it plans to implement these same traffic control measures for the proposed project.

Thank you again for your comments. If you have any further questions, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

LINDA LINGLE
GOVERNOR

RUSS K. SAITO
COMPTROLLER

BARBARA A. ANNIS
DEPUTY COMPTROLLER

(P)1057.8

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810

FEB 26 2008

Mr. Perry J. White
Planning Solutions, Inc.
Ward Plaza, Suite 330
210 Ward Avenue
Honolulu, Hawaii 96814-4012

Dear Mr. White:

Subject: Kaheawa Wind Power II: Environmental Assessment/Environmental Impact Statement Preparation Notice (EA/EISPN)

Thank you for the opportunity to review the Environmental Impact Statement Preparation Notice for the Kaheawa Wind Power II, Wind Energy Generation Facility project at Ukumehame, Maui, Hawaii. The project does not impact any of the Department of Accounting and General Services' projects or existing facilities, and we have no comments to offer.

If you have any questions, please have your staff call Mr. Clarence Kubo of the Planning Branch at 586-0488.

Sincerely,

ERNEST Y. W. LAU
Public Works Administrator

CKK:vca

PLANNING SOLUTIONS

February 28, 2008

Mr. Ernest Y.W. Lau, Public Works Administrator
Department of Accounting and General Services
State of Hawai'i
P.O. Box 119
Honolulu, Hawai'i 96810

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Lau:

Thank you for your February 26, 2008 letter [your reference (P)1057.8] concerning Kaheawa Wind Power II LLC's proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and preparing your letter.

We appreciate your confirmation that the project will not impact any of your Department's projects or existing facilities and understand that your Department has no further comments to offer at this time.

If you have any questions in the future concerning this project, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

CHARMAINE TAVARES
Mayor

TAMARA HORCAJO
Director

ZACHARY Z. HELM
Deputy Director

(808) 270-7230
Fax (808) 270-7934

DEPARTMENT OF PARKS & RECREATION

700 Hali'a Nakoa Street, Unit 2 , Wailuku, Hawaii 96793

February 22, 2008

Planning Solutions
Attention: Perry J. White
219 Ward Avenue Suite 330
Honolulu, Hawaii 96814 - 4012

Dear Mr. Perry J. White

Subject: Kaheawa Wind power II Environmental Assessment / Environmental Impact Statement Preparation Notice (EA / EISPN)

We have reviewed the Kaheawa Wind power II Environmental Assessment / Environmental Impact Statement Preparation Notice (EA / EISPN) , and we have no comments or objections to the subject project.

Thank you for the opportunity to comment. Please contact me or Patrick Matsui, Chief of Planning and Development, at 270-7387 if there are any questions.

Sincerely,

TAMARA HORCAJO
Director, Parks & Recreation

xc: Patrick Matsui, Chief of Planning & Development

TH:PM:tk

PLANNING SOLUTIONS

March 4, 2008

Ms. Tamara Horcajo, Director
Department of Parks and Recreation
700 Hali'a Nakoa Street, Unit 2
Wailuku, Hawai'i 96793

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Ms. Horcajo:

Thank you for your February 22, 2008 letter concerning Kaheawa Wind Power II LLC's proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and preparing your letter.

We understand that your Department has no comments to offer on the project at this time. If you have any questions in the future, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

LINDA LINGLE
GOVERNOR

MAJOR GENERAL ROBERT G. F. LEE
DIRECTOR OF CIVIL DEFENSE

EDWARD T. TEIXEIRA
VICE DIRECTOR OF CIVIL DEFENSE

PHONE (808) 733-4300
FAX (808) 733-4287

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE DIRECTOR OF CIVIL DEFENSE
3949 DIAMOND HEAD ROAD
HONOLULU, HAWAII 96816-4495

March 4, 2008

Mr. Perry White
Planning Solutions, Inc.
210 Ward Ave., Suite 330
Honolulu, Hawaii 96814

Dear Mr. White:

Environmental Impact Statement Preparation Notice
Wind Energy Generation Facility, Ukumehame, Maui, Hawaii

Thank you for the opportunity to comment on this project. After careful review of the documents in the Environmental Impact Statement, we recommend a study of wind amplification in the West Maui Mountains which could impact the project area. Tropical cyclone systems, from tropical depressions to full hurricanes, are possible on any of the Hawaiian Islands. A study may show the potential effects of these weather hazards on the current wind farm, along with the proposed additional wind generating turbines. Beyond that, we have no further comments to make at this time.

If you have any questions, please call Mr. Richard Stercho, State Civil Defense Mitigation Planner, at (808) 733-4300, ext. 583.

Sincerely,

EDWARD T. TEIXEIRA,
Vice Director of Civil Defense

c: Kaheawa Wind Power II, LLC
Office of Conservation and Coastal Lands, DLNR
Department of Emergency Management (City and County of Honolulu)
State Civil Defense Radio Shop

PLANNING SOLUTIONS

May 19, 2008

Mr. Edward T. Teixeira, Vice Director of Civil Defense
Office of the Director of Civil Defense
Department of Defense
State of Hawai'i
3949 Diamond Head Road
Honolulu, Hawai'i 96816-4495

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Teixeira:

Thank you for your March 4, 2008 letter concerning Kaheawa Wind Power II LLC's (KWP II's) proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and providing written comments. To simplify your examination, we have reproduced the text of your comment in *italics* below, followed by our response.

Comment 1:

> *Thank you for the opportunity to comment on this project. After careful review of the documents in the Environmental Impact Statement, we recommend a study of wind amplification in the West Maui Mountains which could impact the project area. Tropical cyclone systems, from tropical depressions to full hurricanes, are possible on any of the Hawaiian Islands. A study may show the potential effects of these weather hazards on the current wind farm, along with the proposed additional wind generating turbines. Beyond that, we have no further comments to make at this time.*

Response: The GE 1.5 MW wind turbine generators (WTGs) proposed for the KWP II project are designed to operate (i.e., generate power) in wind speeds between about 9 and 55 mph. At winds above that velocity the WTGs automatically cut out and the blades feather to an inactive position (i.e., perpendicular to the wind), which allows them to withstand hurricane-force winds. KWP II engineers' analysis of the available wind data indicates that winds in excess of the design speed are extremely rare. Hence, KWP II believes it is very unlikely that the equipment will be overstressed to the point of breakage during the 30-year project life span. The results of KWP II's failure analysis of the equipment will be included in the *Draft EIS.*

Thank you again for your comments. If you have any questions or would like to discuss this further, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

MAUI TOMORROW FOUNDATION, INC.

Protecting Maui's Future

March 8, 2008

Perry J. White
Planning Solutions
Ward Plaza, Suite 330
210 Ward Avenue
Honolulu, Hawaii 96914-4012

Subject: Comments on Kaheawa Wind Power II: Environmental Assessment/Environmental Impact Statement

In reviewing the above-referenced materials Maui Tomorrow Foundation, Inc. strongly agrees that additional 1.5 MW wind turbine generators ("WTG's) are needed and that they should be sited near the existing farm to leverage infrastructure while minimizing visual impact. We believe that two distant farms are more visually jarring than a single, larger one. Further, from the wind data presented in Figures 3.3 and 3.4 of this document, there is doubt of the viability of the competing Shell/Ulupalakua project.

Maui Tomorrow does have several specific observations:

1. This document cites MECO's April 2007 "Preferred Plan" calling for another 10.5MW (7 WTG's) in 2011. While this proposal is for another 14 to 20 WTG's, they are "not actively investigating a farm with fewer than 14 WTG's and would not consider a facility with fewer than 7 WTG's." Maps indicate 37 potential sites, subject to the conclusions of on-going wind studies. We are unsure how useful an EIS could be with so many variables -- specifically, how many turbines will there be and in which locations?

2. An archaeological survey in 2006 covered "most of the proposed KWP II project area." Section 4.8 seems to indicate that additional archaeological fieldwork will not be done for the EIS, despite the fact that a note on Figure 3.5 indicates 19 of the 37 proposed locations are in areas not covered by the 2006 survey.

3. The proposed on-site battery storage facility using "Power Cell technology" needs further details. Maui needs more assurance than merely stating that this

P.O. Box 299 • Makawao, HI 96768 • Phone: 579-9802 • Fax: 572-9802 • aina@maui-tomorrow.org • www.maui-tomorrow.org

MAUI TOMORROW FOUNDATION, INC.
"Protecting Maui's Future"

technology "offers several environmental advantages."

4. No mention is made of Maui Cultural Lands' efforts to plant native vegetation on Kaheawa Pasture areas disrupted by construction. While guided by the Wild Life Fire Contingency Plan that is in place for KWF I, and as part of a continued Habitat Conservation Plan, inclusion of Maui Cultural Lands' efforts should be specifically endorsed and fully funded by KWP II.

Maui Tomorrow Foundation would hope that Kaheawa Wind Power would also install some type of energy storage devise to assure MECO that the energy is from a firm power source, not a wind-variable source. This might be possible using "pump-storage" on the steep slopes above Maalaea or in Ukumahame Canyon on the west side of the mountain ridge.

In summation, Kaheawa Wind Power II builds on the successes of its initial phase. It further substitutes renewable energy for fossil fuel and thus receives Maui Tomorrow Foundation's general support.

Sincerely,

Irene Bowie

Irene Bowie
Executive Director

P.O. Box 299 • Makawao, HI 96768 • Phone: 579-9802 • Fax: 572-9802 • aina@maui-tomorrow.org • www.maui-tomorrow.org

PLANNING
SOLUTIONS

May 6, 2008

Ms. Irene Bowie, Executive Director
Maui Tomorrow Foundation, Inc.
P.O. Box 299
Makawao, Hawai'i 96768

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Ms. Bowie:

Thank you very much for your March 8, 2008 letter expressing support for Kaheawa Wind Power II LLC's (KWP II's) proposed Kaheawa Wind Power II Project. We appreciate the time you and others in your organization spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice (EA/EISPN)* and providing written comments.

Item-by-item responses to your comments are provided below. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

Comment 1:

In reviewing the above-referenced materials Maui Tomorrow Foundation, Inc. strongly agrees that additional 1.5 MW wind turbine generators (WTG's) are needed and that they should be sited near the existing farm to leverage infrastructure while minimizing visual impact. We believe that two distant farms are more visually jarring than a single, larger one. Further, from the wind data presented in Figures 3.3 and 3.4 of this document, there is doubt of the viability of the competing Shell/Ulupalakua project.

Response: Thank you very much for expressing your organization's strong belief that additional wind generating capacity is needed on Maui and that placing the additional turbines adjacent to the existing KWP facility would minimize visual impacts while making the most of existing infrastructure and wind resources. KWP II shares your conviction that the proposed project site represents the most viable site for harnessing additional wind energy.

Comment 2:

This document cites MECO's April 2007 "Preferred Plan" calling for another 10.5MW (7 WTG's) in 2011. While this proposal is for another 14 to 20 WTG's, they are "not actively investigating a farm with fewer than 14 WTG's and would not consider a facility with fewer than 7 WTG's. Maps indicate 37 potential sites, subject to the conclusions of on-going wind studies. We are unsure how useful an EIS could be with so many variables – specifically, how many turbines will there be and in which locations?

Response: You are correct in noting that the *EA/EISPN* includes 37 potential turbine locations in four siting areas but, as discussed in the EA/EISPN, only a fraction of the sites would actually be used. We feel it is important to evaluate a wide range of alternatives in the environmental documentation for the project. There are two fundamental reasons for this. First, KWP II has not yet finished collecting the wind data needed to determine exactly which locations have the best wind resources. In fact, the data may show that some are not viable, and it is important to ensure that at least some of the locations covered in the environmental documentation are viable. Because it would be premature to eliminate sites at this time, we must discuss all in the report.

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

Comment 3:

An archaeological survey in 2006 covered "most of the proposed KWP II project area." Section 4.8 seems to indicate that additional archaeological fieldwork will not be done for the EIS, despite the fact that a note on Figure 3.5 indicates 19 of the 37 proposed locations are in areas not covered by the 2006 survey.

Response: The discussion in Section 4.8 of the EA/EISPN was not meant to imply that no further archaeological work would be performed on sites that had not been covered by previous surveys. On the contrary, KWP II is in the process or commissioning the additional work and consultation, and the results of those studies and discussions will be included in the Draft EIS.

Comment 4:

The proposed on-site battery storage facility using "Power Cell technology" needs further details. Maui needs more assurance than merely stating that this technology "offers several environmental advantages."

Response: Your comment is duly noted. KWP II has continued working with MECO on battery storage technology and will include further details on the proposed system in the *Draft EIS.*

Comment 5:

No mention is made of Maui Cultural Lands' efforts to plant native vegetation on Kaheawa Pasture areas disrupted by construction. While guided by the Wild Life Fire Contingency Plan that is in place for KWP I, and as part of a continued Habitat Conservation Plan, inclusion of Maui Cultural Lands' efforts should be specifically endorsed and fully funded by KWP II.

Response: Thank you for your suggestion concerning Maui Cultural Lands' (MCL) possible involvement in KWP II. Kaheawa Wind Power greatly appreciates the service that MCL has provided to the existing wind farm and the community. KWP provided funding to MCL for the care and replanting of native plants that were removed during the development of the existing wind farm site. Under this agreement MCL is propagating native plants at a nursery on Maui for ongoing reintroduction to Kaheawa Pastures. KWP II representatives have informed us that it will continue being supportive of MCL should it wish to continue its restoration initiatives. It should be noted that the Conservation District Use Permit (CDUP) that was issued for the existing wind farm makes Kaheawa Wind Power responsible for replanting areas disturbed by construction with native vegetation. The same is likely to be true if a CDUP is issued for KWP II.

Comment 6:

Maui Tomorrow Foundation would hope that Kaheawa Wind Power would also install some type of energy storage devise [sic] *to assure MECO that the energy is from a firm power source, not a wind-variable source. This might be possible using "pump-storage" on the steep slopes above Maalaea or in Ukumahame* [sic] *Canyon on the west side of the mountain ridge.*

Response: KWP II agrees that some energy storage is a desirable component of any future expansion of wind generating capacity at Kaheawa Pastures. As noted in Section 2.5.3.4 of the *EA/EISPN,* several storage technologies are available, some of which are better suited to the

proposed project than others. The absence of a readily available fresh water source and lack of space for the required upper and lower water storage reservoirs has led KWP II to conclude that it is not feasible to use pumped storage at this location. However, as noted above KWP II plans to provide storage capacity using battery technology and will explore this further in the *DEIS*.

Thank you again for your comments and support of the project. If you have any further questions, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
P.O. Box 50004 Rm. 4-118
Honolulu, HI 96850
808-541-2600

March 5, 2008

Perry J. White
Planning Solutions
Ward Plaza, Suite 330
210 Ward Avenue
Honolulu, Hawaii 96814-4012

Dear Mr. White,

Please find enclosed an NRCS Soil Survey Map, soil reports, and maps indicating areas of Important Farmlands, and Hydric soils. The Important Farmlands map has been enclosed for your aid in determining if an AD-1006 form, Farmland Impact Conversion Rating Form is needed for the USDA-Natural Resources Conservation Service Review of Kaheawa Wind power II Project. Typically, this form is required on projects that convert farmlands into non-farmland uses and have federal dollars attached to the project. See the website link below for more information on the Farmland Protection Act, and a copy of the (AD-1006) form, with instructions. The hydric soils map enclosed identifies potential areas of wetlands. In this project area hydric soils are of very small extent. If wetlands do exist, any proposed impacts to these wetlands would need compliance with the "Clean Water Act", and may need an Army Corp of Engineers 404 permit.

The NRCS Soil Survey Map identifies all soil map units in the project area. The soil reports provide selected soil properties and interpretations, i.e. flooding hazard, limitations for roads, and dwellings, soil layers with USDA textures, and engineering classifications. The limitation ratings for the selected uses, i.e. roads and streets, range from somewhat limited to very limited. Somewhat limited to very limited rating does not preclude the intended land use, however it does identify limitations for the specific use, which may require corrective measures, increase costs, and require continued maintenance. In addition, if the planned service roads are located on the steep slopes in this area, design and construction should consider the potential soil erosion hazard.

The NRCS Soil Survey is a general planning tool and does not eliminate the need for an onsite investigation. If you have any questions concerning the soils or interpretations for this project please contact, Tony Rolfes, Assistant State Soil Scientist, by phone (808-541-2600 x129), or email, Tony.Rolfes@hi.usda.gov.

NRCS - Farmland Protection Policy Act Website:
http://www.nrcs.usda.gov/programs/fppa/

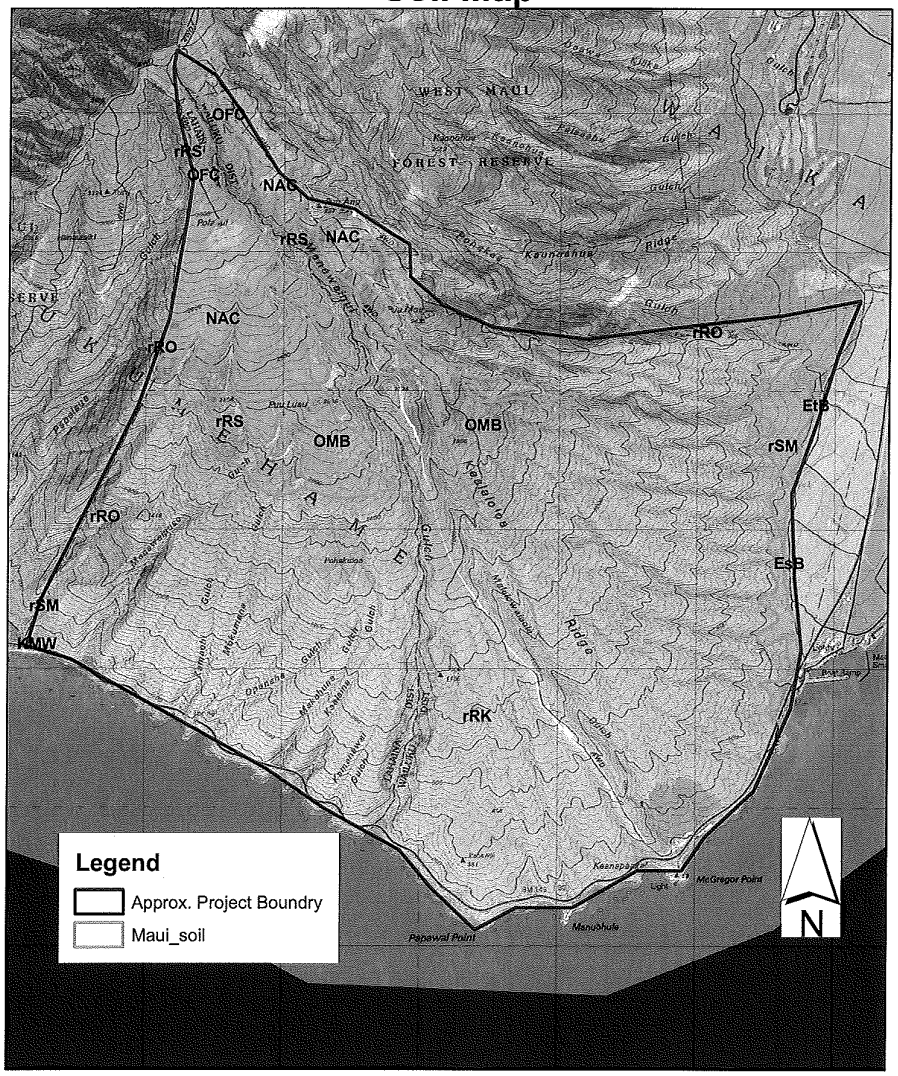
Sincerely,

LAWRENCE T. YAMAMOTO
Director
Pacific Islands Area

Enclosures:

cc: Michael Robotham, Assistant Director for Soil Science and Natural Resource Assessments, USDA-NRCS, Pacific Islands Area, Honolulu, HI

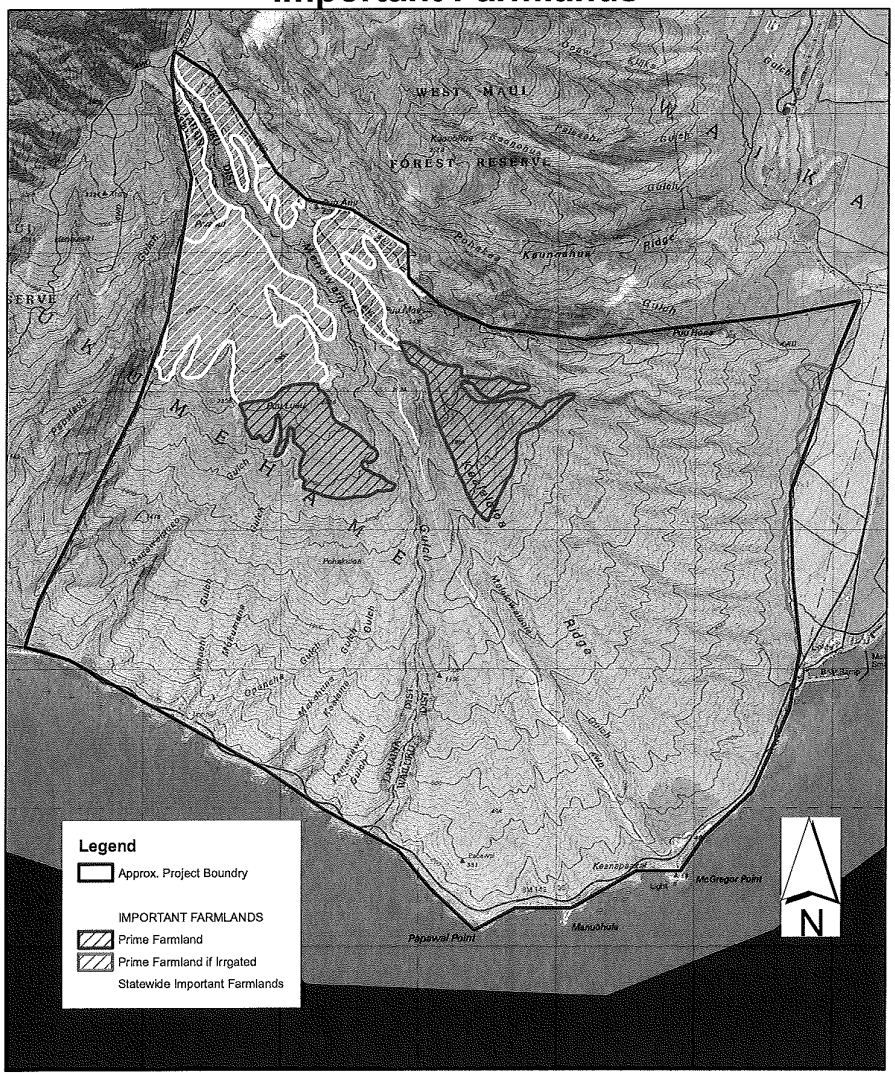
Kaheawa Wind Power II Project Site
Soil Map



0 950 1,900 3,800 5,700 7,600 Feet

NRCS
3/2008

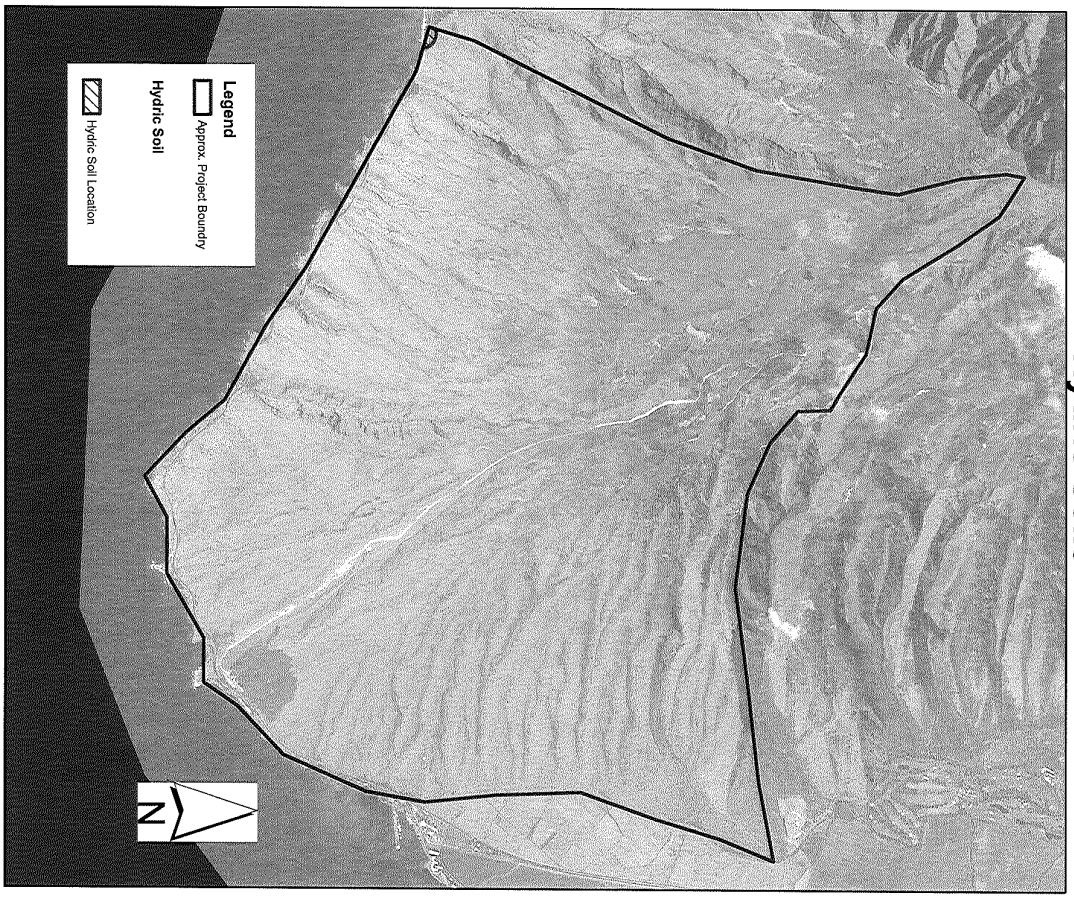
Kaheawa Wind Power II Project Site
Important Farmlands



0 950 1,900 3,800 5,700 7,600 Feet

NRCS
3/2008

Kaheawa Wind Power II Project Site
Hydric Soils



Physical Soil Properties

Island of Maui, Hawaii

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors Kw	Kf	T	Wind erodi-bility group	Wind erodi-bility index
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
OMB:														
Oli	0-13	---	---	12-27	0.25-0.60	4.23-42.00	0.12-0.14	0.0-2.9	5.0-10	.17	.17	2	6	48
	13-30	---	---	12-27	0.25-0.60	4.23-42.00	0.12-0.14	0.0-2.9	1.0-4.0	.17	.17			
	30-40	---	---	0	---	0.02-0.42	0.00	0.0	0.0	.02	.02			
rRK:														
Rock land	0-4	---	---	30-55	1.20-1.40	4.00-14.00	0.12-0.16	0.0-2.9	3.0-6.0	.10	.10	1	7	38
	4-8	---	---	30-55	1.20-1.40	4.00-14.00	0.12-0.16	0.0-2.9	1.0-4.0	.10	.10			
	8-20	---	---	0	---	0.02-0.42	0.00	0.0	0.0	.02	.02			
rRO:														
Rock outcrop	0-60	---	---	0	---	0.02-0.42	0.00	0.0	0.0	---	---	---	---	---
rRS:														
Rough broken and stony land	0-8	---	---	30-50	0.45-0.90	4.00-14.00	0.06-0.11	0.0-2.9	2.0-10	.05	.10	3	8	0
	8-18	---	---	30-50	0.45-0.90	4.00-14.00	0.14-0.16	0.0-2.9	2.0-5.0	.10	.10			
	18-60	---	---	0	---	0.02-0.42	0.00	0.0	0.0-0.3	.02	.02			

Physical Soil Properties

Island of Maui, Hawaii

[Entries under "Erosion Factors--T" apply to the entire profile. Entries under "Wind Erodibility Group" and "Wind Erodibility Index" apply only to the surface layer. Absence of an entry indicates that data were not estimated. This report shows only the major soils in each map unit]

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors Kw	Erosion factors Kf	Erosion factors T	Wind erodi-bility group	Wind erodi-bility index
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
EsB:														
Ewa	0-18	---	---	40-60	1.10-1.35	4.23-14.00	0.09-0.14	0.0-2.9	1.0-4.0	.17	.17	5	7	38
	18-60	---	---	40-60	1.10-1.30	4.23-14.00	0.11-0.17	0.0-2.9	0.1-2.0	.17	.17			
EtB:														
Ewa, cobbly	0-18	---	---	40-60	1.10-1.35	4.23-14.00	0.09-0.11	0.0-2.9	1.0-4.0	.15	.17	5	7	38
	18-60	---	---	40-60	1.10-1.30	4.23-14.00	0.10-0.12	0.0-2.9	0.1-2.0	.17	.17			
KlWV:														
Kealia	0-3	---	---	10-18	1.00-1.30	4.23-42.00	0.09-0.11	0.0-2.9	1.0-3.0	.17	.17	5	5	56
	3-19	---	---	10-18	1.00-1.30	4.23-42.00	0.09-0.11	0.0-2.9	0.0	.17	.17			
	19-63	---	---	10-18	1.00-1.30	4.23-42.00	0.09-0.11	0.0-2.9	0.0	.17	.17			
Kealia, deep water table	0-3	---	---	10-18	1.00-1.30	4.23-42.00	0.09-0.11	0.0-2.9	1.0-3.0	.17	.17	5	5	56
	3-19	---	---	10-18	1.00-1.30	4.23-42.00	0.09-0.11	0.0-2.9	0.0	.17	.17			
	19-63	---	---	10-18	1.00-1.30	4.23-42.00	0.09-0.11	0.0-2.9	0.0	.17	.17			
NAC:														
Naiwa	0-11	---	---	35-40	0.80-1.10	4.23-42.00	0.09-0.11	0.0-2.9	7.0-14	.37	.37	4	4	86
	11-40	---	---	20-27	0.60-0.90	4.23-42.00	0.09-0.11	0.0-2.9	6.0-8.0	.37	.37			
	40-52	---	---	15-25	0.60-0.90	4.23-42.00	0.09-0.11	0.0-2.9	2.0-4.0	.17	.37			
	52-60	---	---	0	—	0.02-0.42	0.00	0.0	0.0	.02	.02			
OFC:														
Olelo	0-10	---	---	55-60	1.20-1.30	1.41-14.11	0.10-0.12	0.0-2.9	4.0-7.0	.10	.10	5	7	38
	10-37	---	---	55-60	1.10-1.20	0.42-4.23	0.10-0.12	0.0-2.9	2.0-4.0	.10	.10			
	37-60	---	---	35-60	1.10-1.20	0.01-1.41	0.10-0.12	0.0-2.9	2.0-4.0	.10	.10			

Sewage Disposal

Island of Maui, Hawaii

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields: Rating class and limiting features	Value	Sewage lagoons: Rating class and limiting features	Value
rRK:					
Rock land	55	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Slope	1.00	Slope	1.00
rRO:					
Rock outcrop	100	Not rated		Not rated	
rRS:					
Rough broken and stony land	100	Very limited		Very limited	
		Slope	1.00	Depth to soft bedrock	1.00
		Depth to bedrock	1.00	Slope	1.00
		Large stones content	0.01	Seepage	0.50
				Large stones content	0.09

Sewage Disposal

Island of Maui, Hawaii

[The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The columns that identify the rating class and limiting features show no more than five limitations for any given soil. The soil may have additional limitations. This report shows only the major soils in each map unit]

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
EsB:					
Ewa	100	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slope	0.68
				Seepage	0.50
EtB:					
Ewa, cobbly	100	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Large stones content	0.83
				Slope	0.68
				Seepage	0.50
KMW:					
Kealia	45	Very limited		Very limited	
		Flooding	1.00	Ponding	1.00
		Ponding	1.00	Flooding	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
				Seepage	1.00
Kealia, deep water table	35	Very limited		Very limited	
		Flooding	1.00	Ponding	1.00
		Ponding	1.00	Flooding	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
				Seepage	1.00
NAC:					
Naiwa	100	Very limited		Very limited	
		Seepage, bottom layer	1.00	Slope	1.00
		Depth to bedrock	0.69	Seepage	1.00
		Slope	0.63	Depth to soft bedrock	0.26
OFC:					
Olelo	100	Very limited		Very limited	
		Slow water movement	1.00	Slope	1.00
		Slope	0.04		
OMB:					
Oli	100	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Seepage, bottom layer	1.00	Slope	1.00
				Seepage	1.00

Dwellings and Small Commercial Buildings

Island of Maui, Hawaii

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
rRS:							
Rough broken and stony land	100	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Depth to soft bedrock	0.50	Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
		Large stones content	0.01	Large stones content	0.01	Large stones content	0.01

Dwellings and Small Commercial Buildings

Island of Maui, Hawaii

[The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The columns that identify the rating class and limiting features show no more than five limitations for any given soil. The soil may have additional limitations. This report shows only the major soils in each map unit]

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
EsB:							
Ewa	100	Not limited		Not limited		Somewhat limited	
						Slope	0.13
EtB:							
Ewa, cobbly	100	Not limited		Not limited		Somewhat limited	
						Slope	0.13
KMW:							
Kealia	45	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Depth to saturated zone	0.07	Depth to saturated zone	1.00	Depth to saturated zone	0.07
Kealia, deep water table	35	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Depth to saturated zone	0.07	Depth to saturated zone	1.00	Depth to saturated zone	0.07
NAC:							
Naiwa	100	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.63	Slope	0.63	Slope	1.00
OFC:							
Olelo	100	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.04	Slope	0.04	Slope	1.00
OMB:							
Oli	100	Somewhat limited		Very limited		Somewhat limited	
		Depth to hard bedrock	0.46	Depth to hard bedrock	1.00	Slope	0.88
						Depth to hard bedrock	0.46
rRK:							
Rock land	55	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Slope	1.00	Slope	1.00	Slope	1.00
rRO:							
Rock outcrop	100	Not rated		Not rated		Not rated	

Roads and Streets, Shallow Excavations, and Lawns and Landscaping

Island of Maui, Hawaii

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
rRK:							
Rock land	55	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Low strength	1.00	Slope	1.00	Droughty	1.00
		Slope	1.00	Cutbanks cave	0.10	Too clayey	1.00
						Slope	1.00
						Large stones content	0.03
rRO:							
Rock outcrop	100	Not rated		Not rated		Not rated	
rRS:							
Rough broken and stony land	100	Very limited		Very limited		Very limited	
		Slope	1.00	Depth to soft bedrock	1.00	Slope	1.00
		Depth to soft bedrock	1.00	Slope	1.00	Large stones content	1.00
		Low strength	1.00	Cutbanks cave	0.10	Depth to bedrock	1.00
		Large stones content	0.01	Large stones content	0.01	Droughty	0.96

Roads and Streets, Shallow Excavations, and Lawns and Landscaping

Island of Maui, Hawaii

[The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The columns that identify the rating class and limiting features show no more than five limitations for any given soil. The soil may have additional limitations. This report shows only the major soils in each map unit]

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
EsB:							
Ewa	100	Somewhat limited		Somewhat limited		Very limited	
		Low strength	0.10	Too clayey	0.96	Too clayey	1.00
				Cutbanks cave	0.10		
EtB:							
Ewa, cobbly	100	Somewhat limited		Somewhat limited		Very limited	
		Low strength	0.10	Too clayey	0.96	Large stones content	1.00
				Cutbanks cave	0.10	Too clayey	1.00
KMW:							
Kealia	45	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Flooding	1.00	Depth to saturated zone	1.00	Flooding	1.00
		Depth to saturated zone	0.03	Flooding	0.80	Salinity	1.00
				Cutbanks cave	0.10	Depth to saturated zone	0.03
						Droughty	0.01
Kealia, deep water table	35	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Flooding	1.00	Depth to saturated zone	1.00	Flooding	1.00
		Depth to saturated zone	0.03	Flooding	0.80	Salinity	1.00
				Cutbanks cave	0.10	Depth to saturated zone	0.03
						Droughty	0.01
NAC:							
Naiwa	100	Very limited		Very limited		Somewhat limited	
		Low strength	1.00	Cutbanks cave	1.00	Slope	0.63
		Slope	0.63	Slope	0.63	Droughty	0.01
OFC:							
Olelo	100	Very limited		Somewhat limited		Very limited	
		Low strength	1.00	Too clayey	0.97	Too clayey	1.00
		Slope	0.04	Cutbanks cave	0.10	Slope	0.04
				Slope	0.04		
OMB:							
Oli	100	Somewhat limited		Very limited		Very limited	
		Depth to hard bedrock	0.46	Depth to hard bedrock	1.00	Gravel content	1.00
				Cutbanks cave	0.10	Depth to bedrock	0.46
						Droughty	0.01

Map Unit Description (Brief, Generated)

Island of Maui, Hawaii

Map unit: rRS - Rough broken and stony land

Component: Rough broken and stony land (100%)

Generated brief soil descriptions are created for major soil components. The Rough broken and stony land is a miscellaneous area.

Map Unit Description (Brief, Generated)

Island of Maui, Hawaii

Map unit: NAC - Naiwa silty clay loam, 3 to 20 percent slopes

Component: Naiwa (100%)

The Naiwa component makes up 100 percent of the map unit. Slopes are 3 to 20 percent. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 10 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map unit: OFC - Olelo silty clay, 3 to 15 percent slopes

Component: Olelo (100%)

The Olelo component makes up 100 percent of the map unit. Slopes are 3 to 15 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 6 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: OMB - Oli silt loam, 3 to 10 percent slopes

Component: Oli (100%)

The Oli component makes up 100 percent of the map unit. Slopes are 3 to 10 percent. Depth to a root restrictive layer, bedrock, lithic, is 24 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 8 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map unit: rRK - Rock land

Component: Rock land (55%)

The Rock land component makes up 55 percent of the map unit. Slopes are 0 to 70 percent. Depth to a root restrictive layer, bedrock, lithic, is 4 to 10 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Map unit: rRO - Rock outcrop

Component: Rock outcrop (100%)

Generated brief soil descriptions are created for major soil components. The Rock outcrop is a miscellaneous area.

Map Unit Description (Brief, Generated)

Island of Maui, Hawaii

[Minor map unit components are excluded from this report]

Map unit: EsB - Ewa silty clay, 3 to 7 percent slopes

Component: Ewa (100%)

The Ewa component makes up 100 percent of the map unit. Slopes are 3 to 7 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 4c. Irrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: EtB - Ewa cobbly silty clay, 3 to 7 percent slopes

Component: Ewa, cobbly (100%)

The Ewa, cobbly component makes up 100 percent of the map unit. Slopes are 3 to 7 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 4s. Irrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: KMW - Kealia silt loam

Component: Kealia (45%)

The Kealia component makes up 45 percent of the map unit. Slopes are 0 to 1 percent. This component is on salt marshes. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 27 inches during January, February, March, April, May, June, July, August, September, October, November, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7w. This soil meets hydric criteria. The soil has a strongly saline horizon within 30 inches of the soil surface.

Component: Kealia, deep water table (35%)

The Kealia, deep water table component makes up 35 percent of the map unit. Slopes are 0 to 1 percent. Depth to a root restrictive layer is greater than 60 inches. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 27 inches during February, March, April, May, June, July, August, September, October, November, December. Organic matter content in the surface horizon is about 2 percent. This soil does not meet hydric criteria. The soil has a strongly saline horizon within 30 inches of the soil surface.

Map Unit Legend

Island of Maui, Hawaii

Map symbol	Map unit name
EsB	Ewa silty clay, 3 to 7 percent slopes
EtB	Ewa cobbly silty clay, 3 to 7 percent slopes
KMW	Kealia silt loam
NAC	Naiwa silty clay loam, 3 to 20 percent slopes
OFC	Olelo silty clay, 3 to 15 percent slopes
OMB	Olil silt loam, 3 to 10 percent slopes
rRK	Rock land
rRO	Rock outcrop
rRS	Rough broken and stony land

Engineering Properties

Island of Maui, Hawaii

[Absence of an entry indicates that the data were not estimated. This report shows only the major soils in each map unit]

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percent passing sieve number–				Liquid limit	Plasticity index
			Unified	AASHTO	>10 Inches	3-10 Inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
EsB:												
Ewa	0-18	Silty clay	CL-K (proposed), ML-K (proposed)	A-6, A-7	0	0	100	100	95-100	85-100	35-45	10-20
	18-60	Silty clay loam	CL-K (proposed), ML-K (proposed)	A-6, A-7	0	0-5	100	95-100	90-100	85-100	35-45	10-20
EtB:												
Ewa, cobbly	0-18	Cobbly silty clay	CL-K (proposed), ML-K (proposed)	A-6, A-7	0-20	15-30	100	100	95-100	85-100	35-45	10-20
	18-60	Silty clay loam	CL-K (proposed), ML-K (proposed)	A-6, A-7	0	0-5	100	95-100	90-100	85-100	35-45	10-20
KMW:												
Kealia	0-3	Silt loam	ML-K (proposed)	A-4	0	0	100	100	90-100	70-90	30-40	NP-10
	3-19	Loam	ML-K (proposed)	A-4	0	0	100	100	85-95	60-75	30-40	NP-10
	19-63	Fine sandy loam	SM	A-4	0	0	90-100	85-95	65-75	40-50	30-40	NP-10

Engineering Properties

Island of Maui, Hawaii

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percent passing sieve number–				Liquid limit	Plasticity index
			Unified	AASHTO	>10 Inches	3-10 Inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
KMW:												
Kealia, deep water table	0-3	Silt loam	ML-K (proposed)	A-4	0	0	100	100	90-100	70-90	30-40	NP-10
	3-19	Loam	ML-K (proposed)	A-4	0	0	100	100	85-95	60-75	30-40	NP-10
	19-63	Fine sandy loam	SM	A-4	0	0	90-100	85-95	65-75	40-50	30-40	NP-10
NAC:												
Naiwa	0-11	Silty clay loam	MH-A (proposed), ML-A (proposed)	A-5, A-7	0	0	100	100	95-100	85-100	45-55	5-15
	11-40	Loam, silt loam	MH-A (proposed), ML-A (proposed)	A-5, A-7	0	0	95-100	90-100	80-100	60-90	45-55	5-15
	40-52	Very gravelly loam	SM	A-5	0	5-22	75-90	50-60	40-55	35-45	45-55	NP-10
	52-60	Bedrock	---	---	0	0	0	0	0	0	0	NP
OFC:												
Olelo	0-10	Silty clay	MH-O (proposed)	A-7	0	0	90-100	85-95	85-90	80-85	55-75	20-35
	10-37	Silty clay	MH-O (proposed)	A-7	0	0	95-100	95-100	95-100	95-100	55-75	20-35
	37-60	Silty clay, silty clay loam	MH-O (proposed)	A-7	0	10-20	95-100	95-100	95-100	95-100	55-75	20-35

Engineering Properties
Island of Maui, Hawaii

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percent passing sieve number–				Liquid limit	Plasticity index
			Unified	AASHTO	>10 Inches	3-10 Inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
OMB:												
Oil	0-13	Silt loam	MH-A (proposed), ML-A (proposed)	A-7	0	0	0	0	0	0	45-70	10-25
	13-30	Loam, silty clay loam, silt loam	MH-A (proposed), ML-A (proposed)	A-7	0	0	0	0	0	0	45-70	10-25
	30-40	Bedrock	---	---	0	0	0	0	0	0	0	NP
rRK:												
Rock land	0-4	Silty clay loam	MH-K (proposed)	A-7	0-10	0-5	90-100	90-100	90-100	85-95	50-60	10-20
	4-8	Silty clay, silty clay loam	MH-K (proposed)	A-7	0-10	0-5	90-100	90-100	90-100	85-95	50-60	10-20
	8-20	Bedrock	---	---	0	0	0	0	0	0	0	NP
rRO:												
Rock outcrop	0-60	Bedrock	---	---	0	0	0	0	0	0	0	NP

Engineering Properties

Island of Maui, Hawaii

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percent passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 Inches	3-10 Inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
rRS:												
Rough broken and stony land	0-8	Very stony silty clay	MH-A (proposed), MH-O (proposed)	A-7	30-50	5-15	90-100	90-100	85-100	80-95	50-60	10-20
	8-18	Silty clay, silty clay loam	MH-A (proposed), MH-O (proposed)	A-7	0-5	0-5	90-100	90-100	85-100	80-95	50-60	10-20
	18-60	Bedrock	---	---	0	0	0	0	0	0	0	NP

Water Features

Island of Maui, Hawaii

[Depths of layers are in feet. See text for definitions of terms used in this table. Estimates of the frequency of ponding and flooding apply to the whole year rather than to individual months. Absence of an entry indicates that the feature is not a concern or that data were not estimated. This report shows only the major soils in each map unit]

Map symbol and soil name	Hydrologic group	Surface runoff	Months	Water table			Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency		Duration	Frequency
				Ft	*Ft*	*Ft*					
EsB:											
Ewa	B	Medium	Jan-Dec			---	---	None		---	None
ETB:											
Ewa, cobbly	B	Medium	Jan-Dec			---	---	None		---	None
KMW:											
Keaila	C	Negligible	January	1.0-3.5	>6.0	0.0-1.6	Long	Frequent		Brief	Frequent
			February	1.0-3.5	>6.0	0.0-1.6	Long	Frequent		Brief	Frequent
			March	1.0-3.5	>6.0	0.0-1.6	Long	Frequent		Brief	Frequent
			April	1.0-3.5	>6.0	0.0-1.6	Long	Frequent		Brief	Frequent
			May	1.0-3.5	>6.0	0.0-1.6	Brief	Rare		Brief	Rare
			June	1.0-3.5	>6.0	0.0-0.8	Brief	Rare		Brief	Rare
			July	1.0-3.5	>6.0	0.0-0.8	Brief	Rare		Brief	Rare
			August	1.0-3.5	>6.0	0.0-0.8	Brief	Rare		Brief	Rare
			September	1.0-3.5	>6.0	0.0-0.8	Brief	Rare		Brief	Rare
			October	1.0-3.5	>6.0	0.0-0.8	Brief	Rare		Brief	Rare
			November	1.0-3.5	>6.0	0.0-1.0	Long	Frequent		Brief	Frequent
			December	1.0-3.5	>6.0	0.0-1.3	Long	Frequent		Brief	Frequent

Soil Features

Island of Maui, Hawaii

[Absence of an entry indicates that the feature is not a concern or that data were not estimated. This report shows only the major soils in each map unit]

Map symbol and soil name	Restrictive layer			Subsidence		Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Initial	Total		Uncoated steel	Concrete
		In	*In*		*In*	*In*			
ESB:									
Ewa	---	---	---	---	0	---	None	Moderate	Low
ETB:									
Ewa, cobbly	---	---	---	---	0	---	None	Moderate	Low
KMW:									
Kealia	---	---	---	---	0	---	None	High	High
Kealia, deep water table	---	---	---	---	0	---	None	High	High
NAC:									
Naiwa	Paralithic bedrock	40-60	---	Weakly cemented	0	---	None	High	High
OFC:									
Olelo	---	---	---	---	0	---	None	High	High
OMB:									
Oli	Lithic bedrock	24-40	---	Indurated	0	---	None	High	High
rRK:									
Rock land	Lithic bedrock	4-10	---	Indurated	0	---	None	Moderate	Low
rRO:									
Rock outcrop	Lithic bedrock	0	---	Indurated	0	---	None	---	---
rRS:									
Rough broken and stony land	Paralithic bedrock	12-55	---	Weakly cemented	0	---	None	Moderate	Moderate

Water Features

Island of Maui, Hawaii

Map symbol and soil name	Hydrologic group	Surface runoff	Months	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	*Ft*	*Ft*				
KMW:										
Kealia, deep water table	C	Negligible	January	---	---	0.0-1.6	Long	Frequent	Brief	Frequent
			February	1.0-3.5	>6.0	0.0-1.6	Long	Frequent	Brief	Frequent
			March	1.0-3.5	>6.0	0.0-1.6	Long	Frequent	Brief	Frequent
			April	1.0-3.5	>6.0	0.0-1.6	Long	Frequent	Brief	Frequent
			May	1.0-3.5	>6.0	0.0-1.6	Brief	Rare	Brief	Rare
			June	1.0-3.5	>6.0	0.0-0.8	Brief	Rare	Brief	Rare
			July	1.0-3.5	>6.0	0.0-0.8	Brief	Rare	Brief	Rare
			August	1.0-3.5	>6.0	0.0-0.8	Brief	Rare	Brief	Rare
			September	1.0-3.5	>6.0	0.0-0.8	Brief	Rare	Brief	Rare
			October	1.0-3.5	>6.0	0.0-0.8	Brief	Rare	Brief	Rare
			November	1.0-3.5	>6.0	0.0-1.0	Long	Frequent	Brief	Frequent
			December	1.0-3.5	>6.0	0.0-1.3	Long	Frequent	Brief	Frequent
NAC:										
Naiwa	B	Medium	Jan-Dec			---	---	None	---	None
OFC:										
Olelo	C	Medium	Jan-Dec			---	---	None	---	None
OMB:										
Oli	B	Medium	Jan-Dec			---	---	None	---	None
rRK:										
Rock land	D	Very high	Jan-Dec			---	---	None	---	None
rRO:										
Rock outcrop	D	---	Jan-Dec			---	---	None	---	None
rRS:										
Rough broken and stony land	C	Very high	Jan-Dec			---	---	None	---	None

PLANNING
SOLUTIONS

April 21, 2008

Mr. Lawrence T. Yamamoto, Director
Pacific Islands Area
Natural Resources Conservation Service
P.O. Box 50004, Rm. 4-118
Honolulu, Hawai'i 96850

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Yamamoto:

Thank you for your March 5, 2008 letter concerning Kaheawa Wind Power II LLC's (KWP II's) proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and providing written comments. Item-by-item responses to your comments are provided below. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

Comment 1:

The Important Farmlands map has been enclosed for your aid in determining if an AD-1006 form, Farmland Impact Conversion Rating Form is needed for the USDA-Natural Resources Conservation Service Review of Kaheawa Wind power II Project. Typically, this form is required on projects that convert farmlands into non-farmland uses and have federal dollars attached to the project.

Response: Thank you for forwarding the information concerning the Farmland Impact Conversion Rating Form. Because the proposed project does not involve federal monies, it is our understanding that the AD-1006 form is not required.

Comment 2:

The hydric soils map enclosed identifies potential areas of wetlands. In this project area hydric soils are of very small extent. If wetlands do exist, any proposed impacts to these wetlands would need compliance with the "Clean Water Act", and may need an Army Corp of Engineers 404 permit.

Response: Thank you for enclosing a map identifying areas of hydric soils. As you mentioned, hydric soils are limited to a very small area in the extreme southwestern corner of one of the subject parcels. No activities are planned on or near that area as part of the project; consequently no wetlands will be affected.

Comment 3:

The NRCS Soil Survey Map identifies all soil map units in the project area. The soil reports provide selected soil properties and interpretations, i.e. flooding hazard, limitations for roads, and dwellings, soil layers with USDA textures, and engineering classifications, The limitation ratings for the selected uses, i.e. roads and streets, range from somewhat limited to very limited. Somewhat limited to very limited rating does not preclude the intended land use, however it does identify limitations for the specific use, which may require corrective

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

measures, increase costs, and require continued maintenance. In addition, if the planned service roads are located on the steep slopes in this area, design and construction should consider the potential soil erosion hazard.

Response: We appreciate the NRCS Soil Survey Map that you provided showing soil map units in the project area. Information from the soil survey was used in identifying potential sites, and KWP II will supplement this information as needed as the design progresses. All of the planned internal service routes will be designed and evaluated by a geotechnical engineer to ensure that all necessary measures are taken to ensure safety and stability. KWP II is committed to preventing erosion through ground stabilization and re-vegetation of disturbed slopes. This will be elaborated on in the *Draft EIS.*

Thank you again for your comments. If you have any further questions, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

LINDA LINGLE
GOVERNOR
THEODORE E. LIU
DIRECTOR
MARK K. ANDERSON
DEPUTY DIRECTOR
ABBEY SETH MAYER
INTERIM DIRECTOR
OFFICE OF PLANNING

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

OFFICE OF PLANNING

235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Telephone: (808) 587-2846
Fax: (808) 587-2824

Ref. No. P-12057

March 10, 2008

Mr. Perry J. White
Planning Solutions
210 Ward Avenue, Suite 330
Honolulu, Hawaii 96814-4012

Dear Mr. White:

Subject: Kaheawa Wind Power II
Environmental Assessment/Preparation Notice (EA/EISPN)
TMK(s): 2-4-8-001:001 and 2-3-6-001:014
Maalaea, Maui

Thank you for sending the Office of Planning the EA/EISPN for the above referenced proposal.

The Office of Planning requests that the Draft Environmental Impact Statement (DEIS) consider the impacts of the proposed project on the following issues:

1. **Cultural/Historic Resources** – Please include an inventory survey of cultural and historic sites, with monitoring and preservation plans approved by the State Historic Preservation Division. The current document discusses archaeological studies that have been or will be conducted (down-road and up-wind siting areas) but does not discuss the intent to conduct a cultural impact study. Please discuss how access for Native Hawaiians for traditional and customary practices will be preserved to include visual landmarks if applicable.

2. **Environmental, Recreational, and Scenic Resources** – Please include an inventory of flora and fauna on the project site, and any required protections that cover areas not included in the earlier October 2006 survey (i.e., the down-road and up-wind sites.) The DEIS should discuss the proximity of the project and its components to existing State Forest Reserves, Natural Area Reserves, or public-private Watershed Partnerships. These areas have been established for the protection and management of important natural and cultural resources. Impacts to resources and possible mitigation measures should be discussed in the DEIS, particularly with respect to the introduction of invasive species.

3. **Coastal Zone Management** – The State oversees protection of natural, cultural, and economic resources within the coastal zone. Please discuss how the proposed project will balance the competing values of economic development and preservation of coastal resources, including protection from hurricane, storm surge, flood hazard, volcano, and soil erosion, as applicable and found in Chapter 205A, Hawaii Revised Statutes.

4. **Lease of State Lands** – The use and lease of State lands may affect beneficiaries of the State Office of Hawaiian Affairs. Please include a discussion of whether the land parcels in question are part of the ceded lands inventory and how that might affect the lease.

The Office of Planning looks forward to receiving the DEIS with the potential impacts and mitigation measures for the above issues addressed. If you have any questions, please call Scott Derrickson in the Land Use Division at 587-2805.

Sincerely,

Abbey Seth Mayer
Interim Director

c: Department of Land and Natural Resources,
Office of Conservation and Coastal Lands
Department of Health, Office of Environmental Quality Control

PLANNING
SOLUTIONS

April 23, 2008

Ms. Abbey Seth Mayer, Interim Director
Office of Planning
Department of Business, Economic
Development, & Tourism
State of Hawai'i
P.O. Box 2359
Honolulu, Hawai'i 96804

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Ms. Mayer:

Thank you for your March 10, 2008 letter [your reference P-12057] concerning Kaheawa Wind Power II LLC's (KWP II's) proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and providing written comments.

Item-by-item responses to your comments are provided below using the headings provided in your letter. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

Cultural/Historic Resources

Comment 1:

Please include an inventory survey of cultural and historic sites, with monitoring and preservation plans approved by the State Historic Preservation Division. The current document discusses archaeological studies that have been or will be conducted (down-road and up-wind siting areas) but does not discuss the intent to conduct a cultural impact study. Please discuss how access for Native Hawaiians for traditional and customary practices will be preserved to include visual landmarks if applicable.

Response: The *Draft Environmental Impact Statement (DEIS)* will include the results of all archaeological inventory surveys conducted in the project area, including those studies that KWP II has commissioned for the "down-road" and "up-wind" siting areas that we described. A cultural impact assessment will be conducted for the various siting areas as well. The *DEIS* will summarize the results of all reports and will describe the mitigation measures that KWP II will implement. Where applicable, the *DEIS* will also reference SHPD-approved monitoring and preservation plans for existing historic and archaeological features.

Environmental, Recreational, and Scenic Resources

Comment 2:

Please include an inventory of flora and fauna on the project site, and any required protections that cover areas not included in the earlier October. 2006 survey (i.e., the down-road and up-wind sites.)_ The DEIS should discuss the proximity of the project and its components to existing State Forest Reserves, Natural Area Reserves, or public-private

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

Watershed Partnerships. These areas have been established for the protection and management of important natural and cultural resources. Impacts to resources and possible mitigation measures should be discussed in the DEIS, particularly with respect to the introduction of invasive species.

Response: The *DEIS* will include the results of floral and faunal surveys conducted in all the proposed siting areas and will identify any State Forest Reserves, Natural Area Reserves, and public-private Watershed Partnerships in proximity to the site. It will identify potential impacts to these resources and, where applicable, the report will include the mitigation measures KWP II proposes to implement to avoid or minimize these impacts. The discussion will include measures designed to minimize the potential for the spread of invasive species.

Coastal Zone Management

Comment 3:

The State oversees protection of natural, cultural, and economic resources within the coastal zone. Please discuss how the proposed project will balance the competing values of economic development and preservation of coastal resources, including protection from hurricane, storm surge, flood hazard, volcano, and soil erosion, as applicable and found in Chapter 205A, Hawaii Revised Statutes.

Response: The *DEIS* will include a section that evaluates the proposed project's compliance with each of the policy objectives listed in Chapter 205A, Hawaii Revised Statutes.

Lease of State Lands

Comment 4:

The use and lease of State lands may affect beneficiaries of the State Office of Hawaiian Affairs. Please include a discussion of whether the land parcels in question are part of the ceded lands inventory and how that might affect the lease.

Response: The lands on which the proposed project would be constructed are identified as ceded lands. The *DEIS* will include a discussion of how the ceded lands designation affects the lease.

Thank you again for your comments. If you have any further questions, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

LINDA LINGLE
GOVERNOR

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

BRENNON T. MORIOKA
INTERIM DIRECTOR

Deputy Directors
MICHAEL D. FORMBY
FRANCIS PAUL KEENO
BRIAN H. SEKIGUCHI

IN REPLY REFER TO:

STP 8.2791

March 5, 2008

Mr. Perry J. White
Planning Solutions
Ward Plaza, Suite 330
210 Ward Avenue
Honolulu, Hawaii 96814-4012

Dear Mr. White:

Subject: Kaheawa Wind Power II
Environmental Assessment
Environmental Impact Statement Preparation Notice (EA/EISPN)

Thank you for the notice of the subject wind power generating facility project. The State Department of Transportation submits the following comments:

1. While the project itself is not expected to significantly impact DOT transportation facilities, DOT is interested in the forthcoming EA/EIS for the reasons below.

2. Request that the EA/EIS address the access and intersection conditions on State Highway Route 30 (Honoapiilani Highway). The project must satisfy access and highway intersection requirements as determined by the DOT Highways Division. Please consult with the Highways Division Maui District Office and/or Planning Branch on this matter.

3. Your notice briefly discussed the effects of construction activities on drainage conditions at the affected site. The EA/EIS should include events, if any, where storm water flow from the site would reach and affect Honoapiilani Highway.

4. Your notice mentions that due to the height of the wind power towers and lines may affect aircraft flights, and that the Federal Aviation Administration requirements for safety indicators or lights and height obstruction would be addressed. Although the wind power facility does not directly affect the DOT's airports on Maui, your recognition of these safety factors is acknowledged.

The DOT would appreciate receiving four (4) copies of the Draft EA/EIS when it is completed for further review and comment.

Very truly yours,

BRENNON T. MORIOKA, PH.D., P.E.
Interim Director of Transportation

c: Laurence Lau, Office of Environmental Quality Control
Samuel Lemmo, DLNR

PLANNING
SOLUTIONS

April 14, 2008

Mr. Brennon T. Morioka, Interim Director
Department of Transportation
State of Hawai'i
869 Punchbowl Street
Honolulu, Hawai'i 96813-5097

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Morioka:

Thank you for your March 5, 2008 letter [your reference STP 8.2791] concerning Kaheawa Wind Power II LLC's (KWP II's) proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and providing written comments.

We appreciate your confirmation that the project is not expected to significantly impact DOT transportation facilities and understand that DOT maintains an interest in the *Environmental Impact Statement (EIS)* for the reasons outlined in your letter. Item-by-item responses to your comments are provided below. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

Comment 1:

Request that the EA/EIS address the access and intersection conditions on State Highway Route 30 (Honoapiilani Highway). The project must satisfy access and highway intersection requirements as determined by the DOT Highways Division. Please consult with the Highways Division Maui District Office and/or Planning Branch on this matter.

Response: The *Draft EIS* will include a description of existing traffic conditions at the project site and a discussion of how the proposed project will comply with access and highway intersection requirements. KWP II plans to consult with the Highways Division Maui District Office on this matter.

Comment 2:

Your notice briefly discussed the effects of construction activities on drainage conditions at the affected site. The EA/EIS should include events, if any, where storm water flow from the site would reach and affect Honoapiilani Highway,

Response: The *Draft EIS* will include a discussion of stormwater drainage patterns and the amount and quality of runoff that is likely to be generated on-site during construction. KWP II will also be required to obtain NPDES General Permit Coverage for construction of the project; its NOI-C application for that will describe the details of the construction BMPs that the contractor will use to treat, reduce, or eliminate runoff leaving the site during construction.

Comment 3:

Your notice mentions that due to the height of the wind power towers and lines may affect aircraft flights, and that the Federal Aviation Administration requirements for safety

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

indicators or lights and height obstruction would be addressed. Although the wind power facility does not directly affect the DOT's airports on Maui, your recognition of these safety factors is acknowledged.

Response: Thank you for acknowledging KWP II's recognition of the project's potential impacts to navigable airspace. As mentioned in the *EISPN*, KWP II will comply with all pertinent FAA requirements.

Comment 4:

The DOT would appreciate receiving four (4) copies of the Draft EA/EIS when it is completed for further review and comment.

Response: We have noted on our distribution list for the *Draft EIS* that DOT is to receive four copies of the report when it is completed.

Thank you again for your comments. If you have any further questions, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

PHONE (808) 594-1888

FAX (808) 594-1865

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

HRD08/2078D

March 5, 2008

Perry White
Planning Solutions
Ward Plaza, Suite 330
210 Ward Avenue
Honolulu, HI 96814-4012

RE: Request for comments on the Draft Environmental Assessment Preparation Notice for the Kaheawa Wind Power II project, located above Mā'alaea, Maui, TMK: (2) 4-8-001:001 and (2) 3-6-001:014.

Dear Perry White,

The Office of Hawaiian Affairs (OHA) is in receipt of the above-referenced Draft Environmental Assessment Preparation Notice. Applicant Kaheawa Wind Power II, LLC, is considering establishing a new 21-30 megawatt wind power generating facility. The project would include the installation of 14 to 20 General Electric 1.5 megawatt wind turbine generators, electrical power lines, an electrical substation, a Battery Energy Storage System and the construction of various other facilities. The project would be located on about 400 acres of state land above Mā'alaea. The project would be located near the existing Kaheawa Wind Power I project. OHA offers the following comments.

We look forward to reviewing the Draft Environmental Assessment's analysis and mitigation measures relating to the project's impact on the area's native plants and birds. Specifically, we are interested in the applicant's plans to mitigate the project's impacts on the area's endangered Hawaiian Petrel, the threatened Newell's Shearwater, the endangered Nēnē and the endangered Hawaiian Hoary Bat. Moreover, we ask the applicant to study the cumulative effects this project will have on the area's natural and cultural resources when combined with impacts from the Kaheawa Wind Power I project.

In addition, OHA requests the applicant's assurances that should iwi kūpuna or Native Hawaiian cultural or traditional deposits be found during the construction of the project, work will cease, and the appropriate agencies will be contacted pursuant to applicable law.

OHA would like to point out that the subject parcels are designated as Section 5(b) Ceded Lands, which hold a considerable amount of sentimental, historical and legal significance for Native Hawaiians and OHA. These lands were illegally taken from the Hawaiian Kingdom after the 1893 overthrow and later transferred ("ceded") by the United States government to the State of Hawai'i upon statehood. Today, the state holds the Ceded Lands corpus in trust for Native Hawaiians and the general public. OHA is supposed to receive a portion of all revenues generated on these lands.

Thank you for the opportunity to comment. If you have further questions, please contact Sterling Wong (808) 594-0248 or e-mail him at sterlingw@oha.org.

Sincerely,

Clyde W. Nāmu'o
Administrator

C: Sam Lemmo, Administrator
Office of Conservation and Coastal Lands
Department of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

PLANNING
SOLUTIONS

April 14, 2008

Mr. Clyde W. Nāmuʻo, Administrator
Office of Hawaiian Affairs
State of Hawaiʻi
711 Kapiʻolani Boulevard, Suite 500
Honolulu, Hawaiʻi 96813

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawaiʻi

Dear Mr. Nāmuʻo:

Thank you for your March 5, 2008 letter [your reference HRD08/2078D] concerning Kaheawa Wind Power II LLC's (KWP II's) proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and providing written comments.

Item-by-item responses to your comments are provided below. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

Comment 1:

Specifically, we are interested in the applicant's plans to mitigate the project's impacts on the area's endangered Hawaiian Petrel, the threatened Newell's Shearwater, the endangered Nēnē and the endangered Hawaiian Hoary Bat.

Response: As indicated in the *EA/EISPN,* information concerning the occurrence of the above-mentioned protected species and their interactions with the existing wind project will be included in the *Draft EIS* to inform the discussion of KWP II's potential impacts and mitigation measures. As is true of KWP I, the applicant's Habitat Conservation Plan (HCP) for the proposed KWP II facility will ensure that all anticipated take of protected species is minimized and mitigated to the maximum extent practicable.

Comment 2:

Moreover, we ask the applicant to study the cumulative effects this project will have on the area's natural and cultural resources when combined with impacts from the Kaheawa Wind Power I project.

Response: The *Draft EIS* will study the cumulative effect of wind power development at Kaheawa. The impacts of the existing wind generating facility were evaluated and are being minimized and mitigated in accordance with the environmental permits in place for the facility, including Chapter 343 environmental documentation, an incidental take permit and HCP under the Endangered Species Act, a Conservation District Use Permit, and conditions related to the preservation of cultural and historic resources. The *Draft EIS* will note this, and where applicable, will include the existing facility in its discussion of the cumulative impacts of the KWP II project.

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

Comment 3:

In addition, OHA requests the applicant's assurances that should iwi kupuna or Native Hawaiian cultural or traditional deposits be found during the construction of the project, work will cease, and the appropriate agencies will be contacted pursuant to applicable law.

Response: The *Draft EIS* will specify that should *iwi kupuna* or Native Hawaiian cultural or traditional deposits be found during the construction of the project, work that might affect them will be halted immediately and the appropriate agencies will be contacted pursuant to applicable law.

Comment 4:

OHA would like to point out that the subject parcels are designated as Section 5(b) Ceded Lands, which hold a considerable amount of sentimental, historical and legal significance for Native Hawaiians and OHA. These lands were illegally taken from the Hawaiian Kingdom after the 1893 overthrow and later transferred ("ceded") by the United States government to the State of Hawai`i upon statehood. Today, the state holds the Ceded Lands corpus in trust for Native Hawaiians and the general public. OHA is supposed to receive a portion of all revenues generated on these lands.

Response: Thank you for noting that the subject parcels are designated as Section 5(b) Ceded Lands; we will include this information in the *DEIS*. We will also indicate that the State holds the Ceded Lands corpus in trust for Native Hawaiians and the general public and that OHA is to receive a portion of all revenues generated on these lands. It is our understanding that the sharing of revenues generated by public lands is handled by the Department of Land and Natural Resources, and we presume that agency will comply with all applicable revenue-sharing requirements.

Thank you again for your comments. If you have any further questions, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

LINDA LINGLE
GOVERNOR OF HAWAII

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

Laura H. Thielen
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

Russell Y. Tsujii
FIRST DEPUTY

KEN C. KAWAHARA
DEPUTY DIRECTOR FOR
THE COMMISSION ON
WATER RESOURCE MANAGEMENT

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND MANAGEMENT
STATE PARKS

March 10, 2008

Mr. Perry J. White
Planning Solutions, Inc.
210 Ward Avenue, Suite 330
Honolulu, Hawaii 96814

Dear Mr. White:

Subject: Kahe'awa Wind Power II (KWP II) HRS 343 FEA-EISPN

Department of Land and Natural Resources, Division of Forestry and Wildlife have reviewed the Kahe'awa Wind Power II FEA-EISPN and provide the following comments for your consideration. Our previous March 21, 2007 and August 23, 2006 (attached) comments remain relevant to this Kahe'awa Wind Power II document. We have the same concerns in the first phase that need mitigation in the second phase.

The proposed substation (option 1) and the downwind sites are in known nesting areas for the nene as well as the upper portion of the downwind site which is closer to the nene open-top release pens. The additional towers will increase bird strikes as anticipated in first phase. A survey by qualified professional i.e. wildlife biologist should be completed for phase II during the flocking and nesting season of nene as identified in our previous review of this extended project. Additional comments that were contained in our previous review include: mitigate fire ignitions, invasive weed control, noise and view plane concerns. Questions should be addressed through our DOFAW Maui Branch – Forestry, Wildlife, and Trails programs office number (808) 984-8100 or my administrative staff, Nelson L. Ayers, at (808) 587-4175. Thank you for allowing us to review your project.

Sincerely yours,

Paul J. Conry
Administrator

C: Maui DOFAW
OCCL

Attachments

DIVISION OF FORESTRY & WILDLIFE - MAUI

MEMORANDUM

DATE: 11 March 2008

TO: Nelson Ayers, Forester — Ph: 808-587-4175

FROM: Dr. Fern P. Duvall II, Wildlife Biologist
808-873-3502 Phone
808-873-3505 Fax

SUBJECT: Comments for EIS preparation Kaheawa Wind II, referenced to application for Direct Lease on a portion of TMK 2-4-8-001 and 3-6-001:014 for Commercial Wind Farm Expansion

Your suspense date: 09 March 2008
My comments about the application that need discussion are bulleted in the following:

1. This application should require that all the issues, items, and stipulations of the original Kaheawa energy development's EIS, EA, HCP, and HCP Incidental Take Permits be addressed anew. It seems that this is now equivalent to significant parceling out, and portioning of what is a very large scale project, the scope and imprint of which should have been all addressed together in the project's original first stage of development and the original EIS, EA and HCP processes.
2. The built out effect of project-introduced invasive species, and impacts on birds, flora of the current site requires scrutiny. No methods are presented for invasive species detection, interception, or mitigation for this new work. At a minimum inspection protocols and methods for all equipment and contractor equipment, tower components, and construction materials (some coming from out-of–country manufacture) should presented. How will mitigation be handled for any invasive species introductions?
3. Meterological Towers are mentioned. Will any be permanently left in place? How will possible take of birds by met towers – temporary assessment type, or permanent - be integrated into this application approval process? Will downed-wildlife searcher efficiency, and downed wildlife search efficiency trials be instituted for met tower, and wind towers?
4. No adequate flora survey has been done since the October 2006 vegetation survey, at that time 80% of the site had been burned. A resurvey of the old burn site should be done to document vegetation

present on the site – especially all areas proposed top be roads, or met tower sites, or wind tower pads sites. The original pre-burned site contained a more diverse native plant biota, than the Phase I (first 20 towers) area, due to its gulch walls and microhabitats.

John Medeiros' comments follow -

Fern,

Here's my comments for the Kaheawa II proposed project.

Concerns:

-- The proposed substation (option 1) and the downwind sites are in known nesting areas for the nene.
-- In the downwind sites, nene are known to flock the area and may become possible nesting sites. The upper portion of the downwind site is also closer to the nene open-top release pen
-- Addition towers may also increase possible bird strikes.

Recommendation:

-- To resurvey the proposed areas during the flocking and nesting season of nene.
--To have the Kaheawa Wind Project fund a full-time permanent position for DLNR, Forestry and Wildlife to monitor nene in the existing and proposed sites. Since the release site is adjacent to the existing and proposed area, this position will be used to monitor nene activities in the area, respond to down birds, and monitor the West side population. It is also recommended that this position be in place at the beginning of any work done in the proposed area and be equipped with a vehicle and necessary equipment.

John S. Medeiros
Department of Land & Natural Resources
Division of Forestry & Wildlife
54 South High Street, Room 101
Wailuku, Hawaii 96793
Phone - (808)-873-3510 Fax (808) 873-3505

Division of Forestry & Wildlife

1151 Punchbowl Street, Rm. 325 • Honolulu, HI 96813 • (808) 587-0166 • Fax: (808) 587-0160

August 23, 2006

MEMORANDUM

TO: Gary Martin, Land Agent
Land Division

THRU: Russell Y. Tsuji, Administrator
Land Division

FROM: Paul J. Conry, Administrator
Division of Forestry and Wildlife

SUBJECT: Request for Comments: Kaheawa Wind Power II, LLC, Ukumehame, Lahaina, Wailuku, Maui, TMK: (2) 4-8-001: por. 001.

DOFAW understands that the applicant is requesting authorization through the Board of Land and Natural Resources and Land Division to negotiate a lease of additional state land for the expansion of their wind farm at Ukumehame, Maui, Hawaii. We provide the following comments to your subject request.

- The applicant must comply with all state and federal environmental protection laws appropriate to this project.
- The applicant must continue their compliance of the terms they agreed to regarding their existing Habitat Conservation Plan.
- The applicant must obtain another Habitat Conservation Plan and Incidental Take approval or an approved amendment to their existing Habitat Conservation Plan and Incidental Take License prior to any new construction activities.
- The applicant must implement an active monitoring and response protocol to prevent further invasive plant introductions to the area and most importantly, keep them from spreading into nearby forest reserve.
- There is an apparent confusion to the number of additional towers being requested (14 or 18). Please confirm the correct number of towers that is being requested.
- DOFAW is concerned on the location of these towers once the numbers are confirmed because they may be located on possible nene nesting sites. Please work with the Maui DOFAW Wildlife staff regarding this issue.
- The applicant will need to take seriously the removal of construction debris and materials during construction. Stricter regulations of the applicant's lease by DLNR (landowner) or Department of Health (environment laws) are needed to

prevent debris from settling into the gulch areas with the current lease or should be added to the amended lease. Thank you for the opportunity to comment on this project.

C: DOFAW Maui Branch
John Medeiros, DOFAW Maui Wildlife
Bill Standley, DOFAW Administration

Division of Forestry & Wildlife

1151 Punchbowl Street, Rm. 325 ▯ Honolulu, HI 96813 ▯ (808) 587-0166 ▯ Fax: (808) 587-0160

March 21, 2007

MEMORANDUM

TO: Tiger Mills, Planner
Office of Conservation and Coastal Land

FROM: Paul J. Conry, Administrator
Division of Forestry and Wildlife

SUBJECT: CDUA MA-3380, Meteorological Measurement Towers, Kaheawa Wind Power II, LLC's (KWPII) TMK: (2) 4-8-001: 001 & (2) 3-6-001: 014 Olowalu-Ukumehame, Lahaina, Maui, Hawaii.

We appreciate the opportunity to comment on this project. DLNR, Division of Forestry and Wildlife have the following comments from DOFAW wildlife staff in administration and from our DOFAW Maui branch staff.

Administration wildlife staff:

The applicant should be able to proceed with the construction of the tower but should be required to comply with, in addition to the standard conditions OCCL generally applies to all such CDUAs, the following conditions (which are the same with those applied under a similar request made by KWP 2 years ago file MA-2778). A qualified wildlife biologist should be retained to survey the area surrounding each tower for downed birds/bats two to three times a week in March through November 15th. These surveys should be conducted using the protocol for the Habitat Conservation Plan that was previously approved by the Board of Land and Natural Resources. The applicant should use a combination of fluorescent foam wraps and "bird diverters" along all guy wires. If any impacts to listed species do occur, the tower should be removed as soon as possible and not reconstructed until impacts are covered under a new amended Habitat Conservation Plan. Any take to listed species that occur prior to the approval of a Habitat Conservation Plan and the issuance of the accompanying Incidental Take License will not be authorized and the

applicant will be liable to prosecution under the State and Federal endangered species laws.

Maui Branch:

Prior and during construction of these met towers, a survey is required to determine the species of wildlife in the area i.e. nene, pueo, seabirds etc. Encasing the guy wires with PVC tubing or fencing tape along the entire length of the guy wires is recommended. Project managers will need to flag and gps all areas where the met towers will be located and installed. This will allow wildlife staff to review pas and current records of nesting site and field observations on nene; especially those near met towers 3 and 4. Thank you for the opportunity to review this project.

C: DOFAW Maui Branch

PLANNING SOLUTIONS

May 12, 2008

Mr. Paul J. Conry, Administrator
Division of Forestry and Wildlife
Department of Land and Natural Resources
State of Hawai'i
1151 Punchbowl Street
Honolulu, Hawai'i 96813

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Conry:

Thank you for your March 10, 2008 letter concerning Kaheawa Wind Power II LLC's (KWP II's) proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and compiling written comments from DOFAW's Maui and O'ahu Offices.

Your comments are reproduced below in italics, grouped by office and date. Our responses are given under each comment.

O'ahu DOFAW Office – March 10, 2008

Comment 1:

The proposed substation (option 1) and the downwind sites are in known nesting areas for the nene as well as the upper portion of the downwind site which is closer to the nene open-top release pens. The additional towers will increase bird strikes as anticipated in first phase. A survey by qualified professional i.e. wildlife biologist should be completed for phase II during the flocking and nesting season of nene as identified in our previous review of this extended project.

Response: KWP II has retained a qualified wildlife biologist to complete surveys during the Nēnē flocking and nesting season to determine the extent to which nesting and use of the area is occurring by that and other protected species. As with KWP I, the results of Nēnē surveys will be used to help avoid and minimize potential adverse effects through careful siting and construction and operations practices. The results of the surveys will also help to identify additional mitigation as necessary to ensure a net conservation benefit to the species. Detailed plans for accomplishing these goals will be addressed either in an amendment to the existing Habitat Conservation Plan (HCP) for wind facilities at Kaheawa or in a separate HCP for the Kaheawa Wind Power II project, as appropriate.

Comment 2:

Additional comments that were contained in our previous review include: mitigate fire ignitions, invasive weed control, noise and view plane concerns.

Response: The *Draft EIS* for the project will discuss the measures that KWP II will take to protect against wildfires, control invasive weeds, and minimize noise and visual impacts.

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

Maui DOFAW Office (Dr. Fern Duvall) – March 11, 2008

Comment 3:

This application should require that all the issues, items, and stipulations of the original Kaheawa energy development's EIS, EA, HCP, and HCP Incidental Take Permits be addressed anew. It seems that this is now equivalent to significant parceling out, and portioning of what is a very large scale project, the scope and imprint of which should have been all addressed together in the project's original first stage of development and the original EIS, EA and HCP processes.

Response: At the time the KWP I project was developed it was unknown whether there would be a market demand for further wind energy on Maui. The KWP II project proposal is the result of recent dramatic changes in the price of conventional (i.e., fossil fuel) energy, as well as the island utility's new-found confidence in its ability to integrate substantial amounts of fluctuating wind energy into its grid. This opportunity was neither anticipated nor planned for at the time that the KWP I facility was proposed and approved.

In order to develop the facilities described in the EA/EISPN, KWP II must obtain additional approvals and undergo a complete review, including an assessment of the cumulative effects of both the existing and proposed wind generation facilities in the Kaheawa area. If possible and allowed by the permit-issuing agencies, KWP II will seek a modification to the Incidental Take Permit and HCP that was originally issued for KWP I, thereby revisiting their issues, scope, and stipulations anew as this comment suggests. We note that this review will now have the benefit of a large amount of data that has been collected at the site through the efforts of KWP in coordination with DOFAW and USFWS. Accordingly, the *EIS* will discuss the impacts of the facilities associated with KWP II and relate them to the cumulative impacts of both wind facilities where relevant.

Comment 4:

The built out effect of project-introduced invasive species and impacts on birds, flora of the current site requires scrutiny. No methods are presented for invasive species detection, interception, or mitigation for this new work. At a minimum inspection protocols and methods for all equipment and contractor equipment, tower components, and construction materials (some coming from out-of-country manufacture) should presented [sic]. *How will mitigation be handled for any invasive species introductions?*

Response: Thank you for your input. The *Draft EIS* will include a discussion on measures KWP II will implement for invasive species detection, interception, or mitigation for the project. The discussion will benefit from knowledge gained during the development and operation of the existing wind generating facilities at Kaheawa Pastures, but we do not anticipate that the *EIS* will scrutinize the existing facilities.

Comment 5:

Meteorological Towers are mentioned. Will any be permanently left in place? How will possible take of birds by met towers – temporary assessment type, or permanent - be integrated into this application approval process? Will downed-wildlife searcher efficiency, and downed wildlife search efficiency trials be instituted for met tower, and wind towers?

Response: As stated on page 2-4 of the *EA/EISPN*, two permanent meteorological towers and a communications tower are planned as part of the project. KWP II plans to monitor take of birds from these structures and the wind turbines using the same approved methodologies that are currently in use for KWP I. This will be discussed in detail in the *Draft EIS.*

Comment 6:

No adequate flora survey has been done since the October 2006 vegetation survey, at that time 80% of the site had been burned. A resurvey of the old burn site should be done to document vegetation present on the site – especially all areas proposed top [sic] *be roads, or met tower sites, or wind tower pads sites. The original pre-burned site contained a more diverse native plant biota, than the Phase I (first 20 towers) area, due to its gulch walls and microhabitats.*

Response: KWP II will commission a flora survey of all four siting areas being considered as part of its proposed project. The results will be included in the *Draft EIS.* At the present time we do not plan to survey other areas on and around the KWP I area that may have been affected by the fire. If the Department has undertaken (or plans to undertake in the near future) a survey of any of its lands that were affected by the fire that encroached upon the area near the existing wind farm we would very much appreciate it if you would send us a copy of the survey report and/or apprise us of the proposed survey methodology and timing.

Maui DOFAW Office (John Medeiros) – March 11, 2008

Comment 7:

Concerns:

-- The proposed substation (option 1) and the downwind sites are in known nesting areas for the nene.

-- In the downwind sites, nene are known to flock the area and may become possible nesting sites [sic]. *The upper portion of the downwind site is also closer to the nene open-top release pen.*

-- Addition towers may also increase possible bird strikes.

Recommendation:

-- To resurvey the proposed areas during the flocking and nesting season of nene.

--To have the Kaheawa Wind Project fund a full-time permanent position for DLNR, Forestry and Wildlife to monitor nene in the existing and proposed sites. Since the release site is adjacent to the existing and proposed area, this position will be used to monitor nene activities in the area, respond to down birds, and monitor the West side population. It is also recommended that this position be in place at the beginning of any work done in the proposed area and be equipped with a vehicle and necessary equipment.

Response: For a response to the first recommendation contained in this comment please see our earlier response to Comment #1. Regarding your second recommendation that KWP II provide funding for a DOFAW position to monitor Nēnē activities in the area, respond to down birds, and monitor the West side population, we note that KWP has two (2) full-time biologists in charge of

HCP wildlife resources and conservation initiatives at KWP I and the areas presently occupied by and adjacent to 4 temporary met towers on portions of the proposed KWP II site. These biologists work closely at various times of the year alongside and in coordination with DOFAW Nēnē biologists to obtain information on Nēnē distribution, nesting, flocking behavior, and provide valuable information on banded birds that enable DOFAW to estimate population status. Under its present HCP, Kaheawa Wind Power continues to dedicate financial support for DOFAW wildlife personnel and has provided funding for a vehicle to support their work. Close coordination between KWP II wildlife biologists and DOFAW personnel on matters associated with Nēnē ecology and monitoring in the immediate area prior to, during, and after site development will be addressed in the *Draft EIS*.

O'ahu DOFAW Office to DLNR Land Division Regarding Proposed KWP II Land Lease – August 23, 2006

Comment 8:

The applicant must comply with all state and federal environmental protection laws appropriate to this project.

Response: KWP II has informed us that it will comply with all State and federal environmental protection laws appropriate to the project.

Comment 9:

The applicant must continue their compliance of the terms they agreed to regarding their existing Habitat Conservation Plan..

Response: KWP I has informed us that it will continue its compliance with the terms agreed to in the Habitat Conservation Plan for the existing facility.

Comment 10:

The applicant must obtain another Habitat Conservation Plan and Incidental Take approval or an approved amendment to their existing Habitat Conservation Plan and Incidental Take License prior to any new construction activities.

Response: KWP II LLC understands that it will need incidental take coverage for the proposed project from both the State and Federal governments. It will work with the U.S. Fish and Wildlife Service, DOFAW, and KWP LLC to either complete another HCP in conjunction with a new Incidental Take Permit (ITP)/Incidental Take License or to amend the existing HCP and Incidental Take Permit (ITP)/Incidental Take License prior to construction of KWP II.

Comment 11:

The applicant must implement an active monitoring and response protocol to prevent further invasive plant introductions to the area and most importantly, keep them from spreading into nearby forest reserve.

Response: The *Draft EIS* will discuss the measures KWP II proposes to take (including monitoring) to prevent invasive plants from spreading or being introduced to the area around its proposed facilities.

Comment 12:

There is an apparent confusion to the number of additional towers being requested (14 or 18). Please confirm the correct number of towers that is being requested.

Response: As described in Section 2.2.1 of the *EA/EISPN*, the proposal is to install from 14 to 20 1.5 MW wind turbine generators (WTGs) on the KWP II site. The actual number of WTGs will depend on the results of the applicant's analysis of the wind data that is now being collected, the outcome of environmental and economic analyses that KWP II is presently conducting, and the applicant's ability to sign a power purchase agreement with the Maui Electric Company. In addition to the WTGs, the project will also entail the installation and operation of two permanent meteorological monitoring towers. The *Draft EIS* will include a detailed description and impact analysis of the action alternatives KWP II is considering.

Comment 13:

DOFAW is concerned on the location of these towers once the numbers are confirmed because they may be located on possible nene nesting sites. Please work with the Maui DOFAW Wildlife staff regarding this issue.

Response: The applicant is committed to working closely with DOFAW and continuing the relationship that its wildlife biologists have established with the agency's staff. Please see response to Comment #1 (regarding Nēnē surveys), Comment #10 (regarding DOFAW coordination), and Comment #12 (regarding the number of proposed towers).

Comment 14:

The applicant will need to take seriously the removal of construction debris and materials during construction. Stricter regulations of the applicant's lease by DLNR (landowner) or Department of Health (environment laws) are needed to prevent debris from settling into the gulch areas with the current lease or should be added to the amended lease.

Response: KWP II has informed us that it will comply with all regulations and lease provisions regarding the removal of construction debris and materials during construction.

O'ahu DOFAW Office to DLNR Office of Conservation and Coastal Lands Commenting on Conservation District Use Application for KWP II Met Towers – March 21, 2007

NOTE: The following comments are reproduced from your March 21, 2007 letter relating to KWP's December 2006 Conservation District Use Application (CDUA) for four meteorological monitoring towers. KWP II responded to those comments in a letter dated May 4, 2007, and DLNR approved the CDUA for the met towers in July 2007. KWP II's previous responses fully address those comments, but we are able to provide updates on the status of certain items.

Comment 15:

A qualified wildlife biologist should be retained to survey the area surrounding each tower for downed birds/bats two to three times a week in March through November 15th. These surveys should be conducted using the protocol for the Habitat Conservation Plan that was previously approved by the Board of Land and Natural Resources.

Response: The approved met towers were installed in August 2007. Since that time a qualified wildlife biologist has searched the area around each tower at least twice a week for downed wildlife. The surveys will continue to be conducted year-round so long as the towers remain in place.

Comment 16:

The applicant should use a combination of fluorescent foam wraps and "bird diverters" along all guy wires.

Response: KWP II has installed the same kinds of Bird-Flight Diverters$_{TM}$ on the temporary met towers as are used on the existing KWP I meteorological monitoring towers. These Bird-Flight Diverters are manufactured of rigid, high impact PVC; this material has good UV and chemical resistance and high tensile strength, which makes them durable. The fact that to date, no birds have been harmed by the towers is testament to the Bird-Flight Diverters' effectiveness.

Comment 17:

If any impacts to listed species do occur, the tower should be removed as soon as possible and not reconstructed until impacts are covered under a new amended Habitat Conservation Plan. Any take to listed species that occur prior to the approval of a Habitat Conservation Plan and the issuance of the accompanying Incidental Take License will not be authorized and the applicant will be liable to prosecution under the State and Federal endangered species laws.

Response: Based on the data collected over the past five years, the potential for incidental impacts to listed species is very low. However, in accordance with Condition 6 of its approved CDUP, if impacts to listed species do occur KWP II will remove the met tower(s) until such time as they are covered by an Incidental Take License and accompanying (amended) Habitat Conservation Plan.

Comment 18:

Prior and during construction of these met towers, a survey is required to determine the species of wildlife in the area i.e. nene, pueo, seabirds etc. Encasing the guy wires with PVC tubing or fencing tape along the entire length of the guy wires is recommended. Project managers will need to flag and gps all areas where the met towers will be located and installed. This will allow wildlife staff to review past and current records of nesting site and field observations on nene; especially those near met towers 3 and 4.

Response: Exhibits N and O of the Conservation District Use Permit (MA-3380) for the temporary met towers contained the results of bird and bat surveys conducted in the project area for the existing wind energy facility. KWP I's ongoing monitoring of the area continues to add to the database, and the monitoring results are shared with DLNR staff on a regular basis. Prior to construction of the four met towers at the KWP II site, staff biologists surveyed the entire area within a 125 meter radius of each tower site to confirm the absence of notable wildlife (e.g., nesting Nēnē). No sensitive

wildlife or nesting activities were observed. As noted in our response to Comment 15, the monitoring around each tower is ongoing.

Thank you again for your comments. If you have any further questions, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, First Wind
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON

MEREDITH J. CHING
JAMES A. FRAZIER
NEAL S. FUJIWARA
CHIYOME L. FUKINO, M.D.
DONNA FAY K. KIYOSAKI, P.E.
LAWRENCE H. MIIKE, M.D., J.D.

KEN C. KAWAHARA, P.E.
DEPUTY DIRECTOR

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

March 14, 2008

Mr. Perry J. White
Planning Solutions
210 Ward Avenue, Suite 330
Honolulu HI 96814-4012

Dear Mr. White:

SUBJECT: Kaheawa Wind Power II EA/EISPN

FILE NO.: N/A

Thank you for the opportunity to review the subject document. The Commission on Water Resource Management (CWRM) is the agency responsible for administering the State Water Code (Code). Under the Code, all waters of the State are held in trust for the benefit of the citizens of the State, therefore, all water use is subject to legally protected water rights. CWRM strongly promotes the efficient use of Hawaii's water resources through conservation measures and appropriate resource management. For more information, please refer to the State Water Code, Chapter 174C, Hawaii Revised Statutes, and Hawaii Administrative Rules, Chapters 13-167 to 13-171. These documents are available via the Internet at *http://www.hawaii.gov/dlnr/cwrm*.

Our comments related to water resources are checked off below.

☐ 1. We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.

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

☐ 3. There may be 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.

Permits required by CWRM: Additional information and forms are available at *www.hawaii.gov/dlnr/cwrm/forms.htm*.

☐ 4. The proposed water supply source for the project is located in a designated ground-water management area, and a Water Use Permit is required prior to use of ground water.

☐ 5. A Well Construction Permit(s) is (are) required before the commencement of any well construction work.

☐ 6. A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.

☐ 7. There is (are) well(s) located on or adjacent to this project. If wells are not planned to be used and will be affected by any new construction, they must be properly abandoned and sealed. A permit for well abandonment must be obtained.

☐ 8. Ground-water withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

☐ 9. A Stream Channel Alteration Permit(s) is (are) required before any alteration can be made to the bed and/or banks of a stream channel.

☐ 10. A Stream Diversion Works Permit(s) is (are) required before any stream diversion works is constructed or altered.

☐ 11. A Petition to Amend the Interim Instream Flow Standard is required for any new or expanded diversion(s) of surface water.

☐ 12. The planned source of water for this project has not been identified in this report. Therefore, we cannot determine what permits or petitions are required from our office, or whether there are potential impacts to water resources.

☐ 13. We recommend that the report identify feasible alternative non-potable water resources, including reclaimed wastewater.

☒ OTHER:
No comments

If there are any questions, please contact Charley Ice at 587-0251.

Sincerely,

KEN C. KAWAHARA, P.E.
Deputy Director

CI:ss

PLANNING
SOLUTIONS

April 14, 2008

Mr. Ken C. Kawahara, P.E., Deputy Director
Commission on Water Resource Management
Department of Land and Natural Resources
State of Hawai'i
P.O. Box 621
Honolulu, Hawai'i 96809

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Kawahara:

Thank you for your March 14, 2008 letter concerning Kaheawa Wind Power II LLC's proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and preparing your letter.

We understand that your Department has no comments to offer on the project at this time. If you have any questions in the future concerning this project, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

CHARMAINE TAVARES
Mayor

JEFFREY S. HUNT
Director

COLLEEN M. SUYAMA
Deputy Director

COUNTY OF MAUI
DEPARTMENT OF PLANNING

March 14, 2008

Mr. Perry J. White
Planning Solutions
Ward Plaza
210 Ward Avenue
Suite 300
Honolulu, Hawaii 96814-4012S

Dear Mr. White:

SUBJECT: Environmental Impact Statement Preparation Notice (EISPN) Comments in Preparation of a Draft Environmental Impact Statement for the Proposed Kaheawa Wind Power II Wind Generation Facility located at TMK: 4-8-001:001 and 3-6-001:014, Island of Maui, Hawaii (EAC 2008/0007)

The Maui County Department of Planning (Department) is in receipt of the above-referenced document for the proposed Kaheawa Wind Power II Generation Facility. The Department understands the proposed action includes the following:

- The construction of a new 21 – 30 mega watt (MW) wind power facility (Facility) on approximately 300-400 acres of land adjacent to the existing Kaheawa Wind Power facility located at Ma`alaea, Ukumehame, Lahaina District, Island of Maui.

- The proposed Facility will be comprised of meteorological and communication towers to support data gathering and control functions; internal service roads to be connected to the existing main access road; an operations and maintenance building to house personnel, equipment, and facility spare parts; 14 to 20 General Electric (GE) 1.5 MW wind turbine generators; an electrical substation, battery energy storage system, and interconnected facilities to link the Facility to the

250 SOUTH HIGH STREET, WAILUKU, MAUI, HAWAII 96793
MAIN LINE (808) 270-7735; FACSIMILE (808) 270-7634
CURRENT DIVISION (808) 270-8205; LONG RANGE DIVISION (808) 270-7214; ZONING DIVISION (808) 270-7253

existing MECO power transmission system; and electrical power lines connecting the turbines with the substation.

Based on the foregoing, the Department provides the following comments in preparation of the Draft EIS:

1. The land use designations for the project area are as follows:
   a. State Land Use – Conservation
   b. Community Plan:
      i. TMK: 3-6-001:014, Kihei-Makena Community Plan - Conservation;
      ii. TMK: 2-4-008:001, West Maui Community Plan - Conservation
   c. County Zoning – Not Zoned
   d. Other – Located outside of the Special Management Area

2. Maui County is generally supportive of the development of alternative energy sources. The Draft EIS should include a thorough discussion of how the proposed project implements the County General Plan as well as the West Maui and Kihei-Makena Community Plans.

3. The West Maui Mountains have been identified as distinctive visual resources in the *Maui Coastal Scenic Resources Study*, August 1990 done for the Department by Environmental Planning Associates Inc. This should be included as part of the proposed visual impacts of the Draft EIS.

4. The proposed project is located on lands within the Coastal Zone Management Area pursuant to Chapter 205A Coastal Zone Management, Hawaii Revised Statutes (HRS). The Draft EIS should include a thorough discussion of how the proposed project complies with the objectives and policies of the Coastal Zone Management Program.

5. The Draft EIS should identify the Conservation District Sub-Zone of the property for the proposed project.

6. The introduction of invasive species, particularly fireweed, has dramatically expanded with the operation of the Kaheawa Wind Power I Project (KWP I). In 2007, the Maui County Environmental Coordinator (MCEC) met with Kaheawa Wind Power Officials and requested that action be taken to control the spread of fireweed. The Draft EIS should include a discussion on the introduction of and

spread of invasive species at KWP I. Further, what mechanisms have been put in place by KWP I for the existing facility to stop the spread and to control the fireweed. Lastly, the Draft EIS should identify how the proposed project will seek to minimize the risk of introducing and spreading invasive species.

7. The maintenance of existing functional native ecosystems and the use of native plants on the proposed project site are strongly encouraged as they can minimize soil erosion and risk of wildfires. The Draft EIS should include a discussion on how this will be accomplished during the construction phase of the project, including the access roadways; as well as after the projects construction.

8. Further, the existing vegetation provides habitat to a number of endemic, indigenous and migratory birds and mammals. The U.S. Fish and Wildlife Service and the State Department of Land and Natural Resources should continue to be consulted on the risks of bird strikes.

9. Economic benefits are cited to Maui Electric Company (MECO) and the project developer for mitigating green house gas (GHG) emissions of equivalent fossil fuel to be displaced by the proposed project. Additionally, the proposed project will assist MECO to achieve its Integrated Resource Planning (IRP) objective as well as meet its renewable portfolio standard (RPS) goal. The Draft EIS should also discuss what actions, if any, will be taken to ensure that these proposed economic benefits will be shared with the public in the form of lower electric bills. For instance could the power purchase agreement (PPA) with MECO be translated into advantageous rates for the public?

10. The proposed storage battery is identified as a flow battery; however, the trade mark mentioned in the project, Power Cell, does not currently exist for this type of storage. The Draft EIS should include the identification of the make and manufacturer of the proposed storage system. This will then determine required mitigation measures based upon the chemical composition and containment methods for the proposed storage system.

11. The Honoapi'ilani Highway can become congested at times. The DEIS should address any impacts to the highway from the proposal, along with mitigation, including timing of impacts during non-peak traffic periods.

12. The DEIS should discuss what information has been acquired from the operation of the existing wind turbines (KWP I) and how this information will be incorporated into the proposal for the new wind turbines.

Thank you for the opportunity to comment. Please include the Department on the distribution list for the Draft. Should you require further clarification, please contact Robyn L. Loudermilk, Staff Planner by email at robyn.loudermilk@mauicounty.gov or by phone at 270-7180.

Sincerely,

JEFFREY S. HUNT, AICP
Planning Director

JSH:RLL:bg
c: Clayton I. Yoshida, AICP, Planning Program Administrator
Robyn L. Loudermilk, Staff Planner
Kuhea Paracuelles, Environmental Coordinator
Victor Reyes, Energy Commissioner
Project File
General File
K:\WP_DOCS\PLANNING\EAC\2008\0007_KaheawaIIEISP\EAC_Comments.DOC

PLANNING
SOLUTIONS

April 21, 2008

Mr. Jeffrey S. Hunt, Planning Director
Department of Planning
County of Maui
250 S. High Street
Wailuku, Hawai'i 96793

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Hunt:

Thank you for your March 14, 2008 letter concerning Kaheawa Wind Power II LLC's (KWP II's) proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and providing written comments.

Item-by-item responses to your comments are provided below. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

Comment 1:

The land use designations for the project area are as follows:

a. State Land Use – Conservation

b. Community Plan:

i. TMK: 3-6-001:014, Kihei-Makena Community Plan - Conservation

ii. TMK: 2-4-008:001, West Maui Community Plan - Conservation

c. County Zoning – Not Zoned

d. Other – Located outside of the Special Management Area

Response: Thank you for confirming the land use designations for the KWP II project site. They are consistent with our understandings and will be reflected in the *Draft EIS.*

Comment 2:

Maui County is generally supportive of the development of alternative energy sources. The Draft EIS should include a thorough discussion of how the proposed project implements the County General Plan as well as the West Maui and Kihei-Makena Community Plans.

Response: The *Draft EIS* for the project will include a thorough discussion of how the proposed project implements the County General Plan, the West Maui Community Plan and the Kihei-Makena Community Plan.

Comment 3:

The West Maui Mountains have been identified as distinctive visual resources in the Maui Coastal Scenic Resources Study, August 1990 done for the Department by Environmental Planning Associates Inc. This should be included as part of the proposed visual impacts of the Draft EIS.

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

Response: Thank you for noting that the West Maui Mountains are identified as distinctive visual resources and providing a citation. We will address the effects that the proposed facilities will have on them in the visual impact section of the *Draft EIS.*

Comment 4:

The proposed project is located on lands within the Coastal Zone Management Area pursuant to Chapter 205A Coastal Zone Management, Hawaii Revised Statutes (HRS). The Draft EIS should include a thorough discussion of how the proposed project complies with the objectives and policies of the Coastal Zone Management Program.

Response: The *Draft EIS* will include a section that evaluates the proposed project's compliance with each of the applicable objectives and policies listed in Chapter 205A, Hawaii Revised Statutes.

Comment 5:

The Draft EIS should identify the Conservation District Sub-Zone of the property for the proposed project.

Response: The KWP II project site is within the "General" subzone of the Conservation District, and we will include this information in the *Draft EIS.*

Comment 6:

The introduction of invasive species, particularly fireweed, has dramatically expanded with the operation of the Kaheawa Wind Power 1 Project (KWP I). In 2007, the Maui County Environmental Coordinator (MCEC) met with Kaheawa Wind Power Officials and requested that action be taken to control the spread of fireweed. The Draft EIS should include a discussion on the introduction of and spread of invasive species at KWP I. Further, what mechanisms have been put in place by KWP 1 for the existing facility to stop the spread and to control the fireweed. Lastly, the Draft EIS should identify how the proposed project will seek to minimize the risk of introducing and spreading invasive species.

Response: The *Draft EIS* will include a discussion of the fireweed situation at Kaheawa Pastures and the invasive species detection, interception, and mitigation measures KWP II will implement for its proposed project. However, it is worth noting that the biologist responsible for the invasive species program at the existing wind farm has noted that fireweed was first seen at Kaheawa Pastures in and around the existing windfarm only after an extensive wildfire swept through the region in September 2006. Fireweed is a fire-adapted pasture species that readily establishes in areas that have been disturbed by events such as fire. Its seeds are naturally dispersed by wind and once established it is a challenge to control. There are seed banks associated with fireweed stands in West Maui immediately upwind of Kaheawa Pastures, and it is likely that seeds spread from there across the burned area (including the KWP I site) following the wildfire. In short, the species' spread was not triggered by construction or operation of the existing wind farm. In fact, KWP staff, equipment and infrastructure shortened the time needed to bring the fire under control, thereby limiting the burned area where fireweed could easily become established.

Following the 2007 meeting referenced in your letter, KWP and the Maui County Office of the Environmental Coordinator co-founded the Fireweed Working Group (FWG). The FWG provides a forum where individuals from various sectors of the conservation community (County of Maui, State of Hawai'i, Maui Invasive Species Commission, USDA, University of Hawaii, and KWP) with expertise in fireweed management can share ideas and coordinate efforts. Since its founding, the FWG has facilitated information gathering, conducted field surveys, and coordinated manual removal initiatives that have enhanced land managers' understanding of fireweed and the factors that control and/or limit its distribution. For its part, KWP has hosted research teams who are independently looking for ways to better characterize the conditions that promote fireweed growth and dispersal and to evaluate possible control methods. KWP continues to look for guidance from these specialists and will rely upon the results of ongoing studies to determine the most effective means of countering the ingress of this species at Kaheawa Pastures.

KWP II LLC, if the proposed project is approved, will support the existing collaborative efforts to control and manage fireweed by implementing pro-active measures to reduce the likelihood of fireweed introduction to other areas of Kaheawa Pastures that might be affected by its activities. These measures will be discussed in detail in the *Draft EIS,* and will include:

- Surveying areas proposed for expansion and ground clearing in advance to delineate proximity to established beds of fireweed;
- Implementing control and management initiatives aimed at excluding fireweed propagules on bare ground using manual and, where warranted, chemical treatments;
- Working in advance with local experts and stakeholders to obtain the best recommendations for control measures and to develop protocols for documentation and sharing results;
- Inspecting potential off-site sources of materials (gravel, fill, etc.), and prohibiting the import of materials from sites that are known or likely to contain seeds or propagules of invasive species. ;
- Requiring that vehicle operators transporting materials to KWP II from off-site follow protocols for removing soils and plant materials from vehicles and equipment prior to entry onto the site.

Comment 7:

The maintenance of existing functional native ecosystems and the use of native plants on the proposed project site are strongly encouraged as they can minimize soil erosion and risk of wildfires. The Draft EIS should include a discussion on how this will be accomplished during the construction phase of the project, including the access roadways; as well as after the projects construction.

Response: The *Draft EIS* will discuss the extent to which native vegetation is still present on the land that would be affected by construction of the proposed facilities and will explain the measures (including revegetation) it will take to minimize erosion during and after construction of KWP II. KWP II has indicated that native plants will be used whenever possible just as has been done at the existing Kaheawa Pastures wind farm.

Comment 8:

Further, the existing vegetation provides habitat to a number of endemic, indigenous and migratory birds and mammals. The U.S. Fish and Wildlife Service and the State Department of Land and Natural Resources should continue to be consulted on the risks of bird strikes.

Response: Under the HCP for the existing wind farm, its environmental and wildlife staff work in coordination with the U.S. Fish and Wildlife Service and the State Department of Land and Natural Resources to ensure that appropriate minimization and mitigation measures are implemented on behalf of native, indigenous, and migratory bird species. KWP II LLC understands that it will also need to coordinate with the resource agencies to prepare either an independent Habitat Conservation Plan or to amend and become a party to the HCP and permits for the existing wind farm. In any event, the HCP and binding implementing agreement will provide avoidance, minimization, and mitigation measures for addressing the threats posed to native, indigenous, and migratory bird species. Monitoring and documenting bird strikes and interaction with project structures is a fundamental component of the existing HCP for KWP I and is anticipated to be similarly regarded under the proposed KWP II project.

Comment 9:

Economic benefits are cited to Maui Electric Company (MECO) and the project developer for mitigating green house gas (GHG) emissions of equivalent fossil fuel to be displaced by the proposed project. Additionally, the proposed project will assist MECO to achieve its Integrated Resource Planning (IRP) objective as well as meet its renewable portfolio standard (RPS) goal. The Draft EIS should also discuss what actions, if any, will be taken to ensure that these proposed economic benefits will be shared with the public in the form of lower electric bills. For instance could the power purchase agreement (PPA) with MECO be translated into advantageous rates for the public?

Response: Section 1.2.2 of the EA/EISPN discusses economic benefits of the proposed action. These include generating tax and lease revenue for the State, reducing dependencies on imported (and price-volatile) fossil fuels, and contributing to MECO's IRP and RPS goals, all of which have economic implications. The project's anticipated benefits with respect to reducing greenhouse gas emissions (which are non-economic, though they have economic implications) are discussed separately in Section 1.2.3.

The extent to which the proposed project will produce other economic benefits, particularly "lower electric utility bills", will depend upon many factors that cannot be determined at this time. Among these are the per kilowatt-hour rate established in the Power Purchase Agreement (PPA) between MECO and KWP II and the cost of producing electricity using alternative means (such as the operation of fossil fuel power plants). While it is unlikely that any combination of factors will lead to the non-fuel component of the electric utility bills to consumers being lower than they are at present, given present forecasts of future oil costs it is likely that the availability of electricity from the proposed project will lead to lower utility bills than would be the case if additional wind power is not available. The EIS will discuss this issue in full, but the State of Hawai'i Public Utility Commission will ultimately decide the matter.

Comment 10:

The proposed storage battery is identified as a flow battery; however, the trade mark mentioned in the project, Power Cell, does not currently exist for this type of storage. The Draft EIS should include the identification of the make and manufacturer of the proposed storage system. This will then determine required mitigation measures based upon the chemical composition and containment methods for the proposed storage system.

Response: The *Draft EIS* will describe the proposed battery storage system in detail. It will then discuss the measures (e.g., containment, handling, storage, etc.) that KWP II will take to minimize and/or mitigate the life-cycle effects of the energy storage system.

Comment 11:

The Honoapi'ilani Highway can become congested at times. The DEIS should address any impacts to the highway from the proposal, along with mitigation, including timing of impacts during non-peak traffic periods.

Response: The *Draft EIS* will include a description of existing traffic conditions on Honoapi'ilani Highway and a discussion of how the proposed project will comply with access and highway intersection requirements. It will also discuss potential impacts to traffic during construction and how KWP II plans to minimize and mitigate them. KWP II will consult with the Highways Division Maui District Office on this matter.

Comment 12:

The DEIS should discuss what information has been acquired from the operation of the existing wind turbines (KWP I) and how this information will be incorporated into the proposal for the new wind turbines.

Response: Information from the operation of the existing KWP I facility has helped to inform the design of KWP II. It will also help to inform the minimization and mitigation measures relating to specific aspects of the project such as biota, and the *Draft EIS* will note this.

Thank you again for your comments. If you have any further questions, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

LINDA LINGLE
GOVERNOR OF HAWAII

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

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

In reply, please refer to:
EPO-08-027

March 18, 2008

Mr. Perry J. White
Planning Solutions, Inc
Ward Plaza, Suite 330
210 Ward Avenue
Honolulu, Hawaii 96814-4012

Dear Mr. White:

SUBJECT: Environmental Impact Statement Preparation Notice for Kaeawa Wind Power II – Wind Energy Generation Facility
Ukumehame, Maui, Hawaii
TMK: (2) 4-8-001: 001
(2) 3-6-001: 014

Thank you for allowing us to review and comment on the subject application. The document was routed to the various branches of the Department of Health (DOH) Environmental Health Administration. We have the following Clean Water Branch, Indoor and Radiological Health Branch, and General comments.

Clean Water Branch

The Department of Health, Clean Water Branch (CWB), has reviewed the subject document and offers these comments on your project. Please note that our review is based solely on the information provided in the subject document and its compliance with Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at http://www.hawaii.gov/health/environmental/env-planning/landuse/CWB-standardcomment.pdf.

1. Any project and its potential impacts to State waters must meet the following criteria:

   a. Antidegradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.

   b. Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters.

   c. Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).

2. You are required to obtain a National Pollutant Discharge Elimination System (NPDES) permit for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55). For the following types of discharges into Class A or Class 2 State waters, you may apply for NPDES general permit coverage by submitting a Notice of Intent (NOI) form:

   a. Storm water associated with construction activities, including clearing, grading, and excavation, that result in the disturbance of equal to or greater than one (1) acre of total land area. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. An NPDES permit is required before the start of the construction activities.

   b. Hydrotesting water.

   c. Construction dewatering effluent.

   You must submit a separate NOI form for each type of discharge at least 30 calendar days prior to the start of the discharge activity, except when applying for coverage for discharges of storm water associated with construction activity. For this type of discharge, the NOI must be submitted 30 calendar days before to the start of construction activities. The NOI forms may be picked up at our office or downloaded from our website at: http://www.hawaii.gov/health/environmental/water/cleanwater/forms/genl-index.html.

3. For types of wastewater not listed in Item 2 above or wastewater discharging into Class 1 or Class AA waters, you must obtain an NPDES individual permit. An application for an NPDES individual permit must be submitted at least 180 calendar days before the commencement of the discharge. The NPDES application forms may be picked up at our office or downloaded from our website at http://www.hawaii.gov/health/environmental/water/cleanwater/forms/indiv-index.html.

4. You must also submit a copy of the NOI or NPDES permit application to the State Department of Land and Natural Resources, State Historic Preservation Division (SHPD), or demonstrate to the satisfaction of the CWB that SHPD has or is in the process of evaluating your project. Please submit a copy of your request for review by SHPD or SHPD's determination letter for the project along with your NOI or NPDES permit application, as applicable.

5. Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 Water Quality Certification are required, must comply with the State's Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54, and/or permitting requirements, specified in HAR, Chapter 11-55, may be subject to penalties of $25,000 per day per violation.

If you have any questions, please visit our website at http://www.hawaii.gov/health/environmental/water/cleanwater/index.html, or contact the Engineering Section, CWB, at 586-4309

Noise, Radiation & Indoor Air Quality Branch

Project activities shall comply with the Administrative Rules of the Department of Health, Chapter 11-46, Community Noise Control. Should there be any questions, please contact Russell S. Takata, Environmental Health Program Manager, Indoor and Radiological Health Branch, at 586-4701

General

We strongly recommend that you review all of the Standard Comments on our website: www.state.hi.us/health/environmental/env-planning/landuse/landuse.html. Any comments specifically applicable to this project should be adhered to.

If there are any questions about these comments please contact Jiacai Liu with the Environmental Planning Office at 586-4346.

Sincerely,

KELVIN H. SUNADA, MANAGER
Environmental Planning Office

c: EPO
CWB
IRH
EH-Maui

PLANNING SOLUTIONS

April 16, 2008

Mr. Kelvin H. Sunada, Manager
Environmental Planning Office
Department of Health
State of Hawai'i
P.O. Box 3378
Honolulu, Hawai'i 96801-3378

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Sunada:

Thank you for your March 18, 2008 letter [your reference EPO-080027] concerning Kaheawa Wind Power II LLC's (KWP II's) proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and compiling written comments from your Department's various branches.

Item-by-item responses to the comments are provided below. To simplify your examination, we have reproduced the text of the comments of each branch in *italics* before each response.

Clean Water Branch

Comment 1:

1. Any project and its potential impacts to State waters must meet the following criteria:

a. Antidegradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.

b. Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters.

c. Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).

Response: Thank you for providing these references. Plans for the project call for use of appropriate erosion control measures during and after construction. Since operation of the proposed facilities will not involve activities with significant potential to adversely affect water quality, KWP II believes the project will be consistent with the criteria you referenced. The reasons for this conclusion will be described in the *EIS* for the project.

Comment 2:

You are required to obtain a National Pollutant Discharge Elimination System (NPDES) permit for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55). For the following types of discharges into Class A or Class 2 State waters, you may apply for NPDES general permit coverage by submitting a Notice of Intent (NOI) form:

a. Storm water associated with construction activities, including clearing, grading, and excavation, that result in the disturbance of equal to or greater than one (1) acre of total

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

land area. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. An NPDES permit is required before the start of the construction activities.

b. Hydrotesting water.

c. Construction dewatering effluent.

You must submit a separate NOI form for each type of discharge at least 30 calendar days prior to the start of the discharge activity, except when applying for coverage for discharges of storm water associated with construction activity. For this type of discharge, the NOI must be submitted 30 calendar days before to the start of construction activities. The NOI forms may be picked up at our office or downloaded from our website at: http://www.hawaii.gov/health/environmental/water/cleanwater/forms/genl-index.html.

Response: Thank you for providing information on activities requiring NPDES General Permit coverage. Construction of the proposed KWP II project will not involve hydrotesting or dewatering; however, it will disturb more than one acre of land. Consequently, KWP II intends to apply for NPDES General Permit coverage for construction-related stormwater runoff.

Comment 3:

For types of wastewater not listed in Item 2 above or wastewater discharging into Class 1 or Class AA waters, you must obtain an NPDES individual permit. An application for an NPDES individual permit must be submitted at least 180 calendar days before the commencement of the discharge. The NPDES application forms may be picked up at our office or downloaded from our website at

http://www.hawaii.gov/health/environmental/water/cleanwater/forms/indiv-index.html.

Response: The *Draft EIS* will include a discussion of impacts to surface water resources. It will document the fact that there are no wetlands, perennial streams, or Class I or Class AA waters in the vicinity of the project site that could be affected by the proposed wind farm. Consequently, it is KWP II's understanding that an NPDES Individual Permit will not be required.

Comment 4:

You must also submit a copy of the NOI or NPDES permit application to the State Department of Land and Natural Resources, State Historic Preservation Division (SHPD), or demonstrate to the satisfaction of the CWB that SHPD has or is in the process of evaluating your project. Please submit a copy of your request for review by SHPD or SHPD's determination letter for the project along with your NOI or NPDES permit application, as applicable.

Response: A copy of the NOI-C for construction of the project will be submitted to SHPD. In addition, a copy of KWP II's request for SHPD review or SHPD's determination letter for the project will be submitted to your Department along with the NOI application.

Comment 5:

Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 Water Quality Certification are required, must comply with the State's Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54, and/or permitting requirements, specified in HAR, Chapter 11-55, may be subject to penalties of $25,000 per day per violation.

Response: Thank you for outlining the regulations governing project-related discharges. As noted above, no discharges into State waters are anticipated; therefore the proposed KWP II project is expected to comply with these regulations.

Noise, Radiation & Indoor Air Quality Branch

Comment 6:

Project activities shall comply with the Administrative Rules of the Department of Health, Chapter 11-46, Community Noise Control.

Response: The *Draft EIS* will include a discussion on potential noise impacts of the proposed project. It will explain the extent to which construction and operation of the project will comply with Hawai'i Administrative Rules Chapter 11-46, Community Noise Control.

General

Comment 7:

We strongly recommend that you review all of the Standard Comments on our website: www.state.hi.us/health/environmental/env-planning/landuse/landuse.html. Any comments specifically applicable to this project should be adhered to.

Response: Thank you for directing us to the Standard Comments on your Department's website. KWP II has reviewed them and will ensure that those specifically applicable to the proposed project are adhered to.

Thank you again for your comments. If you have any further questions, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RUSSELL Y. TSUJI
FIRST DEPUTY

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
Office of Conservation and Coastal Lands
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

RECEIVED
OFFICE OF CONSERVATION
AND COASTAL LANDS
2008 MAR 11 A 11: 36

DEPT. OF LAND &
NATURAL RESOURCES
STATE OF HAWAII

REF:OCCL:MC
FILE NO.: MA-08-136

Suspense Date: 21 Days from stamped date

MEMORANDUM:

FEB 19 2008

TO: DLNR
___ Historic Preservation Division
___ Forestry and Wildlife
___ Land Division
✓ Division of Conservation and Resource Enforcement

FROM: Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

SUBJECT: REQUEST FOR COMMENTS
Correspondence MA-08-136
EIS PREPARATION NOTICE
Kaheawa Wind Power II

APPLICANT: Kaheawa Wind Power II LLC

TMKs: (2) 4-8-01:1, 14

LOCATION: Kaheawa, Mā'alea, Maui

RECEIVED
2008 FEB 26 AM 8: 39
DOCARE, MAUI
DEPT. OF LAND AND
NATURAL RESOURCES

Please contact Michael Cain at 587-0048, should you have any questions on this matter.

RECEIVED
2008 MAR 10 PM 4: 59
DOCARE, MAUI
DEPT. OF LAND AND
NATURAL RESOURCES

If no response is received by the suspense date, we will assume there are no comments. The suspense date starts from the date stamp.

( ) Comments Attached
(✓) No Comments

Signature

Attachments: *EIS Prep Notice*

RECEIVED
2008 FEB 20 AM 10: 01
DOCARE, MAUI
DEPT. OF LAND AND
NATURAL RESOURCES

PLANNING
SOLUTIONS

April 16, 2008

Mr. Gary Moniz, Chief
Division of Conservation & Resource Enforcement
Department of Land and Natural Resources
1151 Punchbowl Street, Room 311
Honolulu, HI 96813

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Moniz:

Thank you for your February 2008 communication to Sam Lemmo concerning Kaheawa Wind Power II LLC's proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and preparing your letter. We understand that your Division has no comments to offer on the project at this time.

If you have any questions in the future concerning this project, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RUSSELL Y. TSUJI
FIRST DEPUTY

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
Office of Conservation and Coastal Lands
POST OFFICE BOX 621
HONOLULU, HAWAI'I 96809

2008 FEB 32 A 8: 07

STATE OF HAWAII

REF:OCCL:MC
FILE NO.: MA-08-136

Suspense Date: 21 Days from stamped date

FEB 19 2008

MEMORANDUM:

TO: DLNR
___ Historic Preservation Division
___ Forestry and Wildlife
✓ Land Division – Room 220
___ Division of Conservation and Resource Enforcement

FROM: Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

SUBJECT: REQUEST FOR COMMENTS
Correspondence MA-08-136
EIS PREPARATION NOTICE
Kaheawa Wind Power II

APPLICANT: Kaheawa Wind Power II LLC

TMKs: (2) 4-8-01:1, 14

LOCATION: Kaheawa, Mā`alea, Maui

2008 MAR -3 A 8: 09

Please contact Michael Cain at 587-0048, should you have any questions on this matter.

If no response is received by the suspense date, we will assume there are no comments. The suspense date starts from the date stamp.

(✓) Comments Attached
( ) No Comments

Signature

Attachments: *EIS Prep Notice*

Separate request to be sent to MDLO by M.C 2/19/08

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

2008 FEB 32 A 8: 08

STATE OF HAWAII

February 25, 2008

2008 MAR -1 A 8: 09

06MD-161
LD-GM

MEMORANDUM:

TO: Samuel J. Lemmo, Administrator
DLNR, OCCL

FROM: Morris Atta, Acting Administrator
DLNR, LD

SUBJECT: Request for Comments, EIS Preparation Notice, Kaheawa Wind Power II, Kaheawa, Maalaea, Maui, TMK: (2) 4-8-001: 014

At its September 22, 2006 meeting, under agenda item D-5, the BLNR approved, in principle, issuance of a direct lease to Kaheawa Wind Power II, LLC for a commercial renewable wind energy generation facility.

On August 8, 2007, a right-of-entry was issued to the Applicant for the purpose of placing meteorological equipment on TMK: (2) 4-8-001: Portion of 1. Should any data collection activities on TMK: (2) 3-6-001: Portion of 014 be necessary in preparing the subject EIS the Applicant will need a right-of-entry permit from the Department covering those portions.

The TMK: 2-4-008: 001 that appears in Figure 1.2 of the Environmental Impact Statement Preparation Notice is incorrect, it should be 4-8-001: 001.

If you have any questions, please call Gary Martin at 587-0421. Thank you.

c: PSF File

PLANNING SOLUTIONS

April 16, 2008

Mr. Morris Atta, Acting Administrator
Land Division
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawai'i 96809

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Atta:

Thank you for your February 25, 2008 letter to Sam Lemmo concerning Kaheawa Wind Power II LLC's (KWP II's) proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and providing written comments.

Thank you for noting that the Board of Land and Natural Resources approved, in principle, the issuance of a direct lease to KWP II for a commercial renewable wind energy generation facility at the proposed project site on September 22, 2006.

Item-by-item responses to your other comments are provided below. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

Comment 1:

On August 8, 2007, a right-of-entry was issued to the Applicant for the purpose of placing meteorological equipment on TMK: (2) 4-8-001: Portion of 1. Should any data collection activities on TMK (2) 3-6-001: Portion of 014 be necessary in preparing the subject EIS the Applicant will need a right-of-entry permit from the Department covering these portions.

Response: Thank you for confirming that a right-of-entry was issued to KWP II for its meteorological monitoring equipment on TMK 4-8-001:001. KWP II understands that it needs to obtain a right-of-entry from the Department for any data collection on the adjacent parcel (TMK 3-6-001:014).

Comment 2:

The TMK: 2-4-008: 001 that appears in Figure 1.2 of the Environmental Impact Statement Preparation Notice is incorrect, it should be 4-8-001:001.

Response: Thank you for catching this error. The TMK number will be corrected in the *Draft Environmental Impact Statement.*

If you have any further questions concerning the project, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

APPENDIX G. FEBRUARY 2009 DRAFT EIS COMMENTS AND RESPONSES

COMMENT NO. 001

LINDA LINGLE
GOVERNOR

RUSS K. SAITO
COMPTROLLER

BARBARA A. ANNIS
DEPUTY COMPTROLLER

(P)1074.9

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810

MAR - 3 2009

MEMORANDUM

TO: Mr. Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands
Department of Land and Natural Resources

FROM: Ernest Y. W. Lau
Public Works Administrator

Subject: Kaheawa Wind Power II: Draft Environmental Impact Statement

Thank you for the opportunity to review the Draft Environmental Impact Statement for the Kaheawa Wind Power II, Wind Energy Generation Facility project at Ukumehame, Maui, Hawaii. The project does not impact any of the Department of Accounting and General Services' projects or existing facilities, and we have no comments to offer.

If you have any questions, please have your staff call Mr. Clarence Kubo of the Planning Branch at 586-0488.

CKK:mo
c: Mr. Perry White, Planning Solutions, Inc.

PLANNING SOLUTIONS

November 16, 2009

Mr. Ernest Y.W. Lau
Public Works Administrator
State of Hawai'i
Department of Accounting and General Services
P.O. Box 119
Honolulu, HI 96810

Subject: Draft Environmental Impact Statement: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Lau:

Thank you for your March 3, 2009 letter [your reference (P)1074.9] concerning Kaheawa Wind Power II LLC's (KWP II) proposed Kaheawa Wind Power II project. We appreciate the time you and your staff spent reviewing the *Draft Environmental Impact Statement* (*DEIS*) and preparing your letter.

At the time the original *DEIS* was published in February, 2009, KWP II LLC had concluded based on the best available wind resource data and on the results of analyses of natural resources that the Downwind/Downstring siting area it proposed would best meet the project objectives. Since that time, it has had the opportunity to collect and analyze additional wind resource data and to consider comments submitted by resource agencies as part of the Chapter 343 and Habitat Conservation Plan review process. Taken together, this new information has led KWP II to conclude that locating its facilities lower on the mountainside has several advantages, some of which are quite substantial and may reduce potential impacts to resources identified by DOFAW and other agencies during the project's review.

KWP II LLC has now identified an additional siting alternative for its proposed facilities that it believes is equal to/superior to the original proposal with respect to potential effects on threatened and endangered species and which has a number of other advantages. Situated in what is referred to as the "Down Road Siting Area", the "Downroad Alternative" is now KWP II LLC's "Preferred Alternative". In discussion with the State of Hawai'i Department of Land and Natural Resources, it has concluded that the best way to proceed is to issue a *Revised DEIS* that addresses the potential effects of what is now its "Preferred Alternative", as well as the effects of the "Downwind/Downstring Alternative" evaluated in the February 2009 *DEIS*.

We are now preparing the *Revised DEIS* and expect that it will be released for public review and comment in the 4th quarter of 2009. If you have any questions in the future concerning this project, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Ms. Noe Kalipi, KWP II LLC
Mr. Dave Cowan, KWP II LLC
DLNR Office of Conservation and Coastal Lands

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

COMMENT NO. 002

POLICE DEPARTMENT
COUNTY OF MAUI

CHARMAINE TAVARES
MAYOR

OUR REFERENCE
YOUR REFERENCE

55 MAHALANI STREET
WAILUKU, HAWAII 96793
(808) 244-6400
FAX (808) 244-6411

THOMAS M. PHILLIPS
CHIEF OF POLICE

GARY A. YABUTA
DEPUTY CHIEF OF POLICE

March 4, 2009

Mr. Perry J. White
Planning Solutions
Ward Plaza, Suite 330
210 Ward Avenue
Honolulu, HI 96814-4012

Dear Mr. White:

SUBJECT: Kaheawa Wind Power II: Draft Environmental Impact Statement

Thank you for your letter of February 21, 2009 requesting comments on the above subject.

We have reviewed the Draft Environmental Impact Statement and have enclosed our comments and recommendations. Thank you for giving us the opportunity to comment on this project.

Very truly yours,

AC Wayne T. Ribao

Assistant Chief Wayne T. Ribao
for: Thomas M. Phillips
Chief of Police

Enclosure

c: Jeffrey Hunt, Maui County Planning Department

COPY

TO : THOMAS PHILLIPS, CHIEF OF POLICE, COUNTY OF MAUI

VIA : CHANNELS

FROM : STEPHEN ORIKASA, ADMINISTRATIVE SERGEANT, WAILUKU PATROL DIVISION

SUBJECT : RESPONSE TO A REQUEST FOR COMMENTS REGARDING THE KAHEAWA WIND POWER II: DRAFT ENVIRONMENTAL STATEMENT (DEIS)

No FURTHER comments
AC Wayne T. Ribao
3/4/09

This communication is submitted as a response to a request for comments by Mr. Perry J. White of Planning Solutions, Inc., in regards to the Kaheawa Wind Power II: Draft Environmental Impact Statement.

RESPONSE:

In review of the submitted documents, the focus from the police perspective would be upon the safety of vehicular & pedestrian movement.

The remoteness of this project would likely not have a significant long term impact upon vehicular and pedestrian movement. Although during the construction phases of this project this will become and issue which will need to be addressed and mitigated.

During the construction phases of this project there will be the transporting of extremely large materials from the Kahului Commercial Harbor to the project site. This will impact all pedestrian and vehicular movement for an approximate 10-13 mile stretch of public roadways. It is imperative that police escorts be utilized and planned routes mitigated well beforehand for these transports. Adequate notification of these routes should be made to the Maui Police Department's Communications Division to keep all emergency services abreast of anything which may impede their response.

At the project site, proper and adequate traffic control personnel and devices must be utilized to mitigate the ingress and egress of heavy equipment, vehicles and materials from the area.

CONCLUSION:

There are no objections to the progression of this project at this time. Although, it is of utmost importance to be cognizant of any health and safety impacts, directly and indirectly, which may arise from this project.

Respectfully submitted for your review and approval.

Stephen T. Orikasa E#716
Administrative Sergeant/Wailuku Patrol Division
03/04/09 @ 0930 Hours

[illegible]
03/04/09 @ 1252 hrs

PLANNING SOLUTIONS

November 16, 2009

Mr. Thomas M. Phillips, Chief
c/o Assistant Chief Wayne T. Ribao
Police Department, County of Maui
55 Mahalani Street
Wailuku, HI 96793

Subject: Draft Environmental Impact Statement: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Chief Phillips:

Thank you for your March 4, 2009 letter concerning Kaheawa Wind Power II LLC's (KWP II's) proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Draft Environmental Impact Statement* (*DEIS*) and providing written comments.

At the time the original *DEIS* was published in February, 2009, KWP II LLC had concluded based on the best available wind resource data and on the results of analyses of natural resources that the Downwind/Downstring siting area it proposed would best meet the project objectives. Since that time, it has had the opportunity to collect and analyze additional wind resource data and to consider comments submitted by resource agencies as part of the Chapter 343 and Habitat Conservation Plan review process. Taken together, this new information has led KWP II to conclude that locating its facilities lower on the mountainside has several advantages, some of which are quite substantial and may reduce potential impacts to resources identified by DOFAW and other agencies during the project's review.

KWP II LLC has now identified an additional siting alternative for its proposed facilities that it believes is equal to/superior to the original proposal with respect to potential effects on threatened and endangered species and which has a number of other advantages. Situated in what is referred to as the "Down Road Siting Area", the "Downroad Alternative" is now KWP II LLC's "Preferred Alternative". In discussion with the State of Hawai'i Department of Land and Natural Resources, it has concluded that the best way to proceed is to issue a Revised Draft EIS that addresses the potential effects of what is now its "Preferred Alternative", as well as the effects of the "Downwind/Downstring Alternative" evaluated in the February 2009 *DEIS*.

We are now preparing the *Revised DEIS* and expect that it will be released for public review and comment in the 4th quarter of 2009. However, because the report will include the project plans on which you commented as an alternative, we would like to take this opportunity to provide the following item-by-item responses to your comments. These are relevant to both the Preferred Alternative and Downwind/Downstring Alternative. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

Comment 1:

During construction phases of this project there will be the transporting of extremely large materials from the Kahului Commercial Harbor to the project site. This will impact all pedestrian and vehicular movement for an approximate 10-13 mile stretch of public roadways. It is imperative that police escorts be utilized and planned routes mitigated well beforehand for these transports.

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

Response: KWP II appreciates the importance of carefully planning delivery routes and will ensure adequate police escort as recommended in your letter. Police escorts and traffic control measures were used successfully for the existing wind farm, and KWP II LLC plans to implement the same carefully coordinated procedures for the proposed project. This topic is discussed in some detail in Section 4.13.1.1.3 of the February 2009 *DEIS*. As indicated in that discussion, the oversize pieces of the wind turbine generators are presently being stored in Kīhei; hence, the travel distance will be considerably shorter than if they needed to be delivered all the way from Kahului Harbor. The police escort traffic control measures that are planned are summarized in the first two bullet items in the report. As indicated there, the trucking company that will transport the large wind turbine generator pieces will arrange for a police escort. The escort will ride ahead of the truck warning other traffic of the oncoming load and stopping other vehicles for the few turns that are required.

Comment 2:

Adequate notification of these routes should be made to the Maui Police Department's Communications Division to keep all emergency services abreast of anything which may impede their response.

Response: KWP II LLC has confirmed to us that it will ensure that the contractor provides adequate notification of its delivery plans to the Maui Police Department's Communications Division so that the Division can inform all emergency services that large equipment will be present on the roadway between Kīhei and the site access road.

Comment 3:

At the project site, proper and adequate traffic control personnel and devices must be utilized to mitigate the ingress and egress of heavy equipment, vehicles and materials from the area.

Response: As noted in the second and third bullet items in Section 4.13.1.1.3 of the February 2009 *DEIS,* KWP II LLC will require its contractor to station two traffic control personnel at the intersection of Honoapi'ilani Highway and the access road during construction working hours to facilitate the safe ingress and egress of heavy equipment, vehicles and materials from the area. They will work as flagmen to stop other traffic for the 1-2 minutes that are needed for the large trucks to turn into and out of the site access road. They will also control traffic as needed to allow other vehicles to safely enter and leave the site. Traffic control on the site access road itself (which is not open to the public) will be maintained via radio communication. Trucks that will be used to carry heavy equipment up the hill will be contacted while en route, and turn-out areas are provided along the side of the road so that passing can be coordinated.

Thank you again for your comments. If you have any further questions or would like to discuss the traffic control measures further, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Ms. Noe Kalipi, KWP II LLC
Mr. Dave Cowan, KWP II LLC
DLNR Office of Conservation and Coastal Lands

COMMENT NO. 003

CHARMAINE TAVARES
Mayor

TAMARA HORCAJO
Director

ZACHARY Z. HELM
Deputy Director

(808) 270-7230
FAX (808) 270-7934

DEPARTMENT OF PARKS & RECREATION
700 Hali'a Nakoa Street, Unit 2, Wailuku, Hawaii 96793

March 11, 2009

State of Hawaii
Department of Land and Natural Resources
Office of Conservation and Coastal Lands
P.O. Box 621
Honolulu, Hawaii 96809

Dear Sir:

SUBJECT: Kaheawa Wind Power II - Draft Environmental Impact Statement (DEIS)

We have reviewed the proposed subject project and have no comments or objections to submit at this time.

Thank you for the opportunity to review and comment on this matter. Please feel free to contact me or Mr. Patrick Matsui, Chief of Parks Planning and Development at 270-7931 should you have any other questions.

Sincerely,

For TAMARA HORCAJO
Director, Parks & Recreation

c: Perry J. White, Planning Solutions, Inc.
Patrick Matsui, Chief of Parks Planning and Development

TH:PM:do

PLANNING SOLUTIONS

November 16, 2009

Ms. Tamara Horcajo, Director
County of Maui
Department of Parks & Recreation
700 Hali'a Nakoa Street, Unit 2
Wailuku, HI 96793

Subject: Draft Environmental Impact Statement: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Ms. Horcajo:

Thank you for your March 11, 2009 letter concerning the proposed Kaheawa Wind Power II project. We appreciate the time you and your staff spent reviewing the *Draft Environmental Impact Statement (DEIS)* and preparing your letter.

At the time the original *DEIS* was published in February, 2009, KWP II LLC had concluded based on the best available wind resource data and on the results of analyses of natural resources that the Downwind/Downstring siting area it proposed would best meet the project objectives. Since that time, it has had the opportunity to collect and analyze additional wind resource data and to consider comments submitted by resource agencies as part of the Chapter 343 and Habitat Conservation Plan review process. Taken together, this new information has led KWP II to conclude that locating its facilities lower on the mountainside has several advantages, some of which are quite substantial and may reduce potential impacts to resources identified by DOFAW and other agencies during the project's review.

KWP II LLC has now identified an additional siting alternative for its proposed facilities that it believes is equal to/superior to the original proposal with respect to potential effects on threatened and endangered species and which has a number of other advantages. Situated in what is referred to as the "Down Road Siting Area", the "Downroad Alternative" is now KWP II LLC's "Preferred Alternative". In discussion with the State of Hawai'i Department of Land and Natural Resources, it has concluded that the best way to proceed is to issue a *Revised DEIS* that addresses the potential effects of what is now its "Preferred Alternative", as well as the effects of the "Downwind/Downstring Alternative" evaluated in the February 2009 *DEIS*.

We are now preparing the *Revised DEIS* and expect that it will be released for public review and comment in the 4th quarter of 2009. If you have any questions in the future, please feel free to call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Ms. Noe Kalipi, KWP II LLC
Mr. Dave Cowan, KWP II LLC
DLNR Office of Conservation and Coastal Lands

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

COMMENT NO. 004

CHARMAINE TAVARES
Mayor

MILTON M. ARAKAWA, A.I.C.P.
Director

MICHAEL M. MIYAMOTO
Deputy Director

RALPH M. NAGAMINE, L.S., P.E.
Development Services Administration

DAVID TAYLOR, P.E.
Wastewater Reclamation Division

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

TRACY TAKAMINE, P.E.
Solid Waste Division

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS
AND ENVIRONMENTAL MANAGEMENT
DEVELOPMENT SERVICES ADMINISTRATION
250 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

March 23, 2009

Department of Land and Natural Resources
Office of Conservation and Coastal Lands
P.O. Box 621
Honolulu, Hawaii 96809

Subject: **DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR KAHEAWA WIND POWER II TMK: (2) 4-8-001:001 (por.)**

We reviewed the subject application and have no comments at this time.

Please call Michael Miyamoto at 270-7845 if you have any questions regarding this letter.

Sincerely,

Milton M. Arakawa, A.I.C.P.
Director of Public Works

ls S:\LUCA\CZM\Kaheawa_Wind_Power_II_deis_48001001_por_ls.wpd
xc: Highways Division
Engineering Division
Planning Solutions, Inc.

PLANNING SOLUTIONS

November 16, 2009

Mr. Milton M. Arakawa, A.I.C.P., Director
Development Services Administration
Department of Public Works
And Environmental Management
County of Maui
250 South High Street
Wailuku, HI 96793

Subject: Draft Environmental Impact Statement: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Arakawa:

Thank you for your March 23, 2009 letter concerning the proposed Kaheawa Wind Power II project. We appreciate the time you and your staff spent reviewing the *Draft Environmental Impact Statement* (*DEIS*) and preparing your letter.

At the time the original *DEIS* was published in February, 2009, KWP II LLC had concluded based on the best available wind resource data and on the results of analyses of natural resources that the Downwind/Downstring siting area it proposed would best meet the project objectives. Since that time, it has had the opportunity to collect and analyze additional wind resource data and to consider comments submitted by resource agencies as part of the Chapter 343 and Habitat Conservation Plan review process. Taken together, this new information has led KWP II to conclude that locating its facilities lower on the mountainside has several advantages, some of which are quite substantial and may reduce potential impacts to resources identified by DOFAW and other agencies during the project's review.

KWP II LLC has now identified an additional siting alternative for its proposed facilities that it believes is equal to/superior to the original proposal with respect to potential effects on threatened and endangered species and which has a number of other advantages. Situated in what is referred to as the "Down Road Siting Area", the "Downroad Alternative" is now KWP II LLC's "Preferred Alternative". In discussion with the State of Hawai'i Department of Land and Natural Resources, it has concluded that the best way to proceed is to issue a *Revised DEIS* that addresses the potential effects of what is now its "Preferred Alternative", as well as the effects of the "Downwind/Downstring Alternative" evaluated in the original Draft EIS.

We are now preparing the *Revised DEIS* and expect that it will be released for public review and comment in the 4th quarter of 2009. If you have any questions in the future, please feel free to call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Ms. Noe Kalipi, KWP II LLC
Mr. Dave Cowan, KWP II LLC
DLNR Office of Conservation and Coastal Lands

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

COMMENT NO. 005

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

REPLY TO ATTENTION OF:

March 23, 2009

Regulatory Branch

File No. POH-2009-104

Mr. Perry J. White
Planning Solutions
210 Ward Avenue, Suite 330
Honolulu, Hawai'i 96814

Dear Mr. White:

This letter is in response to your request, received February 24, 2009, for comments on the preparation of the Draft Environmental Impact Statement (DEIS) for the proposed **Kaheawa Wind Power II** project. The site is located in TMK (2) 4-8-001:001 at Kaheawa Pastures above Ma'alaea, Maui, Hawaii.

Section 10 of the Rivers and Harbors Act (RHA) of 1899 requires that a DA permit be obtained for structures or work in or affecting navigable waters (e.g., Pacific Ocean) of the U.S. (33 U.S.C. 403). Section 10 waters are those subject to the ebb and flow of the tide extending shoreward to the mean high water mark. Section 404 of the Clean Water Act (CWA) requires that a DA permit be obtained for the discharge (placement) of dredge and/ or fill material into waters of the U.S., including jurisdictional wetlands. The Corps defines wetlands as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions.

Based on the information furnished to our office, it appears that the subject parcels consist entirely of uplands, and the proposed project will not involve any activities occurring within navigable waters of the United States (U.S.) or the discharge of dredged and/ or fill material into jurisdictional waters of the U.S.; therefore, a **Department of Army (DA) permit will not be required.** This determination does not relieve you of any responsibility to obtain any other permits, licenses, or approvals that may be required under County, State, or Federal law for your proposed work. Thank you for the opportunity to comment. If you have any questions, please contact Ms. Meris Bantilan-Smith, of my staff at 438-7701 or at Meris.Bantilan-Smith@usace.army.mil and refer to File No. POH-2009-104 for any future correspondence regarding this project.

Sincerely,

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

Copy Furnished:
State of Hawaii DLNR, Office of Conservation and Coastal Lands

---

PLANNING SOLUTIONS

November 16, 2009

Mr. George P. Young, P.E., Chief
Regulatory Branch
U.S. Army Corps of Engineers, Honolulu District
Department of the Army
Fort Shafter, HI 96858-5440

Subject: Draft Environmental Impact Statement: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Young:

Thank you for your March 23, 2009 letter [your reference File No. POH-2009-104] concerning the proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Draft Environmental Impact Statement* (*DEIS*) and preparing your letter.

At the time the original *DEIS* was published in February, 2009, KWP II LLC had concluded based on the best available wind resource data and on the results of analyses of natural resources that the Downwind/Downstring siting area it proposed would best meet the project objectives. Since that time, it has had the opportunity to collect and analyze additional wind resource data and to consider comments submitted by resource agencies as part of the Chapter 343 and Habitat Conservation Plan review process. Taken together, this new information has led KWP II to conclude that locating its facilities lower on the mountainside has several advantages, some of which are quite substantial and may reduce potential impacts to resources identified by DOFAW and other agencies during the project's review.

KWP II LLC has now identified an additional siting alternative for its proposed facilities that it believes is equal to/superior to the original proposal with respect to potential effects on threatened and endangered species and which has a number of other advantages. Situated in what is referred to as the "Down Road Siting Area", the "Downroad Alternative" is now KWP II LLC's "Preferred Alternative". In discussion with the State of Hawai'i Department of Land and Natural Resources, it has concluded that the best way to proceed is to issue a *Revised DEIS* that addresses the potential effects of what is now its "Preferred Alternative", as well as the effects of the "Downwind/Downstring Alternative" evaluated in the original February 2009 *DEIS*.

We are now preparing the *Revised DEIS* and expect that it will be released for public review and comment in the 4th quarter of 2009. However, because the *Revised DEIS* will include the project plans on which you commented as an alternative, we would like to take this opportunity to thank you for confirming that the Downwind/Downstring Alternative, as discussed in the original *DEIS*, will not involve any activities occurring within navigable waters of the United States (U.S.) or the discharge of dredged and/or fill material into jurisdictional waters of the U.S. We appreciate your determination that, on the basis of the information provided, a Department of Army (DA) permit will not be required.

If you have any questions in the future concerning this project, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Ms. Noe Kalipi, KWP II LLC
Mr. Dave Cowan, KWP II LLC
DLNR Office of Conservation and Coastal Lands

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

COMMENT NO. 006

CHARMAINE TAVARES
Mayor

CHERYL K. OKUMA, Esq.
Director

GREGG KRESGE
Deputy Director

TRACY TAKAMINE, P.E.
Solid Waste Division

DAVID TAYLOR, P.E.
Wastewater Reclamation Division

COUNTY OF MAUI
DEPARTMENT OF
ENVIRONMENTAL MANAGEMENT
2200 MAIN STREET, SUITE 100
WAILUKU, MAUI, HAWAII 96793

March 24, 2009

State of Hawaii
Department of Land and Natural Resources
Office of Conservation and Coastal Lands
P.O. Box 621
Honolulu, HI 96809

SUBJECT: KEHEAWA WIND POWER II
DRAFT ENVIRONMENTAL IMPACT STATEMENT
TMK (2) 4-8-001:001, UKUMEHAME, MAUI

Dear Gentlemen,

We reviewed the subject project as a pre-application consultation and have the following comments:

1. Solid Waste Division comments:

   a. None.

2. Wastewater Reclamation Division (WWRD) comments:

   a. None. No County sewer in the area of the project.

If you have any questions regarding this memorandum, please contact Gregg Kresge at 270-8230.

Sincerely,

Cheryl K. Okuma, Director

xc: Mr. Perry White, Planning Solutions, Inc.

PLANNING SOLUTIONS

November 16, 2009

Ms. Cheryl K. Okuma, Director
Department of Environmental Management
County of Maui
2200 Main Street, Suite 100
Wailuku, HI 96793

Subject: Draft Environmental Impact Statement: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Ms. Okuma:

Thank you for your March 24, 2009 letter concerning the proposed Kaheawa Wind Power II project. We appreciate the time you and your staff spent reviewing the *Draft Environmental Impact Statement* (*DEIS*) and preparing your letter.

At the time the *DEIS* was published in February, 2009, KWP II LLC had concluded based on the best available wind resource data and on the results of analyses of natural resources that the Downwind/Downstring siting area it proposed would best meet the project objectives. Since that time, it has had the opportunity to collect and analyze additional wind resource data and to consider comments submitted by resource agencies as part of the Chapter 343 and Habitat Conservation Plan review process. Taken together, this new information has led KWP II to conclude that locating its facilities lower on the mountainside has several advantages, some of which are quite substantial and may reduce potential impacts to resources identified by DOFAW and other agencies during the project's review.

KWP II LLC has now identified an additional siting alternative for its proposed facilities that it believes is equal to/superior to the original proposal with respect to potential effects on threatened and endangered species and which has a number of other advantages. Situated in what is referred to as the "Down Road Siting Area", the "Downroad Alternative" is now KWP II LLC's "Preferred Alternative". In discussion with the State of Hawai'i Department of Land and Natural Resources, it has concluded that the best way to proceed is to issue a *Revised DEIS* that addresses the potential effects of what is now its "Preferred Alternative", as well as the effects of the "Downwind/Downstring Alternative" evaluated in the February 2009 *DEIS*.

We are now preparing the *Revised DEIS* and expect that it will be released for public review and comment in the 4th quarter of 2009. However, because the report will include the project plans on which you commented as an alternative, we would like to take this opportunity to thank you for confirming that there are no County sewers in the Downwind/Downstring project area, as discussed in the February 2009 *DEIS*. If you have any questions in the future, please feel free to call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Ms. Noe Kalipi, KWP II LLC
Mr. Dave Cowan, KWP II LLC
DLNR Office of Conservation and Coastal Lands

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

COMMENT NO. 007

LINDA LINGLE
GOVERNOR

MAJOR GENERAL ROBERT G. F. LEE
DIRECTOR OF CIVIL DEFENSE

EDWARD T. TEIXEIRA
VICE DIRECTOR OF CIVIL DEFENSE

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE DIRECTOR OF CIVIL DEFENSE
3949 DIAMOND HEAD ROAD
HONOLULU, HAWAII 96816-4495

PHONE (808) 733-4300
FAX (808) 733-4287

April 6, 2009

Mr. Perry White
Planning Solutions, Inc.
210 Ward Ave., Suite 330
Honolulu, Hawaii 96814

Dear Mr. White:

Draft Environmental Impact Statement, Kaheawa Wind Power II
Wind Energy Generation Facility, Maui, Hawaii

Thank you for the opportunity to comment on this project. After careful review of the documents provided for this project, we feel that potential natural hazards have been recognized and that appropriate mitigation measures have been considered in preparing for any future incident.

If you have any questions, please call Mr. Richard Stercho, State Civil Defense Mitigation Planner, at (808) 733-4300, ext. 583.

Sincerely,

EDWARD T. TEIXEIRA,
Vice Director of Civil Defense

c: Office of Environmental Quality Control
Maui Civil Defense Agency
DLNR Office of Conservation and Coastal Lands
Dave Cowan, KWP II LLC
Kelly Bronson, KWP II LLC

PLANNING SOLUTIONS

November 16, 2009

Mr. Edward T. Teixeira
Vice Director of Civil Defense
Department of Defense
State of Hawai'i
3949 Diamond Head Road
Honolulu, HI 96816-4495

Subject: Draft Environmental Impact Statement: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Teixeira:

Thank you for your April 6, 2009 letter concerning the proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Draft Environmental Impact Statement* (*DEIS*) and preparing your letter.

At the time the *DEIS* was published in February, 2009, KWP II LLC had concluded based on the best available wind resource data and on the results of analyses of natural resources that the Downwind/Downstring siting area it proposed would best meet the project objectives. Since that time, it has had the opportunity to collect and analyze additional wind resource data and to consider comments submitted by resource agencies as part of the Chapter 343 and Habitat Conservation Plan review process. Taken together, this new information has led KWP II to conclude that locating its facilities lower on the mountainside has several advantages, some of which are quite substantial and may reduce potential impacts to resources identified by DOFAW and other agencies during the project's review.

KWP II LLC has now identified an additional siting alternative for its proposed facilities that it believes is equal to/superior to the original proposal with respect to potential effects on threatened and endangered species and which has a number of other advantages. Situated in what is referred to as the "Down Road Siting Area", the "Downroad Alternative" is now KWP II LLC's "Preferred Alternative". In discussion with the State of Hawai'i Department of Land and Natural Resources, it has concluded that the best way to proceed is to issue a *Revised DEIS* that addresses the potential effects of what is now its "Preferred Alternative", as well as the effects of the "Downwind/Downstring Alternative" evaluated in the February 2009 *DEIS*.

We are now preparing the *Revised DEIS* and expect that it will be released for public review and comment in the 4th quarter of 2009. However, because the *Revised DEIS* will include the project plans on which you commented as an alternative, we would like to take this opportunity to thank you for confirming that the Downwind/Downstring Alternative, as discussed in the February 2009 *DEIS*, recognizes potential natural hazards and that appropriate mitigation measures have been considered in preparing for any future incident.

If you have any questions in the future concerning this project, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Ms. Noe Kalipi, KWP II LLC
Mr. Dave Cowan, KWP II LLC
DLNR Office of Conservation and Coastal Lands

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

COMMENT NO. 008

LINDA LINGLE
GOVERNOR OF HAWAII

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

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

In reply, please refer to:
EPO-09-032

April 3, 2009

Mr. Perry J. White
Planning Solutions, Inc.
210 Ward Avenue, Suite 330
Honolulu, Hawaii 96814

Dear Mr. White:

SUBJECT: Draft Environmental Impact Statement for Kaheawa Wind Power II
Ukumehame, Maui, Hawaii
TMK (2) 4-8-001: 001
(2) 3-6-001: 014

Thank you for allowing us to review and comment on the subject application. The application was routed to the various branches of the Environmental Health Administration. We have the following Clean Water Branch and General comments.

Clean Water Branch

The Department of Health (DOH), Clean Water Branch (CWB), has reviewed the subject document and offers these comments on your project. Please note that our review is based solely on the information provided in the subject document and its compliance with Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at http://www.hawaii.gov/health/environmental/env-planning/landuse/CWB-standardcomment.pdf.

1. Any project and its potential impacts to State waters must meet the following criteria:

   a. Antidegradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.

   b. Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters.

   c. Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).

2. You are required to obtain a National Pollutant Discharge Elimination System (NPDES) permit for discharges of wastewater into State surface waters (HAR, Chapter 11-55). This includes discharges of storm water associated with construction activities (clearing, grading, excavation, etc.) that result in the disturbance of one (1) acre or more of total land area. The total land area includes a contiguous area where multiple, separate, and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. An NPDES permit is required before the start of the construction activities.

   For discharges of storm water associated with construction activities into Class A or Class 2 State waters, you may apply for NPDES general permit coverage by submitting a Notice of Intent (NOI) form. The NOI must be submitted 30 calendar days before the start of construction activities. The NOI form may be picked up at our office or downloaded from our website at http://www.hawaii.gov/health/environmental/water/cleanwater/forms/genl-index.html.

3. For types of wastewater not listed in Item 2 above or wastewater discharging into Class 1 or Class AA waters, you may need an NPDES individual permit. Class 1 waters include, but is not limited to, all State waters in natural reserves, preserves, sanctuaries, and refuges established by the Department of Land and Natural Resources under chapter 195, Hawaii Revised Statutes (HRS), or similar reserves for the protection of aquatic life established under chapter 195, HRS. An application for an NPDES individual permit must be submitted at least 180 calendar days before the commencement of the discharge. The NPDES application forms may be picked up at our office or downloaded from our website at http://www.hawaii.gov/health/environmental/water/cleanwater/forms/indiv-index.html.

4. You must also submit a copy of the NOI or NPDES permit application to the State Department of Land and Natural Resources, State Historic Preservation Division (SHPD), or demonstrate to the satisfaction of the CWB that SHPD has or is in the process of evaluating your project. Please submit a copy of your request for review by SHPD or SHPD's determination letter for the project along with your NOI or NPDES permit application, as applicable.

5. Please ensure that all construction material stockpiles and staging areas are not placed in Manawaipueo Gulch, Pāpalaua Gulch, Mokumana Gulch, Ka'alaina Gulch, or any other State water.

6. Table 4.4. on Page 4-11 of the DEIS indicates that concrete wash water will be contained in wash water pits. Please ensure that these wash water pits contain an impermeable liner. The DOH prohibits disposal of concrete wash water via percolation.

7. Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 WQC are required, must comply with the Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54, and/or permitting requirements, specified in HAR, Chapter 11-55, may be subject to penalties of $25,000 per day per violation

If you have any questions, please visit our website at http://www.hawaii.gov/health/environmental/water/cleanwater/index.html, or contact the Engineering Section, CWB, at 586-4309.

General

We strongly recommend that you review all of the Standard Comments on our website: www.hawaii.gov/health/environmental/env-planning/landuse/landuse.html. Any comments specifically applicable to this project should be adhered to.

If there are any questions about these comments please contact Jiacai Liu with the Environmental Planning Office at 586-4346.

Sincerely,

KELVIN H. SUNADA, MANAGER
Environmental Planning Office

c: EPO
CWB
EH-Maui

PLANNING SOLUTIONS

November 16, 2009

Mr. Kelvin H. Sunada, Manager
Environmental Planning Office
Department of Health, Clean Water Branch
P.O. Box 3378
Honolulu, HI 96801-3378

Subject: Draft Environmental Impact Statement: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Sunada:

Thank you for your April 3, 2009 letter [your reference File No. EPO-09-032] concerning the proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Draft Environmental Impact Statement* (*DEIS*) and preparing your letter.

At the time the *DEIS* was published in February, 2009, KWP II LLC had concluded based on the best available wind resource data and on the results of analyses of natural resources that the Downwind/Downstring siting area it proposed would best meet the project objectives. Since that time, it has had the opportunity to collect and analyze additional wind resource data and to consider comments submitted by resource agencies as part of the Chapter 343 and Habitat Conservation Plan review process. Taken together, this new information has led KWP II to conclude that locating its facilities lower on the mountainside has several advantages, some of which are quite substantial and may reduce potential impacts to resources identified by DOFAW and other agencies during the project's review.

KWP II LLC has now identified an additional siting alternative for its proposed facilities that it believes is equal to/superior to the original proposal with respect to potential effects on threatened and endangered species and which has a number of other advantages. Situated in what is referred to as the "Down Road Siting Area", the "Downroad Alternative" is now KWP II LLC's "Preferred Alternative". In discussion with the State of Hawai'i Department of Land and Natural Resources, it has concluded that the best way to proceed is to issue a *Revised DEIS* that addresses the potential effects of what is now its "Preferred Alternative", as well as the effects of the "Downwind/Downstring Alternative" evaluated in the February 2009 *DEIS*.

We are now preparing the *Revised DEIS* and expect that it will be released for public review and comment in the 4th quarter of 2009. However, because the *Revised DEIS* will include the project plans on which you commented as an alternative, we would like to take this opportunity to provide the following item-by-item responses to your comments. For purposes of clarity, we have reproduced the comments that expressed specific requirements before each response, numbering them as you did in your letter.

Comment 4:

You must also submit a copy of the NOI or NPDES permit application to the State Department of Land and Natural Resources, State Historic Preservation Division (SHPD), or demonstrate to the satisfaction of the CWB that SHPD has or is in the process of evaluating your project. Please submit a copy of your request for review by SHPD or SHPD's determination letter for the project along with your NOI or NPDES permit application, as applicable.

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

Response: As indicated in Table 10.1 of the February 2009 *DEIS*, the State Historic Preservation Division (SHPD) received a copy of the EIS Preparation Notice for the proposed KWP II project. We also provided the SHPD a copy of the *DEIS* and requested comments. KWP II LLC will provide a copy of the NPDES permit application for the selected alternative to the SHPD when it is filed with the State of Hawai'i Department of Health.

Comment 5:

Please ensure that all construction material stockpiles and staging areas are not placed in Manawaipueo Gulch, Pāpalaua Gulch, Mokumana Gulch, Ka'alaina Gulch, or any other State water.

Response: The preliminary grading plans for both alternatives call for all construction material stockpiles and staging areas to be located away from Manawaipueo Gulch, Pāpalaua Gulch, Mokumana Gulch, Ka'alaina Gulch, and all other State water.

Comment 6:

Table 4.4 on Page 4-11 of the DEIS indicates that concrete wash water will be contained in wash water pits. Please ensure that these wash water pits contain an impermeable liner. The DOH prohibits disposal of concrete wash water via percolation.

Response: KWP II LLC's plans call for wash water pits to be constructed and used in accordance with all DOH regulations. Accordingly, any concrete wash water pits used on the site will be lined.

If you have any questions in the future concerning this project, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Ms. Noe Kalipi, KWP II LLC
Mr. Dave Cowan, KWP II LLC
DLNR Office of Conservation and Coastal Lands

COMMENT NO. 009

LINDA LINGLE
GOVERNOR
THEODORE E. LIU
DIRECTOR
MARK K. ANDERSON
DEPUTY DIRECTOR
ABBEY SETH MAYER
DIRECTOR
OFFICE OF PLANNING

DEPARTMENT OF BUSINESS,
ECONOMIC DEVELOPMENT & TOURISM

OFFICE OF PLANNING
235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Telephone: (808) 587-2846
Fax: (808) 587-2824

Ref. No. P-12509

April 8, 2009

To: Ms. Laura Thielen
Chair
Department of Land and Natural Resources

Attn: Office of Conservation and Coastal Lands

From: Abbey Seth Mayer
Director
Office of Planning

Subject: Draft Environmental Impact Statement for Kaheawa Wind Power II
Kaheawa Pastures above Ma'alaea, Maui, Hawaii
TMK: 4-8-001:001(por)

Thank you for sending the Office of Planning (OP) a Draft Environmental Impact Statement (DEIS) for the above referenced proposal to establish a 21 megawatt (MW) wind power generating facility and related improvements at Kaheawa Pastures. The proposed project is immediately to the west of the existing 30 MW Kaheawa Wind Power project which would also supply wind generated electricity to Maui Electric Company. We understand that the applicant will be obtaining a lease from the State Department of Land and Natural Resources for approximately 333 acres of land to construct 14 General Electric 1.5 MW wind turbine generators, electrical substation, operations/maintenance building and two permanent meteorological towers.

Due to the existing 30 MW Kaheawa Wind Power project and the additional 14 wind turbine generators proposed by this project, the visual impacts should be thoroughly evaluated.

If you have any questions, please contact Lorene Maki of our Land Use Division at 587-2888.

c: Perry White, Planning Solutions, Inc.

PLANNING SOLUTIONS

November 16, 2009

Mr. Abbey Seth Mayer, Director
Office of Planning
Department of Business, Economic Development & Tourism
State of Hawai'i
P.O. Box 2359
Honolulu, HI 96804

Subject: Draft Environmental Impact Statement: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Mayer:

Thank you for your April 8, 2009 letter [your reference File No. P-12509] concerning the proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Draft Environmental Impact Statement* (*DEIS*) and providing a written recommendation for minimizing visual impacts.

At the time the *DEIS* was published in February, 2009, KWP II LLC had concluded based on the best available wind resource data and on the results of analyses of natural resources that the Downwind/Downstring siting area it proposed would best meet the project objectives. Since that time, it has had the opportunity to collect and analyze additional wind resource data and to consider comments submitted by resource agencies as part of the Chapter 343 and Habitat Conservation Plan review process. Taken together, this new information has led KWP II to conclude that locating its facilities lower on the mountainside has several advantages, some of which are quite substantial and may reduce potential impacts to resources identified by DOFAW and other agencies during the project's review.

KWP II LLC has now identified an additional siting alternative for its proposed facilities that it believes is equal to/superior to the original proposal with respect to potential effects on threatened and endangered species and which has a number of other advantages. Situated in what is referred to as the "Down Road Siting Area", the "Downroad Alternative" is now KWP II LLC's "Preferred Alternative". In discussion with the State of Hawai'i Department of Land and Natural Resources, it has concluded that the best way to proceed is to issue a *Revised DEIS* that addresses the potential effects of what is now its "Preferred Alternative", as well as the effects of the "Downwind/Downstring Alternative" evaluated in the February 2009 *DEIS*.

We are now preparing the *Revised DEIS* and expect that it will be released for public review and comment in the 4th quarter of 2009. However, because the report will include the project plans on which you commented as an alternative, we would like to take this opportunity to provide our response to your comment. To simplify your examination, we have reproduced the text of your comments in italics before the response.

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

Comment:

Due to the existing 30 MW Kaheawa Wind Power project and the additional 14 wind turbine generators proposed by this project, the visual impacts should be thoroughly evaluated.

Response: The complete discussion of the cumulative effects is presented in the February 2009 *DEIS* in Section 4.11.4 and in further elaboration in Appendix C. A similar discussion will be included in the *Revised DEIS*.

If you have any questions in the future concerning this project, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Ms. Noe Kalipi, KWP II LLC
Mr. Dave Cowan, KWP II LLC
DLNR Office of Conservation and Coastal Lands

Maui Electric Company, Ltd. • 210 West Kamehameha Avenue • PO Box 398 • Kahului, Maui, HI 96733-6898 • (808) 871-8461

COMMENT NO. 010

April 8, 2009

State of Hawaii
Department of Land and Natural Resources
Office of Conservation and Coastal Lands
P.O. Box 621
Honolulu, HI 967809

To whom it may concern:

Subject: Kaheawa Wind Power II
Wind Energy Generation Facility – Ukumehame, Maui, Hawaii
Draft Environmental Impact Statement (DEIS)

Thank you for the opportunity to review and comment on the subject application. Maui Electric Company, Limited (MECO) understands the proposed project as a new power generation facility comprised of fourteen (14) 1.5 MW wind turbine generators (total output of 21 MW), a electrical substation, an operations and maintenance building, various support structures, and electric grid interconnection facilities that will be located adjacent to the current Kaheawa Wind Power facility located near Ukumehame on the Island of Maui.

As noted in the DEIS (p 2-15): "*KWP II and HECO are in the process of conducting a Performance Requirements Study to determine what will be needed to interconnect the proposed project with the Maui grid.*" MECO would like to state that the Performance Requirements Study (a.k.a. the Wind Integration Study) and a future Interconnection Requirements Study (IRS) will determine the technical aspects for the interconnection of KWP II to the Maui grid. Therefore, it is MECO's position to allow the two studies to provide guidance on the specifications of the interconnection infrastructure that will tie the proposed project to the utility's system.

On a detail level, MECO would like to note that in past discussions with the KWP2 electrical consultant, the substation connection for the proposed project would connect to the 69 kV Lahaina #1 transmission line which is the lower (makai-side) of the upper two transmission lines in the area (in other words, the Lahaina #1 line is the middle transmission line of the three 69 kV transmission lines connecting the Maalaea Generating Station to the Lahaina substations). This **differs** from the statement on p. 2-11 which states: "*The new substation that is a part of the KWP II proposal would connect to this lower transmission line.*"

Again, thank you for the opportunity to comment. If you should require further clarification, please contact Fred Oshiro, Electric System Engineer by email at fred.oshiro@mauielectric.com or by phone at (808) 872-3202.

Sincerely,

Andy Herrera
Manager, Transmission and Distribution Department

AH/fo:lb

cc: Perry White, Planning Solutions (via e-mail)

PLANNING
SOLUTIONS

November 16, 2009

Mr. Andy Herrera
Manager, Transmission and Distribution Department
Maui Electric Company, Ltd.
P.O. Box 398
Kahului, Maui, HI 96733-6898

Subject: Draft Environmental Impact Statement: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Herrera:

Thank you for your April 8, 2009 letter concerning the proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Draft Environmental Impact Statement* (*DEIS*) and providing written comments.

At the time the *DEIS* was published in February, 2009, KWP II LLC had concluded based on the best available wind resource data and on the results of analyses of natural resources that the Downwind/Downstring siting area it proposed would best meet the project objectives. Since that time, it has had the opportunity to collect and analyze additional wind resource data and to consider comments submitted by resource agencies as part of the Chapter 343 and Habitat Conservation Plan review process. Taken together, this new information has led KWP II to conclude that locating its facilities lower on the mountainside has several advantages, some of which are quite substantial and may reduce potential impacts to resources identified by DOFAW and other agencies during the project's review.

KWP II LLC has now identified an additional siting alternative for its proposed facilities that it believes is equal to/superior to the original proposal with respect to potential effects on threatened and endangered species and which has a number of other advantages. Situated in what is referred to as the "Down Road Siting Area", the "Downroad Alternative" is now KWP II LLC's "Preferred Alternative". In discussion with the State of Hawai'i Department of Land and Natural Resources, it has concluded that the best way to proceed is to issue a *Revised DEIS* that addresses the potential effects of what is now its "Preferred Alternative", as well as the effects of the "Downwind/Downstring Alternative" evaluated in the February 2009 *DEIS*.

We are now preparing the *Revised DEIS* and expect that it will be released for public review and comment in the 4th quarter of 2009. However, because that report will include the project plans on which you commented as an alternative, we would like to take this opportunity to provide the following item-by-item responses to your comments. These are relevant to both the Preferred Alternative and Downwind/Downstring Alternative. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

Comment 1:

As noted in the DEIS (p 2-15): "KWP II and HECO are in the process of conducting a Performance Requirements Study to determine what will be needed to interconnect the proposed project with the Maui grid." MECO would like to state that the Performance Requirements Study (a.k.a. the Wind Integration Study) and a future Interconnection Requirements Study (IRS) will determine the technical aspects for the interconnection of KWP II to the Maui grid. Therefore, it is MECO's position to allow the two studies to provide guidance on the specifications of the interconnection infrastructure that will tie the proposed project to the utility's system.

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

Response: Thank you for confirming that the results of the Wind Integration Study and Interconnection Requirements Study (IRS) will determine the technical details of the way in which KWP II feeds power into MECO's electrical grid.

Comment 2:

*On a detail level, MECO would like to note that in past discussions with the KWP 2 electrical consultant, the substation connection for the proposed project would connect to the 69 kV Lahaina #1 transmission line which is the lower (makai-side) of the upper two transmission lines in the area (in other words, the Lahaina #1 line is the middle transmission line of the three 69 kV transmission lines connecting the Mā'alaea Generating Station to the Lahaina substations). This **differs** from the statement on p. 2-11 which states:* "The new substation that is a part of the KWP II proposal would connect to this lower transmission line."

Response: Thank you for providing this update on the intended manner of interconnecting the proposed project with MECO's existing electrical transmission facilities. We have amended the paragraph in Section 2.2.6.3 of the report that deals with this to read as follows:

Three electrical transmission lines presently cross the mountainside in the vicinity of Kaheawa Pastures. They are located in two corridors. The upper corridor, which contains two transmission lines, is at an elevation of approximately 2,300 feet, and electrical power from the KWP I substation is fed into the uppermost of the two lines. The lower corridor, which contains a single electrical line, crosses the pastures about a mile makai of the upper two lines at an elevation of about 1,800 feet. The new substation that is part of the KWP II proposal would connect to the lower of the two transmission lines in the upper corridor.

In order to be consistent with this change, we have amended other relevant parts of the *Revised DEIS* as needed. The changes include revisions to drawings that show the substation and electrical lines.

If you have any questions in the future concerning this project, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Ms. Noe Kalipi, KWP II LLC
Mr. Dave Cowan, KWP II LLC
DLNR Office of Conservation and Coastal Lands

COMMENT NO. 011

MAUI CONTRACTORS ASSOCIATION

April 6, 2009

Office of Conservation and Coastal Lands
Department of Land and Natural Resources
State of Hawaii
P.O. Box 621
Honolulu 96809
Attn: Mr. Sam Lemmo

RE: Draft EIS Comments for Kaheawa Wind Power II Wind Energy Generation Facility, Ukumehame, Maui, Hawaii

Dear Mr. Lemmo,

Maui Contractors Association strongly supports the Kaheawa Wind Power II Wind Energy Generation Facility. This project will support the building industry in Maui County by alleviating the economic struggles for our industry by putting workforce back to work. MCA feels that Kaheawa has taken the appropriate steps to conserve the current natural habitat during and after the completion of construction. It is Maui Contractors Association goal to support renewable energy sources for the stability of our state.

Should you have any questions, please don't hesitate to call me at (808)871-5733. Thank you for the opportunity to send in a letter of support for Kaheawa Wind Power II Wind Energy Generation Facility.

Sincerely,

Jacqueline Haraguchi
Executive Director

Cc: Mr. Perry J. White, Planning Solutions Inc., 210 Ward Ave., Suite 330
Honolulu 96814

PLANNING SOLUTIONS

November 16, 2009

Ms. Jacqueline Haraguchi
Executive Director
Maui Contractors Association
319 Ano Street
Kahului, Maui, HI 96732

Subject: Draft Environmental Impact Statement: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Ms. Haraguchi:

Thank you for sending us a copy of your April 6, 2009 letter to the Office of Conservation and Coastal Lands. We acknowledge your Association's support of expanded use of renewable energy sources and appreciate the time you and members of the Maui Contractors Association spent reviewing the *Draft Environmental Impact Statement* (*DEIS*) and preparing written comments.

At the time the *DEIS* was published in February, 2009, KWP II LLC had concluded based on the best available wind resource data and on the results of analyses of natural resources that the Downwind/Downstring siting area it proposed would best meet the project objectives. Since that time, it has had the opportunity to collect and analyze additional wind resource data and to consider comments submitted by resource agencies as part of the Chapter 343 and Habitat Conservation Plan review process. Taken together, this new information has led KWP II to conclude that locating its facilities lower on the mountainside has several advantages, some of which are quite substantial and may reduce potential impacts to resources identified by DOFAW and other agencies during the project's review.

KWP II LLC has now identified an additional siting alternative for its proposed facilities that it believes is equal to/superior to the original proposal with respect to potential effects on threatened and endangered species and which has a number of other advantages. Situated in what is referred to as the "Down Road Siting Area", the "Downroad Alternative" is now KWP II LLC's "Preferred Alternative". In discussion with the State of Hawai'i Department of Land and Natural Resources, it has concluded that the best way to proceed is to issue a *Revised DEIS* that addresses the potential effects of what is now its "Preferred Alternative", as well as the effects of the "Downwind/Downstring Alternative" evaluated in the original *DEIS*.

We are now preparing the *Revised DEIS* and expect that it will be released for public review and comment in the 4th quarter of 2009. However, because the report will include the project plans on which you commented as an alternative, we would like to take this opportunity to provide the following item-by-item responses to your comments. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

Comment 1:

Maui Contractors Association strongly supports the Kaheawa Wind Power II Wind Energy Generation Facility. This project will support the building industry in Maui County by alleviating the economic struggles for our industry by putting workforce back to work.

Response: We appreciate being apprised of the Maui Contractors Association's support for the proposed Kaheawa Wind Power II Project and will include a copy of your letter in the *Revised DEIS* for the project. We are pleased that you agree with the *DEIS*' assessment of the extent to which the construction employment and business activity resulting from the project will affect Maui's economy and the building industry.

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

Comment 2:

MCA feels that Kaheawa has taken the appropriate steps to conserve the current natural habitat during and after the completion of construction.

Response: Thank you for expressing your belief that KWP II, LLC is taking appropriate measures to help conserve the natural habitat in the Downwind/Downstring Alternative project area. We hope you will find that KWP II LLC's Preferred Alternative also meets with your approval.

We will include a copy of your letter and this response in the *FEIS*. If you have any questions, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Ms. Noe Kalipi, KWP II LLC
Mr. Dave Cowan, KWP II LLC
DLNR Office of Conservation and Coastal Lands

COMMENT NO. 012

LINDA LINGLE
GOVERNOR

BRENNON T. MORIOKA
DIRECTOR

Deputy Directors
MICHAEL D. FORMBY
FRANCIS PAUL KEENO
BRIAN H. SEKIGUCHI
JIRO A. SUMADA

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

IN REPLY REFER TO:

STP 8.3214

April 7, 2009

Mr. Samuel J. Lemmo
Administrator
Department of Land and Natural Resources
Office of Conservation and Coastal Lands
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Lemmo:

Subject: Kaheawa Wind Power II
Draft Environmental Impact Statement (DEIS)

Thank you for providing the subject document for review and comments.

The State Department of Transportation (DOT) understands that the subject DEIS addresses a proposed project to construct a 21 megawatt wind generating facility and related improvements at Kaheawa Pastures above Ma'alaea, Maui. The proposed project will encompass approximately 333 acres adjacent to the existing wind power facilities, which will be leased from the State. The proposed new facility will include 14 wind turbine generators, an electrical substation and lines, a battery energy storage system, internal service roads and other related facilities.

DOT previously commented on the subject project's EIS Preparation Notice (EISPN) in letter, STP 8.2791, dated March 5, 2008, and received an acknowledgement of DOT's concerns from the project consultant, Planning Solution, Inc's, letter dated April 14, 2008.

DOT understands that the subject project will address any Federal Aviation Administration requirements.

Because access to the project site originates from the State Highway, Honoapiilani Highway, the EIS should address the following comments from the DOT Highways Division Planning Branch.

1. The most significant impacts to the State highway will occur during construction, given the movment of personnel, trucks and large wind turbine generators, poles and other related equipment, and must be mitigated.

2. A permit for the transport of oversized and/or overweight equipment and materials on the State highway facilities is required. As part of the permit process, the applicant must develop a traffic control plan for such movements of oversized and/or overweight vehicles to the satisfaction of the DOT Highways Division Maui District Engineer.

3. The transport of all such equipment and materials on State highway facilities must be conducted in a safe and appropriate manner. Any damage to State highway facilities and/or equipment caused by transport actions shall be immediately reported to the Maui District Engineer. Further, the applicant must immediately undertake any and all corrective or emergency actions and repairs in order to protect public safety. All such repairs, emergency actions and corrective work shall be done at no cost to the State.

4. To prevent materials and/or debris from impacting State highway facilities and operations, the applicant must implement a maintenance and monitoring program that is approved by the Maui District Engineer. The applicant must immediately remove any and all project-related materials and/or debris from the State highway facilities, including mud tracked onto the roadway by project vehicles. This maintenance and monitoring program must continue to be coordinated with the Maui District Engineer and shall remain in effect for the duration of the wind farm operations.

5. The applicant must acquire a permit for any work done within the State highway right-of-way.

DOT appreciates the opportunity to provide comments. If there are any questions, please contact Mr. David Shimokawa of the DOT Statewide Transportation Planning Office at (808) 587-2356.

Very truly yours,

Francis Paul Keeno

for BRENNON T. MORIOKA, PH.D., P.E.
Director of Transportation

c: Mr. Perry J. White, Planning Solutions, Inc.
Ms. Kathy Kealoha, Office of Environmental Quality Control

PLANNING
SOLUTIONS

November 16, 2009

Mr. Brennon T. Morioka, Ph.D., P.E.
Director of Transportation
Department of Transportation
State of Hawai'i
869 Punchbowl Street
Honolulu, HI 96813-5097

Subject: Draft Environmental Impact Statement: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Dr. Morioka:

Thank you for your April 7, 2009 letter to the Office of Conservation and Coastal Lands [your reference File No. STP 8.3214] concerning the proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Draft Environmental Impact Statement* (*DEIS*) and providing written comments.

At the time the *DEIS* was published in February, 2009, KWP II LLC had concluded based on the best available wind resource data and on the results of analyses of natural resources that the Downwind/Downstring siting area it proposed would best meet the project objectives. Since that time, it has had the opportunity to collect and analyze additional wind resource data and to consider comments submitted by resource agencies as part of the Chapter 343 and Habitat Conservation Plan review process. Taken together, this new information has led KWP II to conclude that locating its facilities lower on the mountainside has several advantages, some of which are quite substantial and may reduce potential impacts to resources identified by DOFAW and other agencies during the project's review.

KWP II LLC has now identified an additional siting alternative for its proposed facilities that it believes is equal to/superior to the original proposal with respect to potential effects on threatened and endangered species and which has a number of other advantages. Situated in what is referred to as the "Down Road Siting Area", the "Downroad Alternative" is now KWP II LLC's "Preferred Alternative". In discussion with the State of Hawai'i Department of Land and Natural Resources, it has concluded that the best way to proceed is to issue a *Revised DEIS* that addresses the potential effects of what is now its "Preferred Alternative", as well as the effects of the "Downwind/Downstring Alternative" evaluated in the original *DEIS*.

We are now preparing the *Revised DEIS* and expect that it will be released for public review and comment in the 4th quarter of 2009. However, because the report will include the project plans on which you commented as an alternative, we would like to take this opportunity to provide the following item-by-item responses to your comments. These are relevant to both the Preferred Alternative and Downwind/Downstring Alternative. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

Comment 1:

The most significant impacts to the State highway will occur during construction, given the movement of personnel, trucks and large wind turbine generators, poles and other related equipment, and must be mitigated.

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

Response: KWP II, LLC recognizes that the most significant impacts to the State highway will occur during construction, when employee vehicles, construction trucks, and trucks transporting large wind turbine generators, poles and other related equipment will be on the highway. Section 4.13.1 (Pg. 4-61) of the February 2009 *DEIS* discusses these effects in some detail and Section 4.13.1.1.3 (Pg. 4-64) outlines the mitigation measures that KWP II will implement.

Comment 2:

A permit for the transport of oversized and/or overweight equipment and materials on the State highway facilities is required. As part of the permit process, the applicant must develop a traffic control plan for such movements of oversized and/or overweight vehicles to the satisfaction of the DOT Highways Division Maui District Engineer.

Response: KWP II understands that the trucking contractor will need to prepare and adhere to a detailed traffic control plan. Section 4.13.1 of the February 2009 *DEIS* provided a detailed discussion for construction and operational trips, and specifically recognizes the transport of oversized and/or overweight equipment (see the bottom of Page 4-63). KWP II will add the permit for transporting oversized and/or overweight equipment and materials on the list of required permits and approvals. KWP II understands that its contractor must obtain a permit for the transport of oversized and/or overweight equipment and materials on the State highway facilities and will make that a requirement of the construction contract.

Comment 3:

The transport of all such equipment and materials on State highway facilities must be conducted in a safe and appropriate manner. Any damage to State highway facilities and/or equipment caused by transport actions shall be immediately reported to the Maui District Engineer. Further, the applicant must immediately undertake any and all corrective or emergency actions and repairs in order to protect public safety. All such repairs, emergency actions and corrective work shall be done at no cost to the State.

Response: KWP II understands that appropriate measures and protocols must be implemented to ensure the safe transport of all equipment and materials on State highway facilities. It has confirmed that it will immediately report any damage to State highway facilities and/or equipment caused by transport actions to the Maui District Engineer and will undertake corrective or emergency actions and repairs in order to protect public safety. It also understands that all of this must be done at no cost to the State.

Comment 4:

To prevent materials and/or debris from impacting State highway facilities and operations, the applicant must implement a maintenance and monitoring program that is approved by the Maui District Engineer. The applicant must immediately remove any and all project-related materials and/or debris from the State highway facilities, including mud tracked onto the roadway by project vehicles. This maintenance and monitoring program must continue to be coordinated with the Maui District Engineer and shall remain in effect for the duration of the wind farm operations.

Response: KWP II has informed us that it will prepare a maintenance and monitoring program designed to prevent materials and/or debris from impacting State highway facilities and operations and submit it to the Maui District Engineer for review and approval. The plan will provide for the immediate removal of project-related materials and/or debris from the State highway facilities, including mud tracked onto the roadway by project vehicles. It will coordinate this monitoring and maintenance program with the Maui District Engineer and will keep it in effect for the duration of the wind farm operations.

Comment 5:

The applicant must acquire a permit for any work done within the State highway right-of-way.

Response: At present, KWP II does not anticipate carrying out any work within the State Highway right-of-way. Should a need for this arise, it understands that it would need to obtain a permit.

If you have any questions in the future concerning this project, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Ms. Noe Kalipi, KWP II LLC
Mr. Dave Cowan, KWP II LLC
DLNR Office of Conservation and Coastal Lands

Water Resources Research Center
Environmental Center

UNIVERSITY of HAWAI'I
MĀNOA

COMMENT NO. 013

April 9, 2009
RE: 0789

Noe Kalipi
Kaheawa Wind Power II LLC
c/o First Wind
33 Lono Avenue, Suite 380
Kahului, HI 96732

Dear Ms. Kalipi:

Draft Environmental Impact Statement
Kaheawa Wind Power II Wind Energy Generation Facility
Ukumehame, Maui

Kaheawa Wind Power II proposes to construct and operate a 21-megawatt (MW) wind generating facility at Kaheawa Pastures in West Maui. The proposed project would involve the construction of fourteen 1.5 MW wind turbine generators (WTGs), new internal service roads, an electrical substation, underground electrical power lines, a Battery Energy Storage System (BESS) and other infrastructure to support the project. The facility has an estimated lifespan of 20 years after which the owner will either decide to extend the lease or remove the facilities. The project is expected to provide both environmental and economic benefits in the form of reduced greenhouse gas emissions, cost savings in comparison to fossil fuel energy, and protection against future increases in fossil or bio-fuel costs.

This review was conducted with the assistance of Ryan Riddle, Environmental Center.

General Comments

The draft environmental impact statement (DEIS) does an adequate job concentrating on the topics that need to be discussed. The DEIS could have been improved if the authors had included a list of acronyms used throughout the document in the front section of the DEIS. There were many references to BESS, SPCC and others in the text that forced the reader to backtrack through the document only to find that the list is in part 8 of this DEIS.

In addition to our general comment we also have several specific comments.

2500 Dole Street, Krauss Annex 19 Honolulu, Hawai'i 96822
Telephone: (808) 956-7361 Fax: (808) 956-3980
An Equal Opportunity/Affirmative Action Institution

Economic Benefits (pp. 1-5 – 1-7)

The discussion on economic benefits should have included the costs and benefits to consumers. Although there is a statement that Hawaii's citizens pay the highest energy cost, there is no discussion of what MECO charges ratepayers and how this project will impact the ratepayer.

Characteristics of 1.5-MW Wind Turbine (p. 2-8)

The operating parameters of a 1.5 MW wind turbine are given in Table 2.2. The DEIS states that the minimum operational speed is 8 miles per hour while the maximum operational speed is 56 miles per hour. How often are wind speeds within these minimum and maximum parameters?

Reasons for Eliminating the Upwind Siting Area (p. 2-18)

In the second paragraph on page 2-18 the DEIS states "The Upwind siting area that was considered is located on the western side of the existing main access road approximately 2,000 feet to the east of the existing KWP I turbines." Figure 2.10 depicts the Upwind String as being east of the existing access road.

Reasons for Eliminating the Downroad Siting Area (p. 2-18)

Excessive wind turbulence is given as a reason for eliminating the Downroad siting area. Can you define what constitutes excessive wind turbulence and how it impacts WTGs?

Develop Wind Power Generating Facility on Another Site (p. 2-19)

In this section, the DEIS mentions that other Maui locations were considered but eliminated due to lack of adequate transmission capability, proximity to populated areas, topography, and other constraints. What other locations were considered and eliminated? None were mentioned in section five which examines only the "no action" alternative.

Hawaiian Petrel and Newell's Shearwater (pp. 3-17 – 3-18)

In paragraph two of section 3.7.2.1 the DEIS states that 1,000 petrel pairs were previously estimated to breed on Maui. Later in the paragraph the DEIS states that the current Maui population is much higher than the previous estimate of 1,000 pairs. What is the current estimate for breeding pairs on Maui?

Nene (Hawaiian Goose) (p. 3-20)

In the fourth paragraph of this section the DEIS states that a new Nene release pen will be established on land owned by Haleakala Ranch. Does this new pen replace the current release pen in Hanaula or will it be in addition to it?

Other Wildlife (p. 3-23)

In Section 3.7.2.4 the DEIS mentions Severns' early 2009 native snail survey and his conclusion that the KWP II site did not provide habitat suitable for native snails. Please include a discussion of what habitats *are* suitable for native snails.

Population and Housing (p. 3-31)

What is the extent of the "sizable" new residential community proposed for Olowalu? How might this project affect future development in the Olowalu area?

Soil-Disturbing Construction Activities (p. 4-2)

What percentage of soil displaced during construction activities will be retained on-site? What percentage will be taken off-site?

Construction Period Impacts & Mitigation Measures (pp. 4-7 – 4-9)

In the last part of this section there is a bulleted list of mitigative measures that construction contractors will be required to follow. We note that the third and fourth bulleted point lack any way to measure whether they will be met. It would be better to place a limit as to how much grubbing and grading can take place at one time. In the absence of any precision it is difficult to measure how well these conditions will be met.

The proponents may wish to schedule grading during the drier summer months as another mitigative measure.

Failure From Lightning Strike (p. 4-13)

In the last sentence in Section 4.5.3 the DEIS states, "there have been instances where lightning strikes have shattered blades. Most of the blades have stayed partially attached to the WTGs, but in a few instances broken pieces of blade have detached and been thrown some distance. In no case has the distance exceeded the distance that would result from the more catastrophic event described above." We assume that you are referring to hurricanes and high winds as "the more catastrophic event." What distances have blades been thrown elsewhere in

hurricane and high wind conditions? What distance have blades been thrown as a result of lightning strikes?

Proposed Fire Prevention and Response Measures (p. 4-14)

Given the high risk of fire in the area it would be helpful to have the KWP II fire contingency plan appended or summarized in the text.

Measures to Mitigate Take of Protected Species (p. 4-28)

The readability of this section could be improved if the rest of the mitigative measures listed on the top of page 4-32 were combined with those listed on page 4-28.

Consistency of the Proposed KWP II Facility with the USFWS Interim Voluntary Guidelines for Wind Projects (pp. 4-29 – 4-31)

In column two, row one, on page 4-30 the DEIS states, "Nene do utilize open areas and rock outcrops, and KWP II LLC has micro-sited the proposed WTGs so as not to disturb the features that are most attractive to Nene." What features are most attractive to Nene and how has KWP II micro-sited with respect to these features?

Applicable Noise Control Standards (p. 4-38)

The first sentence in section 4.8.1 needs revision.

Socio-Economic Impacts (pp. 4-47 – 4-50)

What costs are expected to be associated with maintenance over the 20-year lifespan of the project?

Containment, Spill Prevention & Control Measures (pp. 4-59 – 4-60)

In the subsection on Spill Response, Reporting and Cleanup on page 4-60 the DEIS states, "Spill reporting may include notification to the National Response Center (NRC), US EPA, and the State Department of Land and Natural Resources." What level of spill requires reporting to these entities? Does the requirement for notification also include the Department of Health's Hazard Evaluation and Environmental Response (HEER) office?

No Action Alternative (p. 5-1)

The comment in the fourth paragraph of this section that the "No Action" alternative is included to fulfill a requirement of Chapter 343 is correct but misleading. The reason that the

"No Action" alternative is required as part of the analysis is to provide a baseline against which the proposed action can be compared. There are both consequences for undertaking a project and not undertaking it. In this case, for example, not developing a wind farm might mean that more carbon intensive ways of meeting Maui's energy demand will be required. This means more CO_2 will be released into the atmosphere.

The environment provides services that are foregone when development takes place. In effect, we are measuring the environmental services provided by the existing land use (in this case open space) against a new and different use (wind farms). In some cases, environmental services are highly valued, think of Kawainui marsh. In other cases, the services provided by the environment are valued less than another proposed use. How would decision makers ever know this unless some type of analysis is performed?

Thank you for the opportunity to review this Draft EIS.

Sincerely,

Peter Rappa
Environmental Review Coordinator

cc: OEQC
Perry White, Planning Solutions
Sam Lemmo, DLNR, Office of Conservation & Coastal Lands
James Moncur, WRRC
Ryan Riddle

PLANNING SOLUTIONS

November 16, 2009

Mr. Peter Rappa
Environmental Review Coordinator
Environmental Center
University of Hawai'i - Manoa
2500 Dole Street, Krauss Annex 19
Honolulu, HI 96822

Subject: Draft Environmental Impact Statement: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Rappa:

Thank you for your April 9, 2009 letter to Ms. Noe Kalipi of First Wind [your reference File No. 0789] concerning the proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Draft Environmental Impact Statement* (*DEIS*) and providing written comments. It is gratifying to us that the reviewers took the time needed to become familiar with so much of the document and to provide specific comments.

At the time the *DEIS* was published in February, 2009, KWP II LLC had concluded based on the best available wind resource data and on the results of analyses of natural resources that the Downwind/Downstring siting area it proposed would best meet the project objectives. Since that time, it has had the opportunity to collect and analyze additional wind resource data and to consider comments submitted by resource agencies as part of the Chapter 343 and Habitat Conservation Plan review process. Taken together, this new information has led KWP II to conclude that locating its facilities lower on the mountainside has several advantages, some of which are quite substantial and may reduce potential impacts to resources identified by DOFAW and other agencies during the project's review.

KWP II LLC has now identified an additional siting alternative for its proposed facilities that it believes is equal to/superior to the original proposal with respect to potential effects on threatened and endangered species and which has a number of other advantages. Situated in what is referred to as the "Down Road Siting Area", the "Downroad Alternative" is now KWP II LLC's "Preferred Alternative". In discussion with the State of Hawai'i Department of Land and Natural Resources, it has concluded that the best way to proceed is to issue a *Revised DEIS* that addresses the potential effects of what is now its "Preferred Alternative", as well as the effects of the "Downwind/Downstring Alternative" evaluated in the February 2009 *DEIS*.

We are now preparing the Revised DEIS and expect that it will be released for public review and comment in the 4th quarter of 2009. However, because the report will include the project plans on which you commented as an alternative, we would like to take this opportunity to provide the following item-by-item responses to your comments. These are identified using the headings provided in your letter. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

GENERAL COMMENTS

Comment 1:

The draft environmental impact statement (DEIS) does an adequate job concentrating on the topics that need to be discussed. The DEIS could have been improved if the authors had included a list of acronyms used throughout the document in the front section of the DEIS.

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

There were many references to BESS, SPCC and others in the text that forced the reader to backtrack through the document only to find that the list is in part 8 of this DEIS.

Response: Thank you for confirming that the February 2009 *DEIS* does an adequate job of addressing the important environmental issues associated with the proposed project. We are sorry you had difficulty with the location of the list of acronyms; it is clearly stated in the table of contents. Most of the standard guidance on glossaries and lists of acronyms calls for it to be placed at the end of the document, but we are aware that it is sometimes placed near the beginning.

ECONOMIC BENEFITS

Comment 2:

The discussion on economic benefits should have included the costs and benefits to consumers. Although there is a statement that Hawaii's citizens pay the highest energy cost, there is no discussion of what MECO charges ratepayers and how this project will impact the ratepayer.

Response: The extent to which the proposed project will affect what MECO charges ratepayers will be determined by the State of Hawai'i Public Utilities Commission (PUC). The PUC considers many factors in reaching a decision, including a multitude that are beyond the control of an individual project developer or operator such as KWP II. Because of this, it will not be possible to provide the information you have requested in the *Revised DEIS*.

CHARACTERISTICS OF 1.5-MW WIND TURBINE

Comment 3:

The operating parameters of a 1.5 MW wind turbine are given in Table 2.2. The DEIS states that the minimum operational speed is 8 miles per hour while the maximum operational speed is 56 miles per hour. How often are wind speeds within these minimum and maximum parameters?

Response: On average, wind speeds are expected to be within the operational range of the turbines (i.e., 8 to 56 miles per hour) approximately 70 percent of the time in the proposed development area.

REASONS FOR ELIMINATING THE UPWIND SITING AREA

Comment 4:

In the second paragraph on page 2-18 the DEIS states "The Upwind siting area that was considered is located on the western side of the existing main access road approximately 2,000 feet to the east of the existing KWP I turbines." Figure 2.10 depicts the Upwind String as being east of the existing access road.

Response: Thank you for calling our attention to this error. The Upwind String is located east of the existing access road and not on the western side as stated in the *DEIS*. We will correct this so that the sentence in the *Revised DEIS* will read:

The area eliminated is located on the eastern side of the existing main access road approximately 2,000 feet to the east (i.e., on the Central Valley side) of the existing KWP I turbines."

REASONS FOR ELIMINATING THE DOWNROAD SITING AREA

Comment 5:

Excessive wind turbulence is given as a reason for eliminating the Downroad siting area. Can you define what constitutes excessive wind turbulence and how it impacts WTGs?

Response: Wind turbines operate most efficiently when air flow is steady and laminar (i.e., non-turbulent), and as a general rule, the more turbulent the flow, the greater the wear and tear on the turbines. In addition, greater turbulence makes it more difficult to predict turbine power output. Please note that as explained in the second paragraph of this letter, information not available at the time the February 2009 *DEIS* was prepared has led KWP II to reconsider the Downroad Siting Area, and a variant of it will be included in the *Revised Draft EIS*.

DEVELOP WIND POWER GENERATING FACILITY ON ANOTHER SITE

Comment 6:

In this section, the DEIS mentions that other Maui locations were considered but eliminated due to lack of adequate transmission capability, proximity to populated areas, topography, and other constraints. What other locations were considered and eliminated? None were mentioned in section five which examines only the "no action" alternative.

Response: Section 2.5.2.3 of the February 2009 *DEIS*, which is titled "Develop Wind Power Generating Facility on Another Site", discusses the alternative of developing wind generating facilities elsewhere on Maui. It observes that the wind regime at Kaheawa Pastures is extremely favorable in its consistency and strength. It also notes that the site's proximity to KWP I allows KWP II to share infrastructure such as the main access road, some equipment storage and parts, and to a smaller extent, personnel, with the existing wind project, subject to licensing agreements between the parties. Finally, it notes that other wind-rich sites on Maui are located in areas that lack adequate transmission capability, are closer to/more visible from populated areas, have other constraints. These conclusions were based on a close examination of the wind maps that the State of Hawai'i has produced and that are available at http://www.state.hi.us/dbedt/ert/wwg/windy.html#maui.

HAWAIIAN PETREL AND NEWELL'S SHEARWATER

Comment 7:

In paragraph two of section 3.7.2.1 the DEIS states that 1,000 petrel pairs were previously estimated to breed on Maui. Later in the paragraph the DEIS states that the current Maui population is much higher than the previous estimate of 1,000 pairs. What is the current estimate for breeding pairs on Maui?

Response: The text should have read: *"the Maui population may be much higher than the 1,000 pairs previously estimated (Day and Cooper 2003)"*. Those authors conclude that the population exceeds 1,000 by a substantial amount, but did not attempt to give an exact estimate of the Maui population of Hawaiian Petrels.

NENE (HAWAIIAN GOOSE)

Comment 8:

In the fourth paragraph of this section the DEIS states that a new Nēnē release pen will be established on land owned by Haleakala Ranch. Does this new pen replace the current release pen in Hanaula or will it be in addition to it?

Response: In the latest draft of the HCP, KWP II LLC has committed that if a new release pen is deemed necessary for mitigation, a suitable off-site location will be selected in consultation with DLNR and USFWS. While this may turn out to be on land owned by Haleakala Ranch, this is not a requirement and there is flexibility. Regardless, if a new release pen is established it would be in addition to the one at Hana'ula.

OTHER WILDLIFE

Comment 9:

In Section 3.7.2.4 the DEIS mentions Severns' early 2009 native snail survey and his conclusion that the KWP II site did not provide habitat suitable for native snails. Please include a discussion of what habitats are *suitable for native snails.*

Response: The preferred habitats are a moist environment beneath rocks and talus in gulches at lower elevations; in the leaf litter beneath trees and shrubs; in mosses growing on trees and rocks; and beneath thick understory such as uluhe fern at mid-elevations. We are including this information in the *Revised DEIS.* In addition, the report will address effects on snails if the facilities are constructed on the Preferred Alternative location.

POPULATION AND HOUSING

Comment 10:

What is the extent of the "sizable" new residential community proposed for Olowalu? How might this project affect future development in the Olowalu area?

Response: Footnote 22 at the bottom of page 3-31 in the February 2009 *DEIS* characterizes the residential community that has been proposed for Olowalu. It states:

The plan for Olowalu calls for realigning the highway inland and the development of 565 Single Family Lots, 785 Multi-Family / Apartments, 150 "Live/Work" Units, and 25,000 sq. ft. of commercial business space in the town centers for such things as a surf shop, doctor, café, restaurant, dentist, book store, market, video store, hardware store, drug store, bakery, and bar.

As described in the February 2009 *DEIS*, the nearest of the Downwind/Downstring Alternative WTGs is approximately 4 miles from this proposed development, and most of the wind-related facilities for that alternative would be blocked from view by intervening terrain and/or vegetation. Consequently, other than providing a source of electrical energy that might be used by residents and businesses in the new community, the KWP II project is unlikely to affect this proposed community.

SOIL-DISTURBING CONSTRUCTION ACTIVITIES

Comment 11:

What percentage of soil displaced during construction activities will be retained on-site? What percentage will be taken off-site?

Response: KWP II anticipates that all of the cut material will be retained on-site; none will be trucked away. This is true for both alternatives now under consideration.

CONSTRUCTION PERIOD IMPACTS & MITIGATION MEASURES

Comment 12:

In the last part of this section there is a bulleted list of mitigative measures that construction contractors will be required to follow. We note that the third and fourth bulleted point lack any way to measure whether they will be met. It would be better to place a limit as to how much grubbing and grading can take place at one time. In the absence of any precision it is difficult to measure how well these conditions will be met.

The proponents may wish to schedule grading during the drier summer months as another mitigative measure.

Response: As discussed in the report, KWP II will need to obtain an NPDES Construction permit for either of the alternatives as it will involve the disturbance of more than an acre of land. It anticipates that the conditions of approval of this permit will limit the area that can be disturbed at any one time, and KWP II will adhere to that limit.

FAILURE FROM LIGHTNING STRIKE

Comment 13:

In the last sentence in Section 4.5.3 the DEIS states, "there have been instances where lightning strikes have shattered blades. Most of the blades have stayed partially attached to the WTGs, but in a few instances broken pieces of blade have detached and been thrown some distance. In no case has the distance exceeded the distance that would result from the more catastrophic event described above." We assume that you are referring to hurricanes and high winds as "the more catastrophic event." What distances have blades been thrown elsewhere in hurricane and high wind conditions? What distance have blades been thrown as a result of lightning strikes?

Response: Answers to the questions that you have posed are entirely dependent upon the specific WTG, with different manufacturers and equipment models having significantly different experiences. To date, General Electric 1.5 MW wind turbines of the type that would be installed for either alternative have not experienced any catastrophic failures of this sort. Consequently, it is not possible to provide a quantitative answer to your questions.

PROPOSED FIRE PREVENTION AND RESPONSE MEASURES

Comment 14:

Given the high risk of fire in the area it would be helpful to have the KWP II fire contingency plan appended or summarized in the text.

Response: Section 4.5.4.2 of the February 2009 *DEIS*, entitled "Proposed Fire Prevention and Response Measures" summarizes and notes the two main components of the detailed fire contingency plan for KWP II (in the case of either alternative) – proper education of all on-site contractors and personnel and properly maintaining all vehicles, equipment, tools, and turbine hardware. The Fire Contingency Plan for KWP II details various risk factors and response strategies that are necessary to effectively manage and implement the plan during construction and operation of the wind facility. These include identifying possible ignition sources, a description of the types of firefighting resources that are available, and measures to assure access for emergency response personnel and vehicles. A copy of the plan can be provided upon request.

MEASURES TO MITIGATE TAKE OF PROTECTED SPECIES

Comment 15:

The readability of this section could be improved if the rest of the mitigative measures listed on the top of page 4-32 were combined with those listed on page 4-28.

Response: Thank you for your suggestion. The separation was unintentional on our part, and we apologize for the decreased readability that it produced. This has been corrected in the *Revised DEIS*.

CONSISTENCY OF THE PROPOSED KWP II FACILITY WITH THE USFWS INTERIM VOLUNTARY GUIDELINES FOR WIND PROJECTS

Comment 16:

In column two, row one, on page 4-30 the DEIS states, "Nene do utilize open areas and rock outcrops, and KWP II LLC has micro-sited the proposed WTGs so as not to disturb the features that are most attractive to Nene." What features are most attractive to Nene and how has KWP II micro-sited with respect to these features?

Response: Nēnē are known to occupy rocky outcroppings that provide a clear view of the surrounding area during pair-bonding, nesting site selection, and incubation portions of the breeding season. Together with DOFAW biologists on Maui, KWP II biologists performed an on-site assessment in September, 2008 to evaluate and determine whether the Downwind/Downstring Alternative WTG sites and access roads would directly impact any such features. Several rocky outcroppings that fit the criteria described were identified in the down-string segment of the alternative project vicinity. Revisions in the design layout enabled fine-tuning to avoid directly impacting these features.

APPLICABLE NOISE CONTROL STANDARDS

Comment 17:

The first sentence in section 4.8.1 needs revision.

Response: The sentence you referenced in the February 2009 *DEIS* reads: "As discussed in Section 4.8.1, Hawaii Administrative Rules (HAR) Title 11, Chapter 46, Section 4 (§11-46-4) defines the maximum permissible community sound levels in dBA." I sincerely apologize if the copy that you received contains an error due to a broken cross-reference link.

SOCIO-ECONOMIC IMPACTS

Comment 18:

What costs are expected to be associated with maintenance over the 20-year lifespan of the project?

Response: KWP II LLC considers operations and maintenance cost figures proprietary. However, it reports that in general, operations and maintenance costs, for either of the alternatives, will fall into the following categories:

- *Manufacturer's Warranty/Operations & Maintenance Costs* – Services provided by the Manufacturer to ensure turbine performance and availability during operation, as stipulated by the terms of the warranty.
- *Operations & Maintenance by First Wind* – This includes, for example, all personnel, vehicles, environmental compliance costs, consultants, utilities, substation maintenance, collection system maintenance, and O&M building maintenance. Environmental compliance costs will include mitigation and other operations activities specified by the project's permits, i.e., the CDUP and HCP. An application for a CDUP has not yet been granted for the project, so related costs have not yet been determined. HCP costs have also not yet been determined, but will be estimated and included in the final document prior to approval.
- *Administrative Services – First Wind* – administration and overhead, including legal, accounting services and G&A.
- *Land Rent* – Paid to Hawaii DLNR.
- *Insurance* - Including but not limited to: auto, transit, general liability, umbrella policy, business interruption, disaster, operational property damage/machinery breakdown, and T&D lines.

CONTAINMENT, SPILL PREVENTION & CONTROL MEASURES

Comment 19:

In the subsection on Spill Response, Reporting and Cleanup on page 4-60 the DEIS states, "Spill reporting may include notification to the National Response Center (NRC), US EPA, and the State Department of Land and Natural Resources." What level of spill requires reporting to these entities? Does the requirement for notification also include the Department of Health's Hazard Evaluation and Environmental Response (HEER) office?

Response: The requirement for reporting does include the Department of Health's Hazard Evaluation and Environmental Response (HEER) office, and we will include a reference to that agency in the *Revised DEIS*. As indicated in the third paragraph (bullet item) on page 4-60 of the February 2009 *DEIS*, the reporting requirements vary depending upon the size of the spill. It is not practical to include a complete listing of these in the *Revised DEIS*. However, you can find them on the Internet at http://edocket.access.gpo.gov/cfr_2009/julqtr/pdf/40cfr355AppA.pdf (for the Federal regulations) and at http://gen.doh.hawaii.gov/sites/har/AdmRules1/11-45.pdf (for the State of Hawai'i regulations that reference the Federal regulations).

NO ACTION ALTERNATIVE

Comment 20:

The comment in the fourth paragraph of this section that the "No Action" alternative is included to fulfill a requirement of Chapter 343 is correct but misleading. The reason that the "No Action" alternative is required as part of the analysis is to provide a baseline against which the proposed action can be compared. There are both consequences for undertaking a project and not undertaking it. In this case, for example, not developing a wind farm might mean that more carbon intensive ways of meeting Maui's energy demand will be required. This means more CO_2 will be released into the atmosphere.

The environment provides services that are foregone when development takes place. In effect, we are measuring the environmental services provided by the existing land use (in this case open space) against a new and different use (wind farms). In some cases, environmental services are highly valued, think of Kawainui marsh. In other cases, the services provided by the environment are valued less than another proposed use. How would decision makers ever know this unless some type of analysis is performed?

Response: Your point is well taken. We have added a sentence to the fourth paragraph of Section 5.1 of the *Revised DEIS* that notes the "baseline" function that the "no action" alternative serves.

One of our principal objectives in drafting the EIS was to provide decision-makers all of the information they need to judge whether the environmental services provided by the proposed project are sufficient to offset (and preferably exceed in aggregate) those that would be lost if it is implemented. While we have addressed certain aspects of this in the "no action" chapter, some elements are addressed in various other sections of the document. For example, Section 1.2 discusses the economic and public health benefits associated with the fossil fuel emissions that the proposed project would avoid and Section 4.2.1 includes an analysis of greenhouse gas emissions and the potential for global warming that can be foregone if electrical energy from the proposed project is substituted for electrical energy produced using fossil fuels. Similarly, Chapter 4 discusses the project's impacts on land use and open space (which would be avoided under the "no action" scenario). We believe that when considered in its entirety, the document provides a sound basis for decision-making.

If you have any questions in the future concerning this project, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Ms. Noe Kalipi, KWP II LLC
Mr. Dave Cowan, KWP II LLC
DLNR Office of Conservation and Coastal Lands

COMMENT NO. 014

KCA

Kihei Community Association

"Working together to shape our Community's future"

Sam Lemmo
Dept of Land and Natural Resources
Office of Conservation & Coastal Lands
P.O. Box 621, Honolulu, HI 96809

Dear Mr. Lemmo,

The Kihei Community Association would like to express their support for the Draft EIS for Kaheawa Wind Power II. We at the KCA believe that we need to look towards the future and ensure that our power is generated in a sustainable method and not continue to rely on diesel fuel our electricity. Diesel is a polluting resource and because it is finite, it is unsustainable and will be subject to price increase and volatility. We feel that embracing Kaheawa Wind II is the right decision for Maui, for our environment, and for our economy. The project will reduce our annual consumption of oil by 138,000 barrels and will consequently eliminate millions of pounds of pollutants that are destroying our natural habitats. This project will accomplish this by also reducing our local energy costs to help spur our economy.

We have held a general membership meeting through our organization to discuss this project, and although there was a great deal of support, some concerns were brought to our attention. We would like to ensure that the developers of Kaheawa Wind Power II, through their Habitat Conservation Plan, do everything in its power to mitigate any environmental impacts imposed on the local natural habitat. We are specifically concerned about any disruption to the local ecosystem and any impact on local wildlife in the area. There was further concern from our membership that the power generated from this project, and the derived savings in energy expenditure, would remain on Maui to reduce our local energy costs. Finally, we understand that the Wind Turbines to be erected will be visible from our community, and there is some community apprehension about the visual impact, although in general we feel the overall environmental and economic benefits outweigh any visual impediment.

Thank you for the opportunity to submit testimony.

Jonathan D. Miller

Jon Miller
President
Kihei Community Association

CC: Planning Solutions, Inc.

PLANNING SOLUTIONS

November 16, 2009

Mr. Jon Miller, President
Kihei Community Association
P.O. Box 662
Kihei, Maui, Hawaii 96753

Subject: Draft Environmental Impact Statement: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Miller:

Thank you for your April 9, 2009 letter concerning the proposed Kaheawa Wind Power II Project. We appreciate the time you and your members spent reviewing the *Draft Environmental Impact Statement* (*DEIS*) and providing written comments.

At the time the original *DEIS* was published in February, 2009, KWP II LLC had concluded based on the best available wind resource data and on the results of analyses of natural resources that the Downwind/Downstring siting area it proposed would best meet the project objectives. Since that time, it has had the opportunity to collect and analyze additional wind resource data and to consider comments submitted by resource agencies as part of the Chapter 343 and Habitat Conservation Plan review process. Taken together, this new information has led KWP II to conclude that locating its facilities lower on the mountainside has several advantages, some of which are quite substantial and may reduce potential impacts to resources identified by DOFAW and other agencies during the project's review.

KWP II LLC has now identified an additional siting alternative for its proposed facilities that it believes is equal to/superior to the original proposal with respect to potential effects on threatened and endangered species and which has a number of other advantages. Situated in what is referred to as the "Down Road Siting Area", the "Downroad Alternative" is now KWP II LLC's "Preferred Alternative". In discussion with the State of Hawai'i Department of Land and Natural Resources, it has concluded that the best way to proceed is to issue a *Revised DEIS* that addresses the potential effects of what is now its "Preferred Alternative", as well as the effects of the "Downwind/Downstring Alternative" evaluated in the February 2009 *DEIS*.

We are now preparing the *Revised DEIS* and expect that it will be released for public review and comment in the 4th quarter of 2009. However, because the *Revised DEIS* will include the project plans on which you commented as an alternative, we would like to take this opportunity to provide the following item-by-item responses to your comments. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

Comment 1:

> *We would like to ensure that the developers of Kaheawa Wind Power II, through their Habitat Conservation Plan, do everything in its power to mitigate any environmental impacts imposed on the local natural habitat. We are specifically concerned about any disruption to the local ecosystem and any impact on local wildlife in the area.*

Response: KWP II LLC shares your desire to minimize adverse environmental effects resulting from the proposed project. As mentioned above, it continues its efforts to reduce potential impacts to resources and thus has selected an additional siting alternative as their Preferred Alternative. As previously discussed in the February 2009 *DEIS* and as required by applicable law, KWP II LLC is taking appropriate measures to minimize and mitigate impacts on wildlife and habitat to the

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

maximum extent practicable. These efforts are described in detail in the KWP II Habitat Conservation Plan, which will be released for public review and comment in the coming months.

Comment 2:

There was further concern from our membership that the power generated from this project, and the derived savings in energy expenditure, would remain on Maui to reduce our local energy costs.

Response: The State Public Utilities Commission (PUC) will determine the amount that MECO pays KWP II for electricity generated by the proposed project. The PUC considers many factors in reaching a decision, including many that are beyond the control of an individual project developer or operator such as KWP II. Because of this, it is not possible to provide the information you have requested.

Comment 3:

Finally, we understand that the Wind Turbines to be erected will be visible from our community, and there is some community apprehension about the visual impact, although in general we feel the overall environmental and economic benefits outweigh any visual impediment.

Response: KWP II has asked me to say that it appreciates the Association's expression of its belief that the positive environmental and economic benefits of the proposed project outweigh any visual impediments. As discussed in the *DEIS,* concerns about visual impacts were a factor in the elimination of some potential siting areas at KWP II, most notably the "upwind" siting area. Under the proposed KWP II layout, the new turbines would be somewhat more visible from Kīhei than are the ones already existing at Kaheawa Pastures. Ms. Noe Kalipi has asked me to assure you that they would not have introduced this new possibility if it had not seemed superior from a number of other environmental standpoints.

If you have any questions in the future concerning this project, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Ms. Noe Kalipi, KWP II LLC
Mr. Dave Cowan, KWP II LLC
DLNR Office of Conservation and Coastal Lands

COMMENT NO. 015

blue planet FOUNDATION

Date: April 9, 2009

Contact: Julie Rogers
Blue Planet Foundation
Ph. (808) 954-6144
julie@blueplanetfoundation.org

Comments on Draft EIS for Kaheawa Wind Project expansion

Blue Planet believes that the expansion of the Kaheawa Wind Power (KWP) is instrumental in attaining Hawaii's goal of energy independence. The success of KWP I suggest a high probability of KWP II following suit and reducing a large portion of fossil fuels being burnt in Hawaii today.

Blue Planet offers these comments as follows:

Section 1.2
Term 'local renewable' changed to 'indigenous renewable' to be consistent with the preferred terminology used in official documents.

Section 2.2.6
Blue Planet would like to inquire into the specification of the BESS system chosen for the KWP site. The battery storage component is crucial to intermittent power generation and could help increase the efficiency of the power plant. We do agree that the some of the systems listed in the EIS (hydro, thermal) are not suited for this site, but there are options within the dry cell battery as well as new advances in technologies that may warrant further investigation.

Section 4.3
Blue Planet would like to suggest use of biodiesel in place of diesel. Use of biodiesel would further reduce the impact of KWP project during the construction phase and would strengthen the sustainability aspect of the project.

Section 4.5
Blue Planet would like to see a stronger fire protection system implemented on the KWP site. In light of the recent fires, KWP may want to consider a land management plan that includes planting native plants to displace the fire-ready invasives in areas outside of the projected site.

About Blue Planet Foundation
The Blue Planet Foundation, a non-profit 501(c)3 organization formed in 2007, seeks to end the use of fossil fuel on Earth, starting by making Hawaii a global model for clean energy solutions. For more information, visit www.blueplanetfoundation.org.

PLANNING SOLUTIONS

November 16, 2009

Ms. Julie Rogers
Blue Planet Foundation
55 Merchant Street, 17th Floor
Honolulu, HI 96813

Subject: Draft Environmental Impact Statement: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Ms. Rogers:

Thank you for your April 9, 2009 letter concerning the proposed Kaheawa Wind Power II Project. We appreciate the time you spent reviewing the *Draft Environmental Impact Statement* (*DEIS*) and providing written comments.

At the time the original *DEIS* was published in February, 2009, KWP II LLC had concluded based on the best available wind resource data and on the results of analyses of natural resources that the Downwind/Downstring siting area it proposed would best meet the project objectives. Since that time, it has had the opportunity to collect and analyze additional wind resource data and to consider comments submitted by resource agencies as part of the Chapter 343 and Habitat Conservation Plan review process. Taken together, this new information has led KWP II to conclude that locating its facilities lower on the mountainside has several advantages, some of which are quite substantial and may reduce potential impacts to resources identified by DOFAW and other agencies during the project's review.

KWP II LLC has now identified an additional siting alternative for its proposed facilities that it believes is equal to/superior to the original proposal with respect to potential effects on threatened and endangered species and which has a number of other advantages. Situated in what is referred to as the "Down Road Siting Area", the "Downroad Alternative" is now KWP II LLC's "Preferred Alternative". In discussion with the State of Hawai'i Department of Land and Natural Resources, it has concluded that the best way to proceed is to issue a *Revised DEIS* that addresses the potential effects of what is now its "Preferred Alternative", as well as the effects of the "Downwind/Downstring Alternative" evaluated in the February 2009 *DEIS*.

We are now preparing the *Revised DEIS* and expect that it will be released for public review and comment in the 4th quarter of 2009. However, because the report will include the project plans on which you commented as an alternative, we would like to take this opportunity to provide the following item-by-item responses to your comments. These are identified using the headings provided in your letter. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

SECTION 1.2

Comment:

Term 'local renewable' changed to 'indigenous renewable' to be consistent with the preferred terminology used in official documents.

Response: Thank you for your suggestion. We will incorporate the term indigenous renewable resource in the *Revised DEIS*.

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

SECTION 2.2.6

Comment:

Blue Planet would like to inquire into the specification of the BESS system chosen for the KWP site. The battery storage component is crucial to intermittent power generation and could help increase the efficiency of the power plant. We do agree that some of the systems listed in the EIS (hydro, thermal) are not suited for this site, but there are options within the dry cell battery as well as new advances in technologies that may warrant further investigation.

Response: The exact size of the system is still being determined by studies being conducted by Maui Electric Company as part of the Interconnection Requirements Study (IRS). The Battery Energy Storage System will be manufactured by Xtreme Power, a U.S.-based Company that manufactures large scale power systems which includes XP's PowerCell Technology. The PowerCell is based on a dry cell low reaction electro-chemistry. Dry cells have no liquid, gel, paste, or free electrolyte. XP's PowerCell has double-containment, and the project engineers have concluded that it has an excellent safety record with an extremely low risk of releasing hazardous material into the environment.

SECTION 4.3

Comment:

Blue Planet would like to suggest use of biodiesel in place of diesel. Use of biodiesel would further reduce the impact of KWP project during the construction phase and would strengthen the sustainability aspect of the project.

Response: KWP II has concluded that requiring the construction contractor to use only biodiesel would not be practical. This is due both to the fact that some types of construction equipment are unable to operate on that fuel and to its limited availability. However, KWP II has indicated that it will recommend to the contractor that it be used to the extent practical given price and availability constraints.

SECTION 4.5

Comment:

Blue Planet would like to see a stronger fire protection system implemented on the KWP site. In light of the recent fires, KWP may want to consider a land management plan that includes planting native plants to displace the fire-ready invasives in areas outside of the project site.

Response: The facilities and activities that KWP II is proposing do not carry with them a significant risk of igniting wildfires. Neither will they increase the amount or volatility of fuel in the area that could feed wildfires started by others. The controlled-access roads that KWP II would construct if Alternative 2 is implemented would both serve as firebreaks and increase the ease with which people and equipment used to fight wildfires can access the area, thereby restricting the spread of wildfires

started by other sources and increasing the speed with which wildfires from all sources could be extinguished. In view of this, the only mechanism through which the project could affect wildfire risk is if it facilitated the spread of "fire-ready" invasive vegetation. As the sites that are being considered for the proposed faculties are already largely covered with such species and the proposed construction would actually decrease the amount of fuel available, there is little potential for this to occur.

KWP II's proposed Fire Contingency Plan follows the plan that is currently in place at KWP I. As described in Section 4.6.2.1 of the February 2009 *DEIS,* KWP II is proposing to implement a comprehensive plan for invasive species prevention and control at the KWP II site and to continue coordinating efforts with the Fireweed Working Group, the Hawai'i Department of Agriculture and the Maui Invasive Species Commission. Finally, it is worth noting that the fire-fighting staff and equipment that the existing plan has made available have already proven instrumental in bringing fires under control in a timely manner and limiting the extent of the areas burned. These efforts have gone well beyond the basic provisions of the plan. KWP II will make its fire-fighting resources available in the event of any wildfires in the area, but it lacks the authority to implement land management activities outside the area under its control.

If you have any questions in the future concerning this project, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Ms. Noe Kalipi, KWP II LLC
Mr. Dave Cowan, KWP II LLC
DLNR Office of Conservation and Coastal Lands

COMMENT NO. 016

CHARMAINE TAVARES
Mayor

JEFFREY S. HUNT
Director

KATHLEEN ROSS AOKI
Deputy Director

COUNTY OF MAUI
DEPARTMENT OF PLANNING

April 9, 2009

Mr. Samuel Lemmo
State of Hawaii
Department of Land and Natural Resources
Office of Conservation and Coastal Lands
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Lemmo:

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS) COMMENTS FOR THE PROPOSED KAHEAWA WIND POWER II WIND GENERATION FACILITY LOCATED AT TMK: 4-8-001:001 AND 3-6-001:014, ISLAND OF MAUI, HAWAII (EAC 2009/0011)

The Department of Planning (Department) is in receipt of the above-referenced document for the proposed Kaheawa Wind Power II Generation Facility. The Department understands the proposed action includes the following:

- The construction of a 21 mega watt (MW) wind power generating facility (Facility) and related improvements at Kaheawa Pastures above Maalaea on approximately 333 acres of land adjacent to the existing Kaheawa Wind Power facility.

- The proposed Facility will consist of: meteorological monitoring towers and communication equipment; internal service roads connecting to the existing main access road; operations and maintenance building to house personnel, equipment, and facility spare parts; 14 General Electric (GE) 1.5 MW wind turbine generators; an electrical substation, battery energy storage system, and interconnection facilities to link the Facility to the existing MECO power transmission system; and underground electrical power lines connecting the turbines with the substation.

The Draft EIS includes the information provided by the Department in its letter dated March 14, 2008. Our letter and your responses were included in the Draft EIS.

Additional comments on the Draft EIS pertain to alien species, erosion control and restoration, fire control and protected species and incidental take are as follows:

250 SOUTH HIGH STREET, WAILUKU, MAUI, HAWAII 96793
MAIN LINE (808) 270-7735; FACSIMILE (808) 270-7634
CURRENT DIVISION (808) 270-8205; LONG RANGE DIVISION (808) 270-7214; ZONING DIVISION (808) 270-7253

Alien Species

1) The education program for staff should include information about invasive species and dispersal, with strict protocols set in place for personal vehicles, clothing, and gear;

2) New invasive species should be controlled at the time of introduction, before they can become established and difficult and expensive to eradicate;

Erosion Control/Restoration

3) Native landscaping and protection of intact native ecosystems should be a preventative measure and not merely a means of intervention in disturbed areas. Grading and grubbing should be minimized to the extent possible and re-vegetation should occur immediately after;

4) We oppose the use of kikuyu grass to restore disturbed areas, it is considered invasive by many conservationists because of its ability to encroach quickly into areas that prevent native species from thriving/establishing. Rye grass is preferred over kikuyu if a non-native grass must be used; however, native grasses should be considered for use. Kamanomano, Kawelu, or pili are viable options with advance planning;

5) The site should be approved for use by KWP II with an agreement that it be returned to its original state within a reasonable period of time following completion of the project;

Fire Control

6) According to the DEIS, firebreaks will be re-vegetated with existing species. We recommend they landscape with natives and preserve as much of the existing native vegetation as possible, minimizing disturbance. It is easier to maintain established native vegetation than to clear cut areas and then re-vegetate;

7) All firebreaks should be maintained regularly so that roadside weeds do not encroach into protected areas (Manawainui Sanctuary);

Protected Species/Incidental Take

8) The requested take numbers should be closer to the estimated rate of take. In the case of the Hoary Bat, this species is little understood and population estimates are not established, so the assumed impact of KWP

II's proposed take of 40 adults and 24 juveniles cannot be accepted with any level of confidence that it won't be irreparable to this endangered species;

9) If the potential take of Hawaiian Petrels, nene, and shearwaters is negligible, then the requested take can afford to be closer to the estimated take; and

10) The absence of endangered flora does not give the project a free ticket to alter native habitat, even though the species are commonly found in abundance throughout the islands. Native habitat takes many decades/centuries to become established, is easily destroyed, and is slow to recover after disturbance if at all.

Thank you for the opportunity to comment. Should you require further clarification, please contact Staff Planner Joseph Prutch, by email at joseph.prutch@mauicounty.gov or by phone at 270-7512.

Sincerely,

CLAYTON I. YOSHIDA, AICP
Planning Program Administrator

For: JEFFREY S. HUNT, AICP
Planning Director

xc: Joseph M. Prutch, Staff Planner
Kuhea Paracuelles, Environmental Coordinator
Victor Reyes, Energy Commissioner
Perry White, Planning Solutions, Inc.
Project File
General File

JSH:CIY:JMP:bv
K:\WP_DOCS\PLANNING\EAC\2009\0011_KAHEAWAWINDPOWERII\COMMENTS.DOC

PLANNING SOLUTIONS

November 16, 2009

Mr. Jeffrey S. Hunt, AICP
Planning Director
Department of Planning
County of Maui
250 South High Street
Wailuku, Maui, HI 96793

Subject: Draft Environmental Impact Statement: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Hunt:

Thank you for your April 9, 2009 letter to the Office of Conservation and Coastal Lands concerning the proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Draft Environmental Impact Statement* (*DEIS*) and providing written comments.

At the time the original *DEIS* was published in February, 2009, KWP II LLC had concluded based on the best available wind resource data and on the results of analyses of natural resources that the Downwind/Downstring siting area it proposed would best meet the project objectives. Since that time, it has had the opportunity to collect and analyze additional wind resource data and to consider comments submitted by resource agencies as part of the Chapter 343 and Habitat Conservation Plan review process. Taken together, this new information has led KWP II to conclude that locating its facilities lower on the mountainside has several advantages, some of which are quite substantial and may reduce potential impacts to resources identified by DOFAW and other agencies during the project's review.

KWP II LLC has now identified an additional siting alternative for its proposed facilities that it believes is equal to/superior to the original proposal with respect to potential effects on threatened and endangered species and which has a number of other advantages. Situated in what is referred to as the "Down Road Siting Area", the "Downroad Alternative" is now KWP II LLC's "Preferred Alternative". In discussion with the State of Hawai'i Department of Land and Natural Resources, it has concluded that the best way to proceed is to issue a *Revised DEIS* that addresses the potential effects of what is now its "Preferred Alternative", as well as the effects of the "Downwind/Downstring Alternative" evaluated in the February 2009 *DEIS*.

We are now preparing the *Revised DEIS* and expect that it will be released for public review and comment in the 4th quarter of 2009. However, because the report will include the project plans on which you commented as an alternative, we would like to take this opportunity to provide the following item-by-item responses to your comments. These are identified using the headings provided in your letter. To simplify your examination, we have reproduced the text of your comments in italics before each response.

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

ALIEN SPECIES

Comment 1:

The education program for staff should include information about invasive species and dispersal, with strict protocols set in place for personal vehicles, clothing, and gear;.

Response: As described in Section 4.6.2.1 of the February 2009 *DEIS,* KWP II LLC will continue to consult with the Hawai'i Department of Agriculture and the Maui Invasive Species Commission to establish protocols and training orientation methods for screening invasive species introductions. Efforts will include the inspection of off-site sources of materials, vehicles, and equipment prior to entry onto the proposed site. Should you or other members of the Maui Planning Department staff wish to participate in these discussions, please call Mr. Greg Spencer, chief biologist on the KWP/First Wind staff (1-808-298-5097), and he will arrange for that.

Comment 2:

New invasive species should be controlled at the time of introduction, before they can become established and difficult and expensive to eradicate;

Response: KWP II agrees that problems with invasive species are best avoided by preventing their introduction into a new area rather than trying to eradicate them once they have arrived.

KWP II will carry out control measures to minimize and avoid the introduction of new invasive species to the Kaheawa Pastures region during the proposed project. KWP II will work closely with local experts and stakeholders to obtain the best recommendations for control measures and establish training for staff to recognize and deal with the emergence of new invasive species.

EROSION CONTROL/RESTORATION

Comment 3:

Native landscaping and protection of intact native ecosystems should be a preventative measure and not merely a means of intervention in disturbed areas. Grading and grubbing should be minimized to the extent possible and re-vegetation should occur immediately after;

Response: Immediate revegetation of disturbed areas will be conducted to minimize soil erosion and maximize soil development and retention as described in Section 4.6.2.2.1 and in the draft *Post-Construction Revegetation and Restoration Plan,* which is attached to the February 2009 *DEIS* as Appendix D.

Comment 4:

We oppose the use of kikuyu grass to restore disturbed areas, it is considered invasive by many conservationists because of its ability to encroach quickly into areas that prevent native species from thriving/establishing. Rye grass is preferred over kikuyu if a non-native grass must be used; however, native grasses should be considered for use. Kamanomano, Kawelu, or pili are viable options with advance planning;

Response: Thank you for communicating your opposition to the use of Kikuyu grass to restore disturbed areas. KWP II acknowledges that Kikuyu grass has the potential to displace native plant communities and is not, therefore, ideal. However, it was considered to have merit for short-term revegetation under the previous proposal. In response to comments, and because of differences in the local conditions, KWP II will not be proposing the use of Kikuyu grass in the new *makai* location presented in the *Revised DEIS.* Instead, a plan that incorporates many of the suggestions in your comment will be proposed. We look forward to your review of that plan and further input.

KWP II's biologists have consulted with the DLNR, USFWS, and several conservation specialists in investigating long-term approaches to establishing suitable ground cover at KWP II following construction. KWP II LLC will consult with the Hawai'i Department of Agriculture, the Maui Invasive Species Commission and other experts to determine the use of annual Rye, Kamanomano, Kawelu, *Eragrostis*, or Pili for long-term revegetation of disturbed areas and make a concerted effort to follow their recommendations.

Comment 5:

The site should be approved for use by KWP II with an agreement that it be returned to its original state within a reasonable period of time following completion of the project;

Response: As described in Section 7.3 of the February 2009 *DEIS*, KWP II would remove its facilities at the end of the project lifetime and the land would be allowed to return largely to its prior state with the exception of some of the topography affected by grading for access roads and pads.

FIRE CONTROL

Comment 6:

According to the DEIS, firebreaks will be re-vegetated with existing species. We recommend they landscape with natives and preserve as much of the existing native vegetation as possible, minimizing disturbance. It is easier to maintain established native vegetation than to clear cut areas and then re-vegetate;

Response: The February 2009 *DEIS* does not speak of revegetating firebreaks; these must be kept free of vegetation to serve their purpose. Section 4.5.4.2 does discuss steps KWP II proposes to take to revegetate cleared areas and fill slopes adjacent to access roads and turbine pads. These features function as fire buffers and fuel breaks but are not specifically created for this purpose. Existing firebreaks that were installed to control the 2006 wildfire are managed by DLNR to ensure that they remain clear of invasive vegetation and continue to perform their principle function. Native plant reintroduction will be a part of the long-term revegetation plan for KWP II as will be described in the forthcoming *Revised DEIS.*

Comment 7:

All firebreaks should be maintained regularly so that roadside weeds do not encroach into protected areas (Manawainui Sanctuary);

Response: KWP II will work closely with the Division of Forestry and Wildlife (DOFAW) to ensure the appropriate implementation of vegetation control for the proposed project, which may include creating fire breaks near the Manawainui Plant Sanctuary or elsewhere as necessary as described in Section 4.5.4.2 of the February 2009 *DEIS*. As described in our response to Comment 6, DOFAW currently manages the existing firebreak buffers in the Conservation District.

PROTECTED SPECIES/INCIDENTAL TAKE

Comment 8:

The requested take numbers should be closer to the estimated rate of take. In the case of the Hoary Bat, this species is little understood and population estimates are not established, so the assumed impact of KWP II's proposed take of 40 adults and 24 juveniles cannot be accepted with any level of confidence that it won't be irreparable to this endangered species;

Response: The requested take numbers shown in the original DEIS were arrived at after long discussions with the State and Federal agencies responsible for these species (DOFAW and the USFWS). The numbers requested exceed the levels that the best available scientific information leads biologists to expect. Using the higher-than-expected number provides a buffer in light of the uncertainty that exists with respect to the species and results in a greater requirement for mitigation than would be required if the lower take limit you suggested were used.

KWP II is actively collaborating with researchers at the USGS, DLNR, and USFWS to expand statewide population monitoring that will include further study in West Maui. The range and scope of management options for Hawaiian Hoary Bats are being identified as new insights emerge.

Comment 9:

If the potential take of Hawaiian Petrels, nene, and shearwaters is negligible, then the requested take can afford to be closer to the estimated take; and

Response: As indicated in the February 2009 *DEIS*, the potential take is expected to be small. With respect to making the requested take closer to the estimated take, there are two principal reasons why this is not done. First, the State Incidental Take License (ITL) requires that yearly limits be at least one individual, and that any fractions thereof be rounded upwards to whole numbers. Second, unobserved take (i.e., take that is not found by searchers) is also assessed each time an observed take occurs and further rounded up once more. A great deal of rounding up is therefore included in the calculation of the requested take which accounts for why the requested take is often considerably higher than the estimated take.

Comment 10:

The absence of endangered flora does not give the project a free ticket to alter native habitat, even though the species are commonly found in abundance throughout the islands. Native habitat takes many decades/centuries to become established, is easily destroyed, and is slow to recover after disturbance if at all.

Response: KWP II shares your strong desire to protect native habitats and is working closely with DOFAW, USFWS, the State of Hawai'i Department of Agriculture, the Maui Invasive Species Commission, and other parties to do everything possible to ensure its preservation.

If you have any questions in the future concerning this project, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Ms. Noe Kalipi, KWP II LLC
Mr. Dave Cowan, KWP II LLC
DLNR Office of Conservation and Coastal Lands

COMMENT NO. 017

The Senate
STATE CAPITOL
HONOLULU, HAWAII 96813

April 8, 2009

Mr. Samuel J. Lemmo
Administrator
Department of Land and Natural Resources
Office of Conservation and Coastal Lands
P.O. Box 621
Honolulu, Hawai'i 96809

Dear Mr. Lemmo:

I am writing in strong support of The Kaheawa Wind Power II project to construct additional wind generators at Kaheawa Pastures. This is an example of exactly the type of project our State needs to embrace in order to become energy independent and sustainable.

It makes sense to locate additional turbines adjacent to the current wind farm. The wind regime is known and mitigative measures for the area already have been modeled. This renewable energy project is important to meeting Hawaii's renewable energy goals.

I respectfully urge approval of this project which is within my Senatorial district.

Sincerely yours,

Senator Rosalyn H. Baker
Chair, Commerce and Consumer Protection
5th District - South and West Maui

PLANNING SOLUTIONS

November 16, 2009

Senator Rosalyn H. Baker
Chair, Commerce and Consumer Protection
5th District – South and West Maui
State Capitol
Honolulu, HI 96813

Subject: Draft Environmental Impact Statement: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Senator Baker:

Thank you for your April 8, 2009 letter to the Office of Conservation and Coastal Lands concerning the proposed Kaheawa Wind Power II project. We appreciate the time you spent reviewing the *Draft Environmental Impact Statement* (DEIS) and preparing your comments.

At the time the *DEIS* was published in February, 2009, KWP II LLC had concluded based on the best available wind resource data and on the results of analyses of natural resources that the Downwind/Downstring siting area it proposed would best meet the project objectives. Since that time, it has had the opportunity to collect and analyze additional wind resource data and to consider comments submitted by resource agencies as part of the Chapter 343 and Habitat Conservation Plan review process. Taken together, this new information has led KWP II to conclude that locating its facilities lower on the mountainside has several advantages, some of which are quite substantial and may reduce potential impacts to resources identified by DOFAW and other agencies during the project's review.

KWP II LLC has now identified an additional siting alternative for its proposed facilities that it believes is equal to/superior to the original proposal with respect to potential effects on threatened and endangered species and which has a number of other advantages. Situated in what is referred to as the "Down Road Siting Area", the "Downroad Alternative" is now KWP II LLC's "Preferred Alternative". In discussion with the State of Hawai'i Department of Land and Natural Resources, it has concluded that the best way to proceed is to issue a *Revised DEIS* that addresses the potential effects of what is now its "Preferred Alternative", as well as the effects of the "Downwind/Downstring Alternative" evaluated in the February 2009 *DEIS*.

We are now preparing the *Revised DEIS* and expect that it will be released for public review and comment in the 4th quarter of 2009. Ms. Noe Kalipi of KWP II, LLC asked me to thank you for your support of the expanded use of renewable energy sources on Maui.

If you have any questions in the future, please feel free to call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Ms. Noe Kalipi, KWP II LLC
Mr. Dave Cowan, KWP II LLC
DLNR Office of Conservation and Coastal Lands

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

COMMENT NO. 018

MAUI CHAMBER OF COMMERCE

OUR BUSINESS IS MAUI BUSINESS

April 9, 2009

Office of Conservation and Coastal Lands
Department of Land and Natural Resources
State of Hawaii
P.O. Box 621
Honolulu 96809
Attn: Mr. Sam Lemmo
Via Email: Sam.j.lemmo@hawaii.gov

RE: Draft EIS Comments for Kaheawa Wind Power II Wind Energy Generation Facility, Ukumehame, Maui, Hawaii

Dear Mr. Lemmo,

I am writing on behalf of the Maui Chamber of Commerce, a business organization whose mission it is to advance and promote a healthy economic environment for business, advocating for responsive government and quality education, while preserving Maui's unique community characteristics, to express our support for Kaheawa Wind Power II Wind Energy Generation Facility.

We are a membership driven organization comprised of over 900 members, 88% of which are small businesses with fewer than 25 employees, representing nearly 21,000 employees. As Maui's economy is dependent upon the availability of fossil fuel and any shortage can have disastrous consequences, we advocate for the development of alternative sources that are economically and environmentally sound and sustainable.

We applaud First Wind Holdings LLC, the partnership that constructed the existing 30MW Kaheawa Wind Power facility, for looking to expand their operations and help Maui reduce its dependency on fossil fuels. Kaheawa Wind Power currently provides approximately 9% of Maui's electricity on an annual basis, which increases in off-peak hours. With the expanded capacity of Kaheawa Wind Power II, Maui can further reduce its fuel consumption on by an additional 138,000 barrels of oil per year and can do so without the emission of gases often attributed to undesirable environmental effects.

Kaheawa Wind Power II will also contribute to other areas of the economy. The project is estimated to produce $6 million in state revenue through lease payments and generate $5 million in job-related income through the expenditure of $17 million for site construction contracts and services, resulting in local jobs during design, development and construction.

Additionally, this partnership has demonstrated a strong commitment to the Maui community, as well as the environment. With the first wind power facility, they provided significant conservation benefits to four endangered and threatened species, including the Nene, two species of seabirds, and Hawaiian bats. They are now seeking to expand their efforts, which also include a native replanting program, and are working closely with both the U.S. Fish and Wildlife Service and the Department of Land and Natural Resources Division of Forestry and Wildlife towards the completion of a successful Habitat Conservation Plan through both state and federal processes.

Given their current track record and the many benefits this project offers, we commend First Wind Holdings LLC for their accomplishments to date, lend our support of this project, and look forward to having Kaheawa Wind Power II Wind Energy Generation Facility online soon.

Sincerely,

Pamela Tumpap
President

Cc: Mr. Perry J. White, Planning Solutions Inc., 210 Ward Ave., Suite 330
Honolulu 96814 via email to **pwhite@psi-hi.com**

PLANNING
SOLUTIONS

November 16, 2009

Ms. Pamela Tumpap, President
Maui Chamber of Commerce
313 Ano Street
Kahului, HI 96732

Subject: Draft Environmental Impact Statement: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Ms. Tumpap:

Thank you for your April 9, 2009 letter to the Office of Conservation and Coastal Lands concerning the *Draft Environmental Impact Statement* (*DEIS*) for the proposed Kaheawa Wind Power II project. We appreciate the time you and other members of the Maui County Chamber of Commerce spent reviewing the document and preparing your comments.

At the time the *DEIS* was published in February, 2009, KWP II LLC had concluded based on the best available wind resource data and on the results of analyses of natural resources that the Downwind/Downstring siting area it proposed would best meet the project objectives. Since that time, it has had the opportunity to collect and analyze additional wind resource data and to consider comments submitted by resource agencies as part of the Chapter 343 and Habitat Conservation Plan review process. Taken together, this new information has led KWP II to conclude that locating its facilities lower on the mountainside has several advantages, some of which are quite substantial and may reduce potential impacts to resources identified by DOFAW and other agencies during the project's review.

KWP II LLC has now identified an additional siting alternative for its proposed facilities that it believes is equal to/superior to the original proposal with respect to potential effects on threatened and endangered species and which has a number of other advantages. Situated in what is referred to as the "Down Road Siting Area", the "Downroad Alternative" is now KWP II LLC's "Preferred Alternative". In discussion with the State of Hawai'i Department of Land and Natural Resources, it has concluded that the best way to proceed is to issue a *Revised DEIS* that addresses the potential effects of what is now its "Preferred Alternative", as well as the effects of the "Downwind/Downstring Alternative" evaluated in the February 2009 *DEIS*.

We are now preparing the *Revised DEIS* and expect that it will be released for public review and comment in the 4th quarter of 2009. Noe Kalipi of KWP II, LLC has asked us to express her gratitude for the Chamber's support of the expanded use of renewable energy sources on Maui and for recognizing the benefits of the proposed project. She hopes that she will be able to fulfill your hope that the additional renewable wind energy source will be on-line soon.

If you have any questions in the future, please feel free to call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Ms. Noe Kalipi, KWP II LLC
Mr. Dave Cowan, KWP II LLC
DLNR Office of Conservation and Coastal Lands

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

COMMENT NO. 019

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RUSSELL Y. TSUJI
FIRST DEPUTY

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

RECEIVED
OFFICE OF CONSERVATION
AND COASTAL LANDS
2009 APR 14 A 8:

DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

STATE OF HAWAI'I
DEPARTMENT OF LAND AND NATURAL RESOURCES
Office of Conservation and Coastal Lands
POST OFFICE BOX 621
HONOLULU, HAWAI'I 96809

REF:OCCL:MC
FILE NO.: Kaheawa Wind

Suspense Date: April 9, 2009

FEB 27 2009

MEMORANDUM:

To: DLNR
___ Historic Preservation Division
___ Division of Forestry and Wildlife
___ Land Division
___ Division of Aquatic Resources
✓ Commission on Water Resource Management
___ Division of Conservation and Resource Enforcement

FROM: Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

SUBJECT: REQUEST FOR COMMENTS
Kaheawa Wind Power II
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Wind Energy Facility

TMKs: (2) 4-8-01:01 & 3-6-01:14

LOCATION: Ukumehame, Lahaina, Maui

Please find a CD with the Draft Environmental Impact Statement for the expansion of the Kaheawa wind energy facility enclosed. We also have a hard copy for review at OCCL.

Please contact Michael Cain at 587-0048, should you have any questions on this matter.

If no response is received by the suspense date of April 9, 2009, we will assume there are no comments. The suspense date starts from the date stamp.

( ) Comments Attached
(✓) No Comments

Signature

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RUSSELL Y. TSUJI
FIRST DEPUTY

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

RECEIVED
MAUI DISTRICT
LAND DIVISION
2009 MAR -2 PM 12

STATE OF HAWAI'I
DEPARTMENT OF LAND AND NATURAL RESOURCES
Office of Conservation and Coastal Lands
POST OFFICE BOX 621
HONOLULU, HAWAI'I 96809

REF:OCCL:MC
FILE NO.: Kaheawa Wind

Suspense Date: April 9, 2009

FEB 27 2009

MEMORANDUM:

To: DLNR
___ Historic Preservation Division
___ Division of Forestry and Wildlife
✓ Land Division
___ Division of Aquatic Resources
___ Commission on Water Resource Management
___ Division of Conservation and Resource Enforcement

FROM: Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

SUBJECT: REQUEST FOR COMMENTS
Kaheawa Wind Power II
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Wind Energy Facility

TMKs: (2) 4-8-01:01 & 3-6-01:14

LOCATION: Ukumehame, Lahaina, Maui

RECEIVED
OFFICE OF CONSERVATION
AND COASTAL LANDS
2009 APR 14 A 11:

DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

RECEIVED
LAND DIVISION
2009 FEB 27 A 10:49

Please find a CD with the Draft Environmental Impact Statement for the expansion of the Kaheawa wind energy facility enclosed. We also have a hard copy for review at OCCL.

Please contact Michael Cain at 587-0048, should you have any questions on this matter.

If no response is received by the suspense date of April 9, 2009, we will assume there are no comments. The suspense date starts from the date stamp.

(✓) Comments Attached
( ) No Comments

Signature

There are some outstanding issues that need to be completed regarding the existing project. (e.g. Tank site and transmission line along Honoapiilani Hwy + access easement clean up issues).

Division of Forestry & Wildlife

1151 Punchbowl Street, Rm. 325 ▯ Honolulu, HI 96813 ▯ (808) 587-0166 ▯ Fax: (808) 587-0160

March 31, 2009

MEMORANDUM

TO: Michael Cain, Planner
OCCL

FROM: Paul J. Conry, Administrator
Division of Forestry and Wildlife

SUBJECT: Request for Comments: Kaheawa Wind Power II, Draft EIS for Wind Energy Facility at Ukumehame, Lahaina, Maui. TMK: 4-8-01:01 and 3-6-01: 14.

We have reviewed the subject request and provide the following comments for your consideration. Our Maui wildlife staff has submitted the enclosed comments dated March 30, 2009 to this project. Please note that our March 10, 2008, March 27, 2007 and August 23, 2006 comments remain relevant to this discussion (attached). Please call our wildlife staff on Maui – Fern Duvall at (808) 873-3502 or John Medeiros at (808) 873-3510 should you have questions regarding DOFAW's review of this subject project. Thank you for the opportunity to comment on the Kaheawa Wind Power II draft EIS on Maui.

Copy with Attachments: John Cumming, DOFAW Maui Branch
Fern Duvall, DOFAW Maui Branch
John Medeiros, DOFAW Maui Branch
Torrie Nohara, DOFAW Maui Branch
Glenn Shishido, DOFAW Maui Branch
Paula Hartzell, HCP Coordinator

Attachments

Comments to: Kaheawa Windpower II EIS

From: Maui Wildlife Staff

Date: March 30, 2009

General:

Most important is the continuing inability of the DLNR DOFAW to do sufficient monitoring of the wind power currently developed on Maui – and monitoring of Kaheawa Windpower II's (KWPII) monitoring for "downed wildlife/take of wildlife covered under the HCP process, will require even more DOFAW attention due to its size and physical placement. There is no benefit to the power projects to list actual take (i.e. fox in the hen-house dilemma) and it is reported to be under-reported. This inability of our monitoring effort is due to the lack of sufficient staffing at DLNR DOFAW to monitor the wind power and HCP projects in general. Need: A team of a minimum of 4 full-time equivalent staff *paid for by HCP and Wind power projects*, but under DOFAW supervision, to monitor take and monitoring efficacy around the State on HCP and terrestrial green power projects. The team would do random visits to ALL of the wind power sites; on whichever island they occurred, on a rotating basis to monitor the sites for take and other infractions. The team would also respond to and document the downed/ take wildlife as this occurred.

Also very worrisome is that invasive species considerations are largely absent or underplayed in the EIS document. No assurances for staffing, funding, or mitigating detection, interception, or subsequent control is provided. Component items, from foreign countries, are already on-island with NO inspection or control for any invasive species detections in order.

Specific:

2.2.2 If the Permanent Met Towers are constructed these should be required to be free standing Monopoles with NO GUY WIRES. If the new permanent towers are permanent, then the bases for guyed lattice towers are no longer applicable.

2.2.5 Easement NOT necessary, keep as lease item so that DLNR retains oversight and responsibility for road and any changes or use of it. Retains more management structure within DLNR.

Will there be mitigation for the permanent loss of 16% of the 333 acres to hard surface/road construction?

2.5.2.4 Were other designs than the propeller type turbine even investigated for use in KWPII? It may be that more wildlife friendly designs are equally efficient for power generation. Is the parts sharing legitimate?

The sharing of parts by KWPI and KWPII are reported, at the page bottom on 2-19, to ONLY occur as a commercial basis. Nowhere is mandated parts sharing guaranteed – so a new design other than propeller-type may be warranted.

At a rotor of 231' giving a height of 328' (vs. KWPI of 296') are the differences in bird/bat strike potentials 10% higher? The change would seem to necessitate a review of the 10% extension in view of take potentials.

3.7.2.3 Hawaiian Bat is also regularly detected on Lanaihale, Lanai and just west of Kaunakakai, Molokai.

3.7.2.4 Report and description of methodology. Report gives what probability of accuracy and determination of absences at KWPII?

3.10.1.2 DELETE the statement about Sierra Club and other groups utilizing Manawainui Plant Sanctuary. This is NOT true and has not been for decades (pers. comm. Maui District Forester Glenn Shishido).

4.1.4.1 Fill soil used originates where? Gravel used originates where? Where it comes from has been surveyed for pest species? What is the survey protocol and frequency? Staffed by whom with what qualifications? How are graders, cranes, dump trucks, concrete mix trucks, front loaders, dozers, excavators and heavy haul trucks scrutinized for invasive species concerns? By whom? On what schedule?

4.6.2.1 Which invasive species lists? Who are the staff and what are the qualifications? There is talk of *Senecio* but what of the total non-response to the *Antirrhinum* first introduced to West Maui by KWPI and which is still present and spreading?

4.6.2.2.1 Grassing will attract nene to sites

4.6.2.2.2 Kikuyu is NOT a good choice and should NOT be spread. Long-term it will kill both native shrubs and trees like ohia.

4.7.2 Do "project components" include the 2 permanent met towers in the estimated take levels? The permanent Met Towers SHOULD BE included – it is hard to tell from pages 4-17 and 4-18.

4.7.2.3.2 53 acres of 333 acres = a 16% reduction in current nene (and pueo nesting) habitat. Where is this added into the mitigation?

4.7.2.4.1 'Ope'ape'a may be more at risk of take from KWPII than from KWPI due to KWPII proximities to gulches vegetated with trees and shrubs. The bats are more often seen in/over forested areas than at the KWPI site.

4.7.4.1 Non-protected species should be collected with the same protocol for downed protected species.

4.7.4.2 Remove and reduce Common Barn-owl.

Polytape is NOT reflective, just white. Reflective or shiny tape has been demonstrated to perhaps "attract" seabirds to fencing (R. Swift)

Collect and analyze any and all predated seabirds from mitigation area with DOFAW/USFWS/USGS involvement.

4.12.3 (pg 4-59) Containment, Spill Prevention and Control Measures do not speak of what invasive species, and or novel species of plant, invertebrates, and vertebrate introductions and or mitigation is scheduled and planned for storage sites where turbine/tower, WTG, nacelles, transformers, substation equipment components are stored. These items are already largely here with no oversight! (see 4.13.1.3). What has been done to inspect the items or the site since the arrivals? What is the review of "cleanliness" of the component parts, and the KIHEI storage sites BEFORE they are taken to the KWPII site? What is the scope and procedure to assure NO invasive species importation, and importantly, what is the mitigiation/capture/control IF species are detected? Where are assurances and funds set aside for this?

7.1 No invasive species introductions or mitigation thereof is even described (see above).

Monitoring – The Division of Forestry and Wildlife is currently under staff to monitor KWP for downed or take of wildlife covered under the HCP. Issues and concerns arise during construction and thereafter. Resolution to this concern – Establish a team that is funded by KWP but under DOFAW management. This team would be responsible for monitor KWP site, respond to downed or take wildlife, monitor invasive species entering into the area, monitor disturbance levels to T&E and monitor / evaluate requirements in HCP. If additional wind project are established, this team can also monitor these wind sites and be funded by a HCP.

Nene – The proposed site is an established flocking and nesting area for nene. This past season and records illustrate that nene utilize this proposed site. If two-thirds of the 53 acre site is going to be disturbed by construction, where is the mitigation for that? What about the additional roads? This formulates additional lost of nene habitat, alters movement and behavior of nene.

Any grassing of an area will attract nene to the site, especially with kikuyu. This may also increase the change of more take of Nene. Planting kikuyu with native shrub may also attract nene to the site during the nesting season.

Second row of wind turbines may increase a higher probability of wildlife strikes. How can you assume a take of 1.1 / per year when there is an increase of turbines and multipule rows?

A trapline to control predators in the area needs to be established and maintained by KWP in both KWPI and KWPII sites.

Boundaries and closed areas need to be established during construction to protect T&E species. It is recommended that construction does not occur during the nene nesting season. If construction needs to take place during nesting season, then nene surveys need to be conducted on a daily basis. In the event a nest is found in the vicinity, construction in the area needs to cease and disturbance level monitored. In phase I, disturbance levels during the construction of tower 20 platform may have caused abandonment of a nene nest.

Indirect Take of Nene

In regards to nene, they assumed that adult nene is most likely to collide with turbines. False, there is a better chance of fledglings and sub adults have a greater chance of collision. Take should be calculated on fledgling to Adult stage, age (if possible), productivity of life expectancy and the time to replace the take.

In regards to nene, who cited "Population remains poorly understood; however, no decline in overall productivity is apparent (DOFAW comm.)". Statement false

Is there another possible site on Maui besides Kaheawa that would avoid disruptive displacement of T&E?

Calculations of take for nene should be based on factual information, not on assumptions.

Other – An inspection area needs to be implemented previous to the construction site to control, detect and intercept invasive species. This includes inspections of vehicles, cargo and raw material.

There is no indication that cranes that are not in use shall be lower to ground level. No crane use shall be conducted during night hours. Higher chance of bird strikes.

There is no reference in the EIS that DOFAW has considered the State Lands in the Ukumehame and Kaheawa area for public game bird hunting.

Met Towers should be constructed with no guy wires, especially if the structures are permanent. What time frame should we consider the existing towers permanent?

Silt fences and construction material that are disrepair or non-functional need to be removed immediately. This is to prevent debris from blowing into adjacent gulches and causing harm to wildlife (a problem on Phase I).

PLANNING SOLUTIONS

November 16, 2009

Mr. Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands
Department of Land and Natural Resources
State of Hawai'i
P.O. Box 621
Honolulu, HI 96809

Subject: Draft Environmental Impact Statement: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Lemmo:

Thank you for your April 14, 2009 letter [your reference OCCL:MC, File No. Kaheawa Wind] transmitting to us all of the comments that the Department has received concerning the *Draft Environmental Impact Statement* (*DEIS*) for the Kaheawa Wind Power II Project.

At the time the *DEIS* was published in February, 2009, KWP II LLC had concluded based on the best available wind resource data and on the results of analyses of natural resources that the Downwind/Downstring siting area it proposed would best meet the project objectives. Since that time, it has had the opportunity to collect and analyze additional wind resource data and to consider comments submitted by resource agencies as part of the Chapter 343 and Habitat Conservation Plan review process. Taken together, this new information has led KWP II to conclude that locating its facilities lower on the mountainside has several advantages, some of which are quite substantial and may reduce potential impacts to resources identified by DOFAW and other agencies during the project's review.

KWP II LLC has now identified an additional siting alternative for its proposed facilities that it believes is equal to/superior to the original proposal with respect to potential effects on threatened and endangered species and which has a number of other advantages. Situated in what is referred to as the "Down Road Siting Area", the "Downroad Alternative" is now KWP II LLC's "Preferred Alternative". In discussion with the State of Hawai'i Department of Land and Natural Resources, it has concluded that the best way to proceed is to issue a *Revised DEIS* that addresses the potential effects of what is now its "Preferred Alternative", as well as the effects of the "Downwind/Downroad alternative evaluated in the February 2009 *DEIS*.

We are now preparing the *Revised DEIS* and expect that it will be released for public review and comment in the 4th quarter of 2009. However, because the *Revised DEIS* will include the project plans on which you commented as an alternative, we would like to take this opportunity to provide the following item-by-item responses to your comments.

The Department of Land and Natural Resources comments consisted of attached memoranda from the Commission on Water Resource Management (CWRM), the Land Division, and the Division of Forestry & Wildlife (DOFAW). Most of DOFAW's comments were from its Maui Wildlife staff.

CWRM indicated that it had no comments on the document. The Land Division's comments consisted of a note concerning a few outstanding issues that need to be completed regarding the existing project, but nothing pertaining to KWP II. Because of this, the remainder of this letter focuses on the items from DOFAW. These are identified using the headings provided in your letter. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

GENERAL

Comment 1:

Most important is the continuing inability of the DLNR DOFAW to do sufficient monitoring of the wind power currently developed on Maui – and monitoring of Kaheawa Windpower (KWPII) monitoring for "downed wildlife/take of wildlife covered under the HCP process, will require even more DOFAW attention due to its size and physical placement. There is no benefit to the power projects to list actual take (i.e. fox in the hen-house dilemma) and it is reported to be under-reported. This inability of our monitoring effort is due to the lack of sufficient staffing at DLNR DOFAW to monitor the wind power and HCP projects in general. Need: A team of a minimum of 4 full-time equivalent staff paid for by HCP and Wind power projects, *but under DOFAW supervision, to monitor take and monitoring efficacy around the State on HCP and terrestrial green power projects. The team would do random visits to ALL of the wind power sites; on whichever island they occurred, on a rotating basis to monitor the sites for take and other infractions. The team would also respond to and document the downed/ take wildlife as this occurred.*

Response: This comment relates to wildlife monitoring, and documenting fatalities of listed species to verify predicted take levels and ensure that adequate mitigation leading to a net conservation benefit will be provided. These items are being fully addressed in the Draft Habitat Conservation Plan (HCP) that KWP II has prepared for the proposed project in consultation with DLNR's Division of Forestry and Wildlife (DOFAW) and the U.S. Fish and Wildlife Service (USFWS).

Comment 2:

Also very worrisome is that invasive species considerations are largely absent or underplayed in the EIS document. No assurances for staffing, funding, or mitigating detection, interception, or subsequent control is provided. Component items, from foreign countries, are already on-island with NO inspection or control for any invasive species detections in order.

Response:

KWP II LLC takes its responsibilities for helping to prevent the avoidable spread of invasive species very seriously (see also responses to Comments 23 and 24). In general, and as described in Section 4.6.2.1 of the DEIS, KWP II LLC is continuing to work with the Hawai'i Department of Agriculture and the Maui Invasive Species Commission to establish protocols and training orientation methods for screening invasive species introductions.

With specific reference to project-related items that have already been landed on the island, KWP II LLC has confirmed that these were inspected when they landed on Maui in compliance with all applicable laws and regulations; hence, the last sentence in the comment is factually incorrect. The items, which consist of manufactured turbine components that were shipped to Hawai'i from overseas ports, were off-loaded in Kahului Harbor and inspected by state (Department of Agriculture) cargo inspectors charged with preventing the entry of illegal or undesirable materials. Only after the government inspectors cleared the items were they trucked to the temporary storage facility in Kīhei where they are now waiting.

KWP II LLC will insure that all additional equipment and other building materials will be similarly inspected before being trucked to the project site. Efforts will include the inspection of these and other off-site sources, such as vehicles, equipment, and materials prior to transport and entry onto the access road. All sources of undesirable incipient and/or invasive species (construction materials and machinery) will be inspected to evaluate potential for contamination and control. Should undesirable materials be identified during site access screening, such materials will be contained and removed before vehicles and loads are allowed to proceed.

SPECIFIC

COMMENT 3:

2.2.2 If the Permanent Met Towers are constructed these should be required to be free standing Monopoles with NO GUY WIRES. If the new permanent towers are permanent, then the bases for guyed lattice towers are no longer applicable.

Response: In response to comments it has received during the project review process, KWP II has changed its plans. It now proposes to use self-supporting (i.e., un-guyed) meteorological monitoring towers. Only one tower will be required for the new Preferred Downroad Alternative, versus up to two at the Alternative Downwind/Downstring arrangement.

COMMENT 4:

2.2.5 Easement NOT necessary, keep as lease item so that DLNR retains oversight and responsibility for road and any changes or use of it. Retains more management structure within DLNR.

Response: With respect to the necessity to obtain an easement, KWP II, LLC is amenable to any reasonable arrangement that assures it access to the area it proposes to lease.

COMMENT 5:

Will there be mitigation for the permanent loss of 16% of the 333 acres to hard surface/road construction?

Response: Yes, there will be mitigation. KWP II has incorporated measures into its proposed HCP that will more than compensate for the temporary decrease or loss of habitat function and value that results from development of the proposed facilities. Field surveys of the area by KWP II biologists and independent experts have concluded that much of the project footprint occurs in a highly altered non-native pasture grass landscape and does not contain or represent critical or high value habitat. Similar habitat extends for many hundreds, if not thousands, of acres throughout the surrounding area. Further, substantial portions of the area that is disturbed during construction would be revegetated with equivalent or better cover, thus returning it to a functional condition. And finally, the mitigation being proposed in the HCP has been designed to ensure a substantial net benefit for wildlife inhabiting the site, thus more than offsetting any minor loss of function that may occur.

COMMENT 6:

2.5.2.4 Were other designs than the propeller type turbine even investigated for use in KWPII? It may be that more wildlife friendly designs are equally efficient for power generation. Is the parts sharing legitimate?

Response: The horizontal axis two- or three-bladed turbine is by far the most efficient commercially available design for utility-scale applications, and greater efficiency means fewer turbine are needed to achieve a given power output. This is evidenced by the fact that nearly all utility-scale WTG installations worldwide over the past decade are of the type proposed for KWP II; other designs do not come close to providing the same level of reliability and performance. Consequently, providing the same level of output using other designs requires the installation of more WTGs than are needed using the proposed design. Other things being equal, fewer turbines mean lower risk for wildlife. Importantly, wildlife impacts at the operating KWP I project have been below predicted levels during the first three-plus years of operation.

With respect to the comment in the second sentence, KWP II and KWP I will have the opportunity to share parts; the extent to which they choose to do so will be determined on a case-specific basis. What is certain is that using a different turbine design would eliminate the option.

COMMENT 7:

The sharing of parts by KWPI and KWPII are reported, at the page bottom on 2-19, to ONLY occur as a commercial basis. Nowhere is mandated parts sharing guaranteed – so a new design other than propeller-type may be warranted.

Response: As indicated in the response to Comment 6, the ability to share parts is a potential benefit of using the same equipment; however, the primary considerations in selecting the type of WTG that is proposed are suitability for the site, efficiency, and reliability.

COMMENT 8:

At a rotor of 231' giving a height of 328' (vs. KWPI of 296') are the differences in bird/bat strike potentials 10% higher? The change would seem to necessitate a review of the 10% extension in view of take potentials.

Response: The differences between the two turbine types have been taken into account in the analysis. The risk of wildlife collisions for KWP II was modeled based on the turbines that are proposed, both in terms of their height, the cross-sectional area of the rotors, avian flight characteristics, and other site-specific data.

COMMENT 9:

3.7.2.3 Hawaiian Bat is also regularly detected on Lāna'i hale, Lāna'i and just west of Kaunakakai, Moloka'i.

Response:

Thank you for providing the additional information regarding Hawaiian Hoary Bat detection on Lāna'i and Moloka'i. The latter island was already mentioned in the listing, but in the *Revised DEIS* we have added Lāna'i to the list in the first paragraph in Section 3.7.2.3.

COMMENT 10:

3.7.2.4 Report and description of methodology. Report gives what probability of accuracy and determination of absences at KWPII?

Response: Section 3.7.2.4 of the *DEIS* described the methods used in the snail survey conducted by Michael Severns. Mr. Severn's survey report states:

> *"...The attention First Wind has given to this important but devastated aspect of Hawaiian biology is commendable, but it appears that years of abuse of the land, along with tell-tale hints of pastoral use pointing back to before the 1850's, seem to have reduced the area to a molluscan desert."*

It goes on to say that:

> *"...I am confident there are no living native snails within the area surveyed. Without evidence, not even one fragment of a shell, and with no historic description of the area or collecting data from a snail species within the survey area, there is nothing to do but speculate on what might have existed in the survey area in the past."*

In short, Mr. Severns believes that there is a very high probability that his conclusions are accurate.

COMMENT 11:

3.10.1.2 DELETE the statement about Sierra Club and other groups utilizing Manawainui Plant Sanctuary. This is NOT true and has not been for decades (pers. comm. Maui District Forester Glenn Shishido).

Response: Thank you for the correction. We have deleted the statement from the *Revised DEIS*.

COMMENT 12:

4.1.4.1 Fill soil used originates where? Gravel used originates where? Where it comes from has been surveyed for pest species? What is the survey protocol and frequency? Staffed by whom with what qualifications? How are graders, cranes, dump trucks, concrete mix trucks, front loaders, dozers, excavators and heavy haul trucks scrutinized for invasive species concerns? By whom? On what schedule?

Response: The origin and composition of all fill, gravel and other aggregate will be determined during the contract development period prior to the construction phase of the project. To the extent possible, soil and earthwork requirements will be met using materials excavated on-site. In general it can be said that the soil that will be used during construction will be from within the area that KWP II proposes to lease from the State for the project. Gravel and other aggregate may also come from on-site if sufficient rocky material is available for re-use, otherwise it will come from off-site local sources.

KWP II's construction contract will require the contractor to provide for the inspection of all sources of material by Hawai'i-based individuals or companies with the appropriate expertise. Its agreement with the construction contractor will also require vehicles and construction machinery to be initially treated off-site using high-pressure wash-down procedures that will remove debris and other materials from undercarriages and collection points prior to site access. Vehicles, machinery, and equipment bound for the work area at Kaheawa Pastures will also be inspected daily throughout construction at the site access point at Honoapi'ilani Highway. Materials that might contain exotic

species will be removed. KWP II has been in discussions with DOFAW, USFWS, and the Maui Invasive Species Committee (MISC) concerning invasive and incipient species, and appropriate protocols for inspection and prevention. Any recommendations for protocols that DOFAW may have to offer would be most welcome.

COMMENT 13:

4.6.2.1 Which invasive species lists? Who are the staff and what are the qualifications? There is talk of Senecio but what of the total non-response to the Antirrhinum first introduced to West Maui by KWPI and which is still present and spreading?

Response: KWP biologists do not completely understand the first portion of this comment (Section 4.6.2.1 does not reference any invasive species lists). KWP biologists have expertise in botany and local ecology, and seek the advice of local experts, including DOFAW, USFWS, and the Maui Invasive Species Commission (MISC) on matters concerning invasive and incipient species.

Regarding *Antirrhinum,* an incipient species in the snapdragon family, this species was brought to the attention of KWP I by DOFAW late in 2006. Local incipient species and botanical experts on Maui have advised KWP I that the species was previously well-known from nearby areas, such as the Lahaina-Pali Trail and other portions of West Maui. Hence, it is not at all clear that its presence at Kaheawa Pastures is due to KWP I.

Regardless, upon notification of its presence along the access road, KWP II followed DOFAW's recommendations and treated the affected areas with a pre-emergent herbicide that slowed growth but did not eradicate *Antirrhinum*. This incipient species is presently limited to low densities along portions of the main access road leading to the KWP I site.

COMMENT 14:

4.6.2.2.1 Grassing will attract nene to sites.

Response: Ground cover is necessary to stabilize the soil and control erosion, both to maintain the integrity of the site and to comply with the terms and provisions of the NPDES permit and CDUP. With the approval of the BLNR in 2005, KWP I applied Annual rye to newly cut and fill slopes and road edges to control soil erosion and stabilize bare earthen areas. Nēnē were observed browsing on the emergent rye grass and appeared to be attracted mostly to the newly emergent grass but less so to areas where growth had matured. In addition, all of the proposed grassing will have been done by the time the WTGs are operational. Because nēnē are opportunistic browsers that show an affinity for newly emergent grasses it should be expected that they will be attracted to such sources as available. This attraction alone does not represent an elevated risk because nēnē use a wide range of available foraging resources, and the seasonal duration of attractiveness presented by emergent grasses is limited.

COMMENT 15:

4.6.2.2.2 Kikuyu is NOT a good choice and should NOT be spread. Long-term it will kill both native shrubs and trees like ohia.

Response: Thank you for communicating your concerns regarding the use of Kikuyu grass to restore disturbed areas. KWP II acknowledges that Kikuyu grass is not ideal. However, it was considered to have merit for short-term revegetation under the previous proposal. In response to comments, and

because of differences in the local conditions, KWP II will not be proposing the use of Kikuyu grass in the new makai location presented in the *Revised DEIS*. We look forward to your review of that plan and further input.

KWP II's biologists have consulted with the DLNR, USFWS, and several conservation specialists in investigating long-term approaches to establishing suitable ground cover at KWP II following construction. KWP II LLC will consult with the Hawai'i Department of Agriculture, the Maui Invasive Species Commission and other experts to determine the use of annual rye, Kamanomano, Kawelu, *Eragrostis*, or Pili for long-term revegetation of disturbed areas and make a concerted effort to follow their recommendations.

COMMENT 16:

4.7.2 Do "project components" include the 2 permanent met towers in the estimated take levels? The permanent Met Towers SHOULD BE included – it is hard to tell from pages 4-17 and 4-18.

Response:

Yes, *"project components"* include the permanent met towers in the estimated take levels.

COMMENT 17:

4.7.2.3.2 53 acres of 333 acres = a 16% reduction in current nene (and pueo nesting) habitat. Where is this added into the mitigation?

Response: This question is partially addressed in the response to Comment 5 above. In addition to the information provided there, it is also worth noting that several years of onsite observations and consultation with local experts have led KWP biologists to conclude that the nēnē population at Kaheawa pastures is not presently limited (or close to being limited) by habitat availability, either for food or for nesting sites. Further, the area to be cleared constitutes a very small percentage of the total habitat present at Kaheawa Pastures (far less than 16 percent) and the reduction will not affect the population of these wide-ranging birds. The loss of habitat due to project construction is considered unlikely to measurably displace any individuals of the resident population, affect their survival, or productivity.

Nēnē. Current mitigation proposed in the Draft Habitat Conservation Plan for KWP II identifies predation as a major limiting factor affecting the productivity of nēnē at Kaheawa Pastures. Predator control would thus be the most effective way to increase adult and juvenile survival, increase productivity and provide a net benefit to the species. In addition, the nēnē population at Kaheawa Pastures will be closely monitored. Should a more pressing threat to the survival of nēnē be identified in the project areas, the HCP provides for alternative measures to address that threat to be selected and implemented, in consultation with DLNR and USFWS.

Pueo. Pueo are not presently listed under state or federal threatened and endangered provisions on Maui. To date KWP biologists have not encountered Pueo nesting sites in the grasslands in the project area. However, as Pueo are ground nesters and the eggs and fledglings vulnerable to ground predators, should they actually be nesting there the predator control measures proposed for nēnē will also benefit pueo by increasing productivity and fledgling survival.

COMMENT 18:

4.7.2.4.1 'Ope'ape'a may be more at risk of take from KWPII than from KWPI due to KWPII proximities (sic) to gulches vegetated with trees and shrubs. The bats are more often seen in/over forested areas than at the KWPI site.

Response: Monitoring of bat activity at KWP II is ongoing; the results to date indicate that bat activity rates at KWP I and KWP II are similar. The data show that bat activity at both areas is very low – only 3% of the activity rate observed in habitats where bats are known to occur commonly. In view of the very low rate of bat mortality recorded at KWP I and the fact that the bat activity rates at KWP I and KWP II are similar, the rate of take of bats at KWP II is expected to be very low. The HCP provides for increased mitigation efforts if rates of take prove to be greater than anticipated.

COMMENT 19:

4.7.4.1 Non-protected species should be collected with the same protocol for downed protected species.

Response: The original *DEIS* indicates that this will be done at DLNR's request.

COMMENT 20:

4.7.4.2 Remove and reduce Common Barn-owl.

Response: KWP biologists and the State and Federal staff who have worked on the HCP believe there is no scientific or conservation basis for implementing the removal or reduction of Common Barn owls in conjunction with this project. Hence, such a measure has not been included in the HCP.

COMMENT 21:

Polytape is NOT reflective, just white. Reflective or shiny tape has been demonstrated to perhaps "attract" seabirds to fencing (R. Swift)

Response: Thank you for this information. KWP II biologists consider white steel-reinforced poly-vinyl tape, when used as a visual enhancement aid on met tower guy lines and ungulate fencing, to be a useful measure to reduce the risk of collision mortality among transiting birds and bats in flight. This methodology has demonstrated effectiveness at reducing collision mortality of Hawaiian Petrels at Lana'ihale and at Hawai'i Volcano National Park.

COMMENT 22:

Collect and analyze any and all predated seabirds from mitigation area with DOFAW/USFWS/USGS involvement.

Response: The Revised DEIS will make it clear this will be performed as requested by DLNR, USFWS, USGS, and the ESRC.

COMMENT 23:

4.12.3 (pg 4-59) Containment, Spill Prevention and Control Measures do not speak of what invasive species, and or novel species of plant, invertebrates, and vertebrate introductions and or mitigation is scheduled and planned for storage sites where turbine/tower, WTG, nacelles, transformers, substation equipment components are stored. These items are already largely here with no oversight! (see 4.13.1.3). What has been done to inspect the items or the site since the arrivals? What is the review of "cleanliness" of the component parts, and the KIHEI storage sites BEFORE they are taken to the KWPII site? What is the scope and procedure to assure NO invasive species importation, and importantly, what is the mitigation/capture/control IF species are detected? Where are assurances and funds set aside for this?

Response: Newly manufactured wind turbine generator (WTG) components for KWP II were loaded and transported aboard ocean cargo vessels from points of origin in China and the U.S. mainland and arrived in performance-ready condition at the Port of Kahului between November 2008 and January 2009. All shipments were inspected by the State of Hawai'i Department of Agriculture, Plant Quarantine Branch prior to being off-loaded. Once inspectors cleared the cargo, it was transferred to trucks and transported to a secure storage facility near the town of Kīhei. Since that time, KWP II LLC has conducted monthly assessments of the condition of stored equipment and periodic technical evaluations to ensure that equipment remains fully operational while awaiting installation.

Prior to being transported onto the KWP II site, wind turbine components will be thoroughly inspected by qualified contractors to remove any invasive or incipient species (plant and animal) that might pose a risk of being transported from the Kīhei storage facility to the KWP II site. These inspections will be performed in cooperation with local experts from the Maui Invasive Species Commission or others with experience performing similar screening and will be fully documented. If a significant invasive species risk is identified during the inspections, DLNR will be notified and appropriate procedures for containment will be implemented in consultation with agency officials.

COMMENT 24:

7.1 No invasive species introductions or mitigation thereof is even described (see above).

Response: KWP II intends to continue working alongside local experts to minimize and reduce the ingress of invasive plant and animal species to the Kaheawa Pastures region. For example, fireweed (*Senecio madagascariensis*) was first observed at Kaheawa following the wildfires of September, 2006. Since that time, KWP has monitored its distribution closely and performed control measures that include manual removal. Working cooperatively with the USDA Rangeland Extension Office, KWP has facilitated access and logistical support for researchers examining fireweed occurrence patterns in a non-pastoral setting to evaluate potential vulnerabilities and other growth-limiting factors. Proper management and inspection of incoming materials and equipment during each segment of the construction phase of the KWP II project is expected to significantly reduce, if not eliminate, the chances of introducing unwanted seeds, plant material, and/or animals that are recognized as invasive or incipient species.

KWP biologists believe that those measures will prevent the spread of invasive or incipient species and therefore would not result in secondary and cumulative impacts.

MONITORING

Comment 25:

The Division of Forestry and Wildlife is currently under staff to monitor KWP for downed or take of wildlife covered under the HCP. Issues and concerns arise during construction and thereafter. Resolution to this concern – Establish a team that is funded by KWP but under DOFAW management. This team would be responsible for monitor KWP site, respond to downed or take wildlife, monitor invasive species entering into the area, monitor disturbance levels to T&E and monitor / evaluate requirements in HCP. If additional wind project are established, this team can also monitor these wind sites and be funded by a HCP.

Response: KWP II understands that DOFAW is considering organizing a monitoring team that will oversee the management of threatened and endangered resources under the provisions of existing and future HCPs. How this is addressed at KWP II will be determined through the HCP process currently underway.

NĒNĒ

COMMENT 26:

The proposed site is an established flocking and nesting area for nene. This past season and records illustrate that nene utilize this proposed site. If two-thirds of the 53 acre site is going to be disturbed by construction, where is the mitigation for that? What about the additional roads? This formulates additional lost of nene habitat, alters movement and behavior of nene.

Response: See above responses to Comments 5 and 17 for a discussion of many aspects of this comment. As discussed in the *DEIS*, nēnē are known to utilize a broad area within and around the proposed KWP II site. The site discussed in the *DEIS* is also 333 acres (not 53 acres as stated); moreover, as up to two-thirds of the area that is disturbed will be revegetated post-construction, only part of that represents a conversion. The KWP II Draft Habitat Conservation Plan (HCP) provides for mitigation that is expected to result in a net ecological benefit for nēnē that utilize the KWP II, KWP I, and Hana'ula areas. These measures are specific to this population and are expected to improve both the quality of available habitat and the annual productivity to more than compensate for the effects of site development. The *Revised DEIS* will include the latest description of these measures from the Draft HCP that is now in the agency review stage.

COMMENT 27:

Any grassing of an area will attract nene to the site, especially with kikuyu. This may also increase the change of more take of Nene. Planting kikuyu with native shrub may also attract nene to the site during the nesting season.

Response: See also response to Comment 14 and 15 above. Newly emergent grass, including Kikuyu, may represent a temporary attraction to nēnē. However, this does not mean that nēnē will necessarily be exposed to an elevated collision risk. Nēnē currently occupy the site and move readily among favorable foraging sites. In the case of Kikuyu, nēnē are not expected to remain associated with a particular browsing site once the grass matures. Nēnē are highly adaptable and have been

observed selecting nest sites in a variety of habitat settings. KWP II biologists do not expect nēnē to establish nesting territories preferentially in or close to revegetated fill slopes and road cuts.

COMMENT 28:

Second row of wind turbines may increase a higher probability of wildlife strikes. How can you assume a take of 1.1 / per year when there is an increase of turbines and multipule (sic) rows?

Response: This comment may reflect a misunderstanding. The forecast level of take presented in the *DEIS* is only for the facilities that are included in the proposed expansion. The effect of the existing facilities is accounted for separately, and they will continue to be authorized under their existing incidental take permit and incidental take license.

COMMENT 29:

A trapline to control predators in the area needs to be established and maintained by KWP in both KWPI and KWPII sites.

Response: The Draft HCP for KWP II includes provisions for measures to control predators in the KWP II and KWP I areas by trapping and removal, with the aim of increasing annual survival of goslings and adults. The *Revised DEIS* will clarify this mitigation measure.

COMMENT 30:

Boundaries and closed areas need to be established during construction to protect T&E species. It is recommended that construction does not occur during the nene nesting season. If construction needs to take place during nesting season, then nene surveys need to be conducted on a daily basis. In the event a nest is found in the vicinity, construction in the area needs to cease and disturbance level monitored. In phase I, disturbance levels during the construction of tower 20 platform may have caused abandonment of a nene nest.

Response: As a result of ongoing discussions between the USFWS, DOFAW, and KWP II, the Draft HCP for the proposed project includes provisions that address these recommendations. More specifically, the current Draft HCP includes provisions for daily nēnē nesting surveys to be performed in advance of any planned construction activities if construction occurs during the breeding season and would similarly be performed during any time of year that construction were to occur.

The development of the WTG 20 site during the construction of KWP I occurred in close coordination with DOFAW in order to minimize the possibility of disturbance to a nest site that was located a half-kilometer down-slope. This entailed close monitoring of the nest site and attendant adults for several days prior to any ground work commencing and included preparation for video surveillance. The clutch appeared to have hatched and brood and adults left the area prior to the commencement of any ground clearing, suggesting that the diligence by KWP biologists in cooperation with DOFAW enabled the family group to leave the area prior to any mechanized ground work taking place.

INDIRECT TAKE OF NĒNĒ

COMMENT 31:

In regards to nene, they assumed that adult nene is most likely to collide with turbines. False, there is a better chance of fledglings and sub adults have a greater chance of collision. Take should be calculated on fledgling to Adult stage (if possible), productivity of life expectancy and the time to replace the take.

Response: The HCP/DEIS says: "*It is assumed that adult nēnē are most likely to collide with turbines and associated structures during non-breeding periods (May through July) or at the end of their breeding period when the adults and young may travel as family groups.*" As used here, "assumed" refers to the breeding period, not the age status of *nēnē*.

Take was calculated on fledgling to adult stage. This sentence was written in the context of calculating indirect take. Only adults have indirect take, fledglings and sub-adults do not as they are non-breeding. It does not imply that subadults and fledglings do not have potential to collide with turbines.

COMMENT 32:

In regards to nene, who cited "Population remains poorly understood; however, no decline in overall productivity is apparent (DOFAW comm.)". Statement false.

Response: Mr. Greg Spencer, KWP's biologist, discussed this issue with Mr. Scott Fretz of DOFAW. It is Mr. Spencer's understanding that the nēnē population appears to be self-sustaining at this time with no apparent decline in overall productivity since reintroduction was initiated. Hence, while it is true that numerous ecological factors, some requiring further study, may be affecting annual productivity and population stability, it is Mr. Spencer's understanding that the quoted statement is correct. In evidence of this, he notes that a multi-family brood of nine young was recently observed in the vicinity of the KWP I project site.

COMMENT 33:

Is there another possible site on Maui besides Kaheawa that would avoid disruptive displacement of T&E?

Response: Section 2.5.2.3 of the DEIS, which is titled "Develop Wind Power Generating Facility on Another Site," discusses the alternative of developing wind generating facilities elsewhere on Maui. The wind regime at Kaheawa Pastures is extremely favorable in its consistency and strength, and the site's proximity to KWP I allows KWP II to share infrastructure such as the main access road, some equipment storage and parts, and to a smaller extent, personnel, with the existing wind project. Finally, it is noted that other wind-rich sites on Maui are located in areas that lack adequate transmission capability, are closer to/more visible from populated areas, and have other constraints. These conclusions were based on a close examination of the wind maps that the State of Hawai'i has produced and that are available at http://www.state.hi.us/dbedt/ert/wwg/windy.html#maui.

The HCP for the proposed project reaches a similar conclusion, stating:

Moreover, other sites suitable for wind development on Maui present comparable challenges in terms of topography, visibility, natural resources, and sensitive flora and fauna without having comparable benefits. Operation of the existing KWP has produced data pertaining to the Covered Species at the proposed location which has been used to more accurately estimate levels of take for each Covered Species at the proposed KWP II site. At an alternate location, the species vulnerable to take by a proposed wind facility may be different from the Covered Species in this HCP. The levels of take for those species also may change at an alternate project location, depending on movement rates and the potential level of interaction of each species with the wind facility. These take levels would have to be determined from wildlife surveys and other existing information, but would not have the benefit of long-term data that is available for the proposed location.

COMMENT 34:

Calculations of take for nene should be based on factual information, not on assumptions.

Response: The calculations for nēnē at KWP II are based on actual observed mortality at KWP (factual information) and scaled according to the size of KWP II with respect to KWP (reasonable assumption).

OTHER

COMMENT 35:

An inspection area needs to be implemented previous to the construction site to control, detect and intercept invasive species. This includes inspections of vehicles, cargo and raw material.

Response: As discussed in more detail elsewhere in this response, KWP II has confirmed that it will establish an inspection area at the site entry near Honoapi'ilani Highway to enable all vehicles, raw materials, and cargo to be thoroughly inspected to detect and intercept any material that might constitute an invasive species risk prior to allowing the transport of vehicles, raw materials, and cargo to proceed.

COMMENT 36:

There is no indication that cranes that are not in use shall be lower to ground level. No crane use shall be conducted during night hours. Higher chance of bird strikes.

Response: KWP II expects to conduct nearly all crane operations during daylight. When not in use, the crane boom will be lowered to reduce the chance of bird strikes. On rare occasions extended periods of high winds during the daytime may make it necessary to conduct critical maintenance at night, when wind speeds are typically lower. That is the only safe time to hoist a fully assembled rotor or other component.

COMMENT 37:

There is no reference in the EIS that DOFAW has considered the State Lands in the Ukumehame and Kaheawa area for public game bird hunting.

Response: DOFAW has not made it apparent that State Lands in the Ukumehame and Kaheawa area are being considered for future public game bird hunting.

COMMENT 38:

Met Towers should be constructed with no guy wires, especially if the structures are permanent. What time frame should we consider the existing towers permanent?

Response:

As indicated in our response to Comment No. 3, this recommendation has been incorporated into the site plans and will be addressed in the *Revised DEIS*. It is assumed that permanent met towers will be operational for the entire project duration.

COMMENT 39:

Silt fences and construction material that are disrepair or non-functional need to be removed immediately. This is to prevent debris from blowing into adjacent gulches and causing harm to wildlife (a problem on Phase 1).

Response: Once no longer necessary, all silt fences and construction debris will be removed to reduce the risk of harm to wildlife and habitat.

If you have any questions in the future concerning this project, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Ms. Noe Kalipi, KWP II LLC
Mr. Dave Cowan, KWP II LLC
DLNR Office of Conservation and Coastal Lands

COMMENT NO. 020

PHONE (808) 594-1888

FAX (808) 594-1865

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

HRD09/2078F

April 15, 2009

Perry J. White
Planning Solutions
Ward Plaza, Suite 330
210 Ward Avenue
Honolulu, HI 96814-4012

RE: Draft Environmental Impact Statement for the Kaheawa Wind Power II, Mā'alaea, Maui, TMK: (2) 4-8-01:001.

Aloha e Perry J. White,

The Office of Hawaiian Affairs (OHA) is in receipt of your February 21, 2009, letter requesting comments on the above-mentioned project. Kaheawa Wind Power II LLC proposes to construct a 21 megawatt wind power generating facility and related improvements at Kaheawa pastures above Mā'alaea, Maui. The proposed facility would be located on approximately 333 acres of land adjacent to the existing wind power facilities. Subject to negotiation of a power purchase agreement, it would supply wind-generated electricity to Maui Electric Company Ltd. OHA has reviewed the project and offers the following comments.

OHA has concerns regarding the impacts the proposed project will have on native species such as the Newell's shearwaters, Hawaiian petrels, the nēnē and the Hawaiian hoary bat. We appreciate the mitigation measures proposed for the project, and we ask that no net loss of these species will occur as a result of the project.

We will rely on the applicant's assurances that should iwi kūpuna or Native Hawaiian cultural or traditional deposits be found during the construction of the project, work will cease, and the appropriate agencies will be contacted pursuant to applicable law. In addition, OHA appreciates that the applicant will implement a longterm revegetation program that uses native plants, such as 'akia, ko'oko'okau, 'a'ali'i, 'ulei, 'ōhi'a and 'ilima.

Thank you for the opportunity to comment. If you have further questions, please contact Sterling Wong by phone at (808) 594-0248 or e-mail him at sterlingw@oha.org.

'O wau iho nō me ka 'oia'i'o,

Clyde W. Nāmu'o
Administrator

C: OHA Maui CRC Office

Office of Conservation and Coastal Lands
Department of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

PLANNING
SOLUTIONS

November 16, 2009

Mr. Clyde W. Nāmuʻo, Administrator
Office of Hawaiian Affairs
State of Hawaiʻi
711 Kapiolani Boulevard, Suite 500
Honolulu, HI 96813

Subject: Draft Environmental Impact Statement: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawaiʻi

Dear Mr. Nāmuʻo:

Thank you for your April 15, 2009 letter concerning the proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Draft Environmental Impact Statement* (*DEIS*) and providing written comments.

At the time the original *DEIS* was published in February, 2009, KWP II LLC had concluded based on the best available wind resource data and on the results of analyses of natural resources that the Downwind/Downstring siting area it proposed would best meet the project objectives. Since that time, it has had the opportunity to collect and analyze additional wind resource data and to consider comments submitted by resource agencies as part of the Chapter 343 and Habitat Conservation Plan review process. Taken together, this new information has led KWP II to conclude that locating its facilities lower on the mountainside has several advantages, some of which are quite substantial and may reduce potential impacts to resources identified by DOFAW and other agencies during the project's review.

KWP II LLC has now identified an additional siting alternative for its proposed facilities that it believes is equal to/superior to the original proposal with respect to potential effects on threatened and endangered species and which has a number of other advantages. Situated in what is referred to as the "Down Road Siting Area", the "Downroad Alternative" is now KWP II LLC's "Preferred Alternative". In discussion with the State of Hawaiʻi Department of Land and Natural Resources, it has concluded that the best way to proceed is to issue a *Revised DEIS* that addresses the potential effects of what is now its "Preferred Alternative", as well as the effects of the "Downwind/Downstring Alternative" evaluated in the February 2009 *DEIS*.

We are now preparing the *Revised DEIS* and expect that it will be released for public review and comment in the 4th quarter of 2009. However, because the report will include the project plans on which you commented as an alternative, we would like to take this opportunity to provide the following item-by-item responses to your comments. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

Comment 1:

OHA has concerns regarding the impacts the proposed project will have on native species such as the Newell's shearwaters, Hawaiian petrels, the nēnē and the Hawaiian hoary bat. We appreciate the mitigation measures proposed for the project, and we ask that no net loss of these species will occur as a result of the project.

Response: As discussed in the February 2009 *DEIS*, the project developer is working closely with the U.S. Fish and Wildlife Service and the State of Hawaiʻi Department of Land and Natural Resources' Division of Forestry and Wildlife on a Habitat Conservation Plan (HCP) for the proposed project. In addition to minimizing potential impacts to the maximum extent practicable, it has

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

worked in conjunction with the agencies to develop an extensive set of mitigation measures that, when implemented, will result in a net benefit to the species.

Comment 2:

We will rely on the applicant's assurances that should iwi kūpuna or Native Hawaiian cultural or traditional deposits be found during the construction of the project, work will cease, and the appropriate agencies will be contacted pursuant to applicable law. In addition, OHA appreciates that the applicant will implement a longterm revegetation program that uses native plants, such as ʻakia, koʻokoʻokau, ʻaʻliʻi, ʻulei, ʻōhiʻa and ʻilima.

Response: The *Revised DEIS* will specify that should *iwi kūpuna* or Native Hawaiian cultural or traditional deposits be found during the construction of the project, work that might affect them will be halted immediately and the appropriate agencies will be contacted pursuant to applicable law.

If you have any questions in the future concerning this project, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Ms. Noe Kalipi, KWP II LLC
Mr. Dave Cowan, KWP II LLC
DLNR Office of Conservation and Coastal Lands

APPENDIX H. SEABIRD SURVEY BY COOPER AND DAY (2009)

FINAL REPORT

RADAR AND VISUAL STUDIES OF SEABIRDS AT THE PROPOSED KWP II DOWN-ROAD ALTERNATIVE WIND ENERGY FACILITY, MAUI ISLAND, HAWAII, SUMMER 2009

BRIAN A. COOPER AND ROBERT H. DAY

PREPARED FOR

FIRSTWIND, LLC
NEWTON, MA

PREPARED BY

ABR, INC.–ENVIRONMENTAL RESEARCH AND SERVICES
FOREST GROVE, OREGON ♦ FAIRBANKS, ALASKA

RADAR AND VISUAL STUDIES OF SEABIRDS AT THE PROPOSED KWP II DOWN-ROAD ALTERNATIVE WIND ENERGY FACILITY, MAUI ISLAND, HAWAII, SUMMER 2009

FINAL REPORT

Prepared for

FIRSTWIND, LLC
85 Wells Avenue, Suite 305
Newton, MA 02459–3210

Prepared by

Brian A. Cooper
ABR, Inc.—Environmental Research & Services
P.O. Box 249
Forest Grove, OR 97116–0249

and

Robert H. Day
ABR, Inc.—Environmental Research & Services
P.O. Box 80410
Fairbanks, AK 99708–0410

September 2009

Printed on recycled paper.

EXECUTIVE SUMMARY

- We used radar and audiovisual methods to collect data on movements of endangered Hawaiian Petrels (*Pterodroma sandwichensis*) and threatened Newell's (Townsend's) Shearwaters (*Puffinus auricularis newelli*) at the proposed Kaheawa Wind Power II Down-road Alternative wind energy generation facility, on Maui Island during summer 2009. We conducted evening and morning surveys during 20–24 July 2009.
- The objectives of the study were to: (1) document movement rates of Hawaiian Petrels and Newell's Shearwaters at the proposed KWP II Down-road Alternative facility; (2) estimate the daily number of petrels/ shearwaters that fly within areas that would be occupied by wind turbines at the proposed facility; and (3) estimate annual fatality rates of petrels/shearwaters at proposed turbines and meteorological (met) tower.
- We recorded 37 radar targets that fit our criteria for petrels and shearwaters.
- The mean movement rate across all nights was 1.78 ± 0.14 targets/h. After adjusting our sampling results for hours of the night that we did not sample (i.e., non-peak periods), we estimated a mean movement rate of 10.0 petrel-like/shearwater-like targets/night during summer 2009.
- We recorded one Hawaiian Petrel during visual sampling. This bird was heading east (i.e., toward Haleakala) at 40 m agl at 2126 on 24 July.
- To determine the risk of collision-caused mortality, we used petrel/shearwater movement rates observed on radar in summer 2009, petrel/shearwater flight altitudes from previous studies, and dimensions and characteristics of the proposed turbines and met towers to generate an estimate of exposure risk. We then applied estimates of the fatality probability (i.e., the probability of collision with a portion of the turbine or tower and dying while in the airspace occupied by the structure) and a range of estimated avoidance probabilities (i.e., the probability that a bird will detect and avoid entering the airspace containing the turbine or tower) to this estimate of exposure to calculate annual fatality rates that could be expected at the proposed turbines and met tower.
- We estimate that ~1,607 Hawaiian Petrels and 882 Newell's Shearwaters pass over the 1.5-km-radius radar sampling area in an average year (including birds at all altitudes).
- We estimated annual fatality rates at wind turbines and met towers by assuming that 90%, 95%, or 99% of all petrels/shearwaters flying near a turbine/tower will see and avoid the structure. Based on these scenarios, annual fatality rates for wind turbines ranged from 0.016–0.217 Hawaiian Petrel/turbine/yr and 0.009–0.119 Newell's Shearwaters/turbine/yr. For the 65-m met tower, we estimated a fatality of 0.008–0.081 Hawaiian Petrel/tower/yr and 0.004–0.044 Newell's Shearwaters/tower/year. Although the range of assumed avoidance rates of wind turbines and met towers (90–99%) is not fully supported by empirical data at this time we speculate that avoidance rates of petrels and shearwaters at wind farm structures (e.g., wind turbines and met towers) potentially are ≥95%, based upon fatality rates at existing windfarms and avoidance behavior of petrels observed at other structures (e.g., powerlines and communication towers); thus, we believe that fatality rates will be within the lower half of the range of estimates.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

We thank FirstWind for funding this study and for providing the ornithological radar used for sampling. We thank Greg Spencer and Dave Cowan (FirstWind) for help with logistics and thank Greg Spencer and Ian Bordenave (FirstWind) for their assistance with the visual sampling. At ABR, Rich Blaha and Dorte Dissing produced study figures and Alice Stickney and Pam Odom assisted with report production.

INTRODUCTION

First Wind, LLC, formerly UPC Wind Management, LLC, operates the 30-MW Kaheawa Pastures Wind Energy Generation Facility, referred to as Kaheawa Wind Power I (KWP I), on the island of Maui (Figure 1). A new wind project adjacent to the existing facility is being considered for development by FirstWind and will be operated as Kaheawa Wind Power II (i.e., the KWP II Down-road Alternative). Two federally-listed seabird species occur on Maui: the endangered Hawaiian Petrel (*Pterodroma sandwichensis*; Hawaiian name 'Ua'u) and the threatened Newell's (Townsend's) Shearwater (*Puffinus auricularis newelli*; Hawaiian name 'A'o). Ornithological radar and night-vision techniques have been shown to be successful in assessing numbers and movement rates of these petrels and shearwaters on the Hawaiian Islands (e.g., Kaua'i [Cooper and Day 1995, 1998; Day and Cooper 1995, Day et al. 2003b], Maui [Cooper and Day 2003], Moloka'i [Day and Cooper 2002], and Hawai'i [Day et al. 2003a]). Previous radar and visual studies documented the presence of petrel/shearwater targets, including visual observations of Hawaiian Petrels, in the vicinity of the existing KWP I project site (Day and Cooper 1999, Cooper and Day 2004a). These data were used to model the potential number of annual fatalities at the KWP I development (Cooper and Day 2004b). In addition, radar studies were conducted in 2008 (Sanzenbacher and Cooper 2008, 2009) to model the potential number of fatalities in a nearby portion of an alternate KWP II site that was located just upslope of the KWP II Down-road Alternative.

The currently operational KWP I wind-energy facility consists of an articulated row of 20 1.5-MW turbines (GE 1.5se) with a hub height of ~55 m and a rotor diameter of 70.5 m, plus one 30-m-high, guyed NRG monopole meteorological (met) tower and two 55-m-high, guyed lattice met towers (Figure 2). The proposed KWP II Down-road Alternative project would consist of ~14 additional 1.5-MW turbines (GE 1.5se), each with a hub height of ~65 m and a rotor diameter of 70.5 m, plus one 65-m-high, free-standing met tower.

ABR conducted additional radar and visual studies on Maui in July 2009 with a specific focus on an area proposed for the KWP II Down-road Alternative. The objectives of the study were to: (1) document movement rates of Hawaiian Petrels and Newell's Shearwaters at the proposed KWP II Down-road Alternative facility; (2) estimate the daily number of petrels/shearwaters that fly within areas that would be occupied by wind turbines or met towers at the proposed facility; and (3) estimate annual fatality rates of petrels/shearwaters at proposed turbines and meteorological (met) tower.

Background

Two seabird species that are protected under the Endangered Species Act (ESA) are likely and/or known to occur in the KWP II Down-road Alternative project area: the endangered Hawaiian Petrel and the threatened Newell's (Townsend's) Shearwater. The Hawaiian Petrel and the Newell's Shearwater are forms of tropical Pacific species that nest only on the Hawaiian Islands (American Ornithologists' Union 1998). Both species are Hawaiian endemics whose populations have declined significantly in historical times: they formerly nested widely over all of the Main Islands but now are restricted in most cases to scattered colonies in more inaccessible locations (Ainley et al. 1997b, Simons and Hodges 1998). The one exception is Kaua'i Island, where colonies still are widespread and populations are substantial in size. Of note, Kaua'i (along with Lana'i) also has no introduced Indian Mongooses (*Herpestes auropunctatus*) which prey on these seabirds.

The Hawaiian Petrel nests primarily on Maui (Richardson and Woodside 1954, Banko 1980a; Simons 1984, 1985; Simons and Hodges 1998, Cooper and Day 2003), Kaua'i (Telfer et al. 1987, Gon 1988, Day and Cooper 1995; Ainley et al. 1995, 1997a, 1997b; Day et al. 2003a), Hawai'i (Banko 1980a, Conant 1980, Hu et al. 2001, Day et al. 2003a), Lana'i (Shallenberger 1974; Hirai 1978a, 1978b; Conant 1980; G. Spencer and J. Penniman, pers. comm.), and Moloka'i (Simons and Hodges 1998, Day and Cooper 2002). On Maui, these petrels are known to nest on Haleakala Crater (Brandt et al. 1995, Simons and Hodges 1998) and are believed to nest in West Maui (Cooper and Day 2003), with recent observations of birds calling and exhibiting aerial displays consistent with breeding behavior, despite the

Figure 1. Maui Island, Hawaii, with approximate location of the Kaheawa Pastures Wind Energy Facilities (KWP I and KWP II).

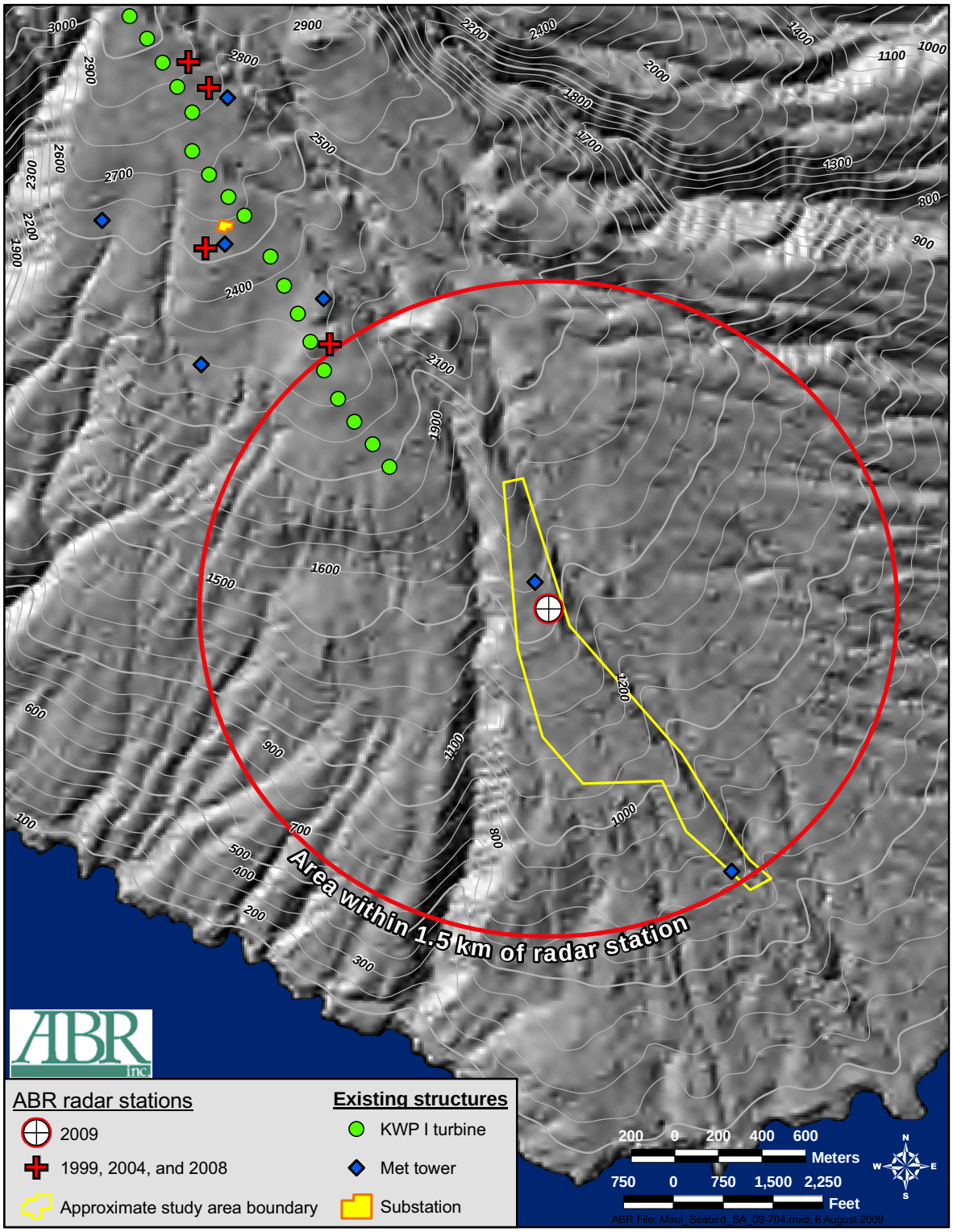


Figure 2. Location of 2009 radar sampling stations relative to sampling stations from previous studies (Day and Cooper 1999, Cooper and Day 2004a; Sanzenbacher and Cooper 2008, 2009) and areas under consideration for siting of wind turbines at the proposed KWP II Down-road Alternative wind energy facility, Maui, Hawaii.

minimal historical evidence and introduction of Indian Mongoose on Maui. For example, on 16 June 1999, a Hawaiian Petrel was heard calling from a bed of uluhe ferns (*Dicranopteris linearis*) at 3,300 ft (~1,000 m) elevation in the Kapunakea Preserve, which lies on the northwestern slope of the West Maui Natural Area Reserve (A. Lyons, *fide* C. Bailey). In addition, recent observations of consistent calling from a single location suggests that there is another small colony of Hawaiian Petrels in the West Maui Mountains ~14 km north of the KWP project areas (G. Spencer, FirstWind, pers. comm.). On the other hand, daily movement rates of Hawaiian Petrels near KWP I and II (i.e., on the southern slope of West Maui Mountain; Day and Cooper 1999, Cooper and Day 2004a, Sanzenbacher and Cooper 2008 and 2009) are much lower than those over the eastern and northern sides of Maui (Cooper and Day 2003), suggesting that few birds use that area.

Newell's Shearwaters nest on several of the main Hawaiian Islands, with the largest numbers clearly occurring on Kaua'i (Telfer et al. 1987, Day and Cooper 1995; Ainley et al. 1995, 1997b; Day et al. 2003b). These birds also nest on Hawai'i (Reynolds and Richotte 1997, Reynolds et al. 1997, Day et al. 2003a), almost certainly nest on Moloka'i (Pratt 1988, Day and Cooper 2002), and may still nest on Oahu (Sincock and Swedberg 1969, Banko 1980b, Conant 1980, Pyle 1983; but see Ainley et al. 1997b). On Maui, recent auditory observations suggest that a small colony of Newell's Shearwaters is present in the west Maui Mountains ~14 km north of the KWP project areas (G. Spencer, FirstWind, pers. comm.), matching a prediction of their occurrence there by Cooper and Day (2003). Newell's Shearwaters typically nest on steep slopes that are vegetated by uluhe fern (*Dicranopteris linearis*) undergrowth and scattered o'hia trees (*Metrosideros polymorpha*).

There is interest in studying these two species because of concerns regarding collisions with structures such as met towers and turbines. To date, there is documented mortality of only one Hawaiian Petrel at a wind turbine and zero Newell's Shearwaters at wind-energy facilities (wind turbines or met towers) within the Hawaiian Islands (G. Spencer, FirstWind, pers. comm.). Note, however, that fatality studies have been conducted only for 3.5 yr at one wind-energy location in the Hawaiian Islands (KWP I, Maui) and 3 mo at six met towers at the same site prior to operation. Hence, there have not been enough studies of adequate duration or geographic scope to answer the question definitively of whether these species are prone to collisions at these types of structures. There has, however, been well-documented petrel and shearwater mortality because of collisions with other human-made objects (e.g., transmission lines, communication towers) on Kaua'i (Telfer et al. 1987, Cooper and Day 1998, Podolsky et al. 1998) and Maui (Hodges 1992), and there have been collision-caused fatalities of other seabirds at other Hawaiian Islands (Fisher 1966).

STUDY AREA

The operational KWP I windfarm and proposed KWP II Down-road Alternative expansion are located on the southern slope of West Maui Mountain, in an area called Kaheawa Pastures (Figure 1). These sites lie on a moderately sloping portion of West Maui Mountain, ~1–6 km inland from McGregor Point. Vegetation at the site consists of non-native grasslands at lower elevations and a mixture of grasslands and scattered shrubs at moderate to higher elevations. Although the KWP II Down-road Alternative area consists of a dry Mediterranean habitat, vegetation becomes much wetter upland, toward the summit of West Maui Mountain. Presumably, vegetation communities also are dominated by native species in these higher, wetter areas. These upland habitats may provide suitable nesting habitat for Newell's Shearwaters, based on our experience on Kaua'i and other sites. In addition to the vegetation, the steepness of the land at higher elevations on West Maui Mountain also suggests that suitable nesting habitat exists for Hawaiian Petrels, as it does on Haleakala (Brandt et al. 1995), Kaua'i (Telfer, pers. comm.), and Lana'i (Hirai 1978b).

In previous studies at the KWP I and KWP II sites (Day and Cooper 1999, Cooper and Day 2004a; Sanzenbacher and Cooper 2008, 2009), sampling was conducted at four other stations; however, for the current study, we established a new sampling station with a focus on providing maximal radar coverage of potential siting areas for the proposed KWP II Down-road Alternative

development (Figure 2). The study area is situated in lower elevations slightly to the east and south of the existing KWP I turbine string, and our 2009 sampling station was located adjacent to the existing KWP I access road, just south of the Lahaina Pali trail (20° 47'52.6" N, 156° 32'16.5" W; elevation ~490 m).

METHODS

We used marine radar and visual equipment to collect data on the movements, flight behaviors, and flight altitudes of petrels and shearwaters at a single sampling station during summer (20–24 July) 2009 (Table 1). The daily sampling effort consisted of 3 h each evening (1900–2200 h) and 2 h each morning (0400–0600 h). These sampling periods were selected to correspond to the evening and morning peaks of movement of petrels and shearwaters, as described near breeding colonies on Kaua'i (Day and Cooper 1995). During sampling, we collected radar and audiovisual data concurrently so the radar operator could help the audiovisual observer locate birds for species identification and data collection. In return, the audiovisual observer provided information to the radar operator on the identity and flight altitude of individual targets (whenever possible). For the purpose of recording data, a calendar day began at 0700 and ended at 0659 the following morning; that way, an evening and the following morning were classified as occurring on the same day.

The ornithological radar used in this study was a Furuno (Model FCR-1510) X-band radar transmitting at 9.410 GHz through a slotted wave guide with a peak power output of 12 kW; a similar radar unit is described in Cooper et al. (1991) and Mabee et al. (2006). The antenna face was tilted upward by ~10°, and we operated the radar at a range setting of 1.5 km and a pulse-length of 0.07 μsec.

Issues associated with radar sampling include ground clutter and shadow zones. Whenever energy is reflected from the ground, surrounding vegetation, and other objects around the radar unit, a ground-clutter echo that can obscure targets of interest (i.e., birds) appears on the radar's display screen. Shadow zones are areas of the screen where birds can fly at an altitude that potentially would

Table 1. Sampling dates and number of inbound and outbound seabird radar targets and number of audio-visual observations of species of interest at the proposed KWP II Down-road Alternative wind-energy site, Maui, Hawaii, July 2009.

			Number of radar targets			Number of audio-visual
Date	Site	Period	Inbound[1]	Outbound[1]	Total	detections[2]
20 July	Lower	Eve	0	7	7	0
		Morn	0	1	1	0
21 July	Lower	Eve	0	5	5	0
		Morn	1	2	3	0
22 July	Lower	Eve	4	0	4	3 SEOW
		Morn	1	0	1	1 TROP
23 July	Lower	Eve	6	1	7	3 SEOW
		Morn	1	0	1	2 SEOW, 1 BAOW, 1 UNOW
24 July	Lower	Eve	6	0	6	1 HAPE, 1 BAOW, 1 UNOW
		Morn	1	1	2	1 SEOW

[1] Flight direction categories for landward and seaward categories included all birds flying toward and away, respectively, from either the colonies located on the opposite end of west Maui to the north of the study site or colonies on Haleakala.
[2] HAPE = Hawaiian Petrel; HOBA = Hoary Bat; NESH = Newell's Shearwater; SEOW = Short-eared Owl; BAOW = Barn Owl: TROP = unidentified Tropicbird; UNOW = Unidentified owl.

put them behind a hill or row of vegetation where they could not be detected because the radar operates only on line-of-sight. We attempted to minimize ground clutter and shadow zones during the selection of radar sampling stations; various structures and landscape features visible on radar indicated that our sampling stations provided good coverage of the study area.

We sampled for six 25-min sessions during each evening and for four 25-min sessions each morning (Table 1). Each 25-min sampling session was separated by a 5-min break for collecting weather data. To help eliminate non-target species, we collected data only for those targets that met a suite of selection criteria, following methods developed by Day and Cooper (1995), that included appropriate flight characteristics and flight speeds (≥30 mi/h [≥50 km/h]). We also removed radar targets identified by flight characteristics or visual observers as being of other bird species.

We conducted audiovisual sampling for birds and bats concurrently with the radar sampling to help identify targets observed on radar and to obtain flight-altitude information. During this sampling, we used 10X binoculars during crepuscular periods and Generation 3 night-vision goggles (Model ATN-PVS7; American Technologies Network Corporation, San Francisco, CA) during nocturnal periods. The magnification of the night-vision goggles was 1X, and their performance was enhanced with the use of a 3-million-Cp floodlight that was fitted with an IR filter to avoid blinding and/or attracting birds. Audiovisual observations were conducted within 25 m of the radar to facilitate coordination between observers, and we also listened for petrel and shearwater vocalizations.

Before each 25-min sampling session, we also collected environmental and weather data, including:

- wind speed (to the nearest 1.6 km/h [1 mi/h]);
- wind direction (to the nearest 1°);
- percent cloud cover (to the nearest 5%);
- cloud ceiling height, in meters above ground level (agl; in several height categories);
- visibility (maximal distance we could see, in categories);
- light condition (daylight, crepuscular, or nocturnal, and with or without precipitation)
- precipitation type; and
- moon phase/position (lunar phase and whether the moon was above or below the horizon in the night sky).

For each appropriate radar target, we recorded the following data:

- species (if identified by visual observer);
- number of birds (if identified by visual observer);
- time;
- direction of flight (to the nearest 1°);
- cardinal transect crossed (000°, 090°, 180°, or 270°);
- tangential range (the minimal perpendicular distance to the target when it passed closest to the radar; used in reconstructing actual flight paths, if necessary);
- flight behavior (straight, erratic, circling);
- velocity (to the nearest 5 mi/h [8 km/h]); and
- flight altitude (meters agl, if identified by visual observer).

For each bird (or bat) recorded during audiovisual sampling, we recorded:

- time;
- species (to the lowest practical taxonomic unit [e.g., Hawaiian Petrel, unidentified petrel/shearwater]);
- number of individuals composing each target;
- ordinal flight direction (000°, 045°, 090°, 135°, 180°, 225°, 270°, 315°); and
- flight altitude (meters agl).

For any birds heard but not observed, we recorded species, number of calls, direction of calls, and approximate distance.

DATA ANALYSIS

We entered all radar and visual data into Microsoft Excel databases. Data files were checked visually for errors after each night's sampling, then were checked electronically for irregularities at the end of the field season, prior to data analyses. In addition, radar data were filtered to remove non-target species, and only known petrel/shearwater targets or unknown targets with appropriate characteristics (i.e., target size, flight characteristics, and airspeeds ≥30 mi/h) were included in data analyses. Airspeeds were calculated by correcting observed target flight speeds (groundspeeds) for speed and relative direction of wind, as measured each half-hour at the radar station (Mabee et al. 2006).

We tabulated counts of numbers of radar targets of petrels and shearwaters recorded during each sampling session, then converted those counts to estimates of movement rates of birds (radar targets/h), based on the number of minutes sampled. No sampling time was lost to rain or other factors; we standardized estimates by actual minutes of sampling effort each half hour. We used all of the estimated movement rates across sampling sessions at a station to calculate the mean ± 1 standard error (SE) nightly movement rate of petrels and shearwaters by station and pooled data across nights to derive an overall hourly movement rate for the study.

We also classified general flight directions of each radar target as landward or seaward and summarized those directional categories by station, date, and time period. To categorize the general flight direction of each target, we defined a landward flight as a radar target flying toward the West Maui Mountains or Haleakala (on East Maui) and classified targets flying in the opposite directions as seaward targets.

MODELING FATALITY RATES

The risk-assessment technique that we have developed involves the use of radar data for estimating the fatality rates for petrels and shearwaters near structures in the Hawaiian Islands. This modeling technique uses the radar data on seasonal movement rates to estimate numbers of birds flying over the area of interest (sampling station) across a 255-d year (for Hawaiian Petrels) or a 210-d year (for Newell's Shearwater) when breeding birds are present on the island. The model then uses information on the physical characteristics of the structures (e.g., wind turbines or met towers) themselves to estimate horizontal and vertical interaction probabilities and combines these interaction probabilities with the movement rates to generate exposure rates (Figure 3). These rates represent the estimated numbers of petrels/shearwaters that pass within the airspace occupied by a proposed wind turbine or within the airspace occupied by a met tower and its associated guy wires each year. We then combine these exposure rates with (1) the probability that an interaction results in fatality, and (2) the probability that birds detect structures and avoid interactions, to estimate fatality rates.

We calculate an exposure rate by multiplying the seabird movement rate observed on radar by horizontal- and vertical-interaction probabilities. The movement rate is an estimate of the average number of birds passing in the vicinity of the proposed turbines/towers in a day, as indicated by numbers of targets on the radar screen and the mean flock size/target. It is generated from the radar data by: (1) multiplying the average movement rates by 5.0 h to estimate the number of targets moving over the radar site in the first 3 h and last 2 h of the night (i.e., during the peak movement periods of petrel/shearwaters); (2) adjusting the sum of those evening and morning counts to account for the estimated percentage of movement that occurs during the middle of the night (when we did not sample); and (3) multiplying that total number of targets/night by the mean number of seabirds/target to generate an estimate of the number of petrel/shearwaters passing in the vicinity of the proposed met towers/turbines during an average day.

We used the radar-based movement data from our current study at the proposed KWP II Down-road Alternative development to estimate seabird movement-rates in summer and assumed that those rates represented average rates observed in an average year. We used data from all-night sampling sessions on Kaua'i (Day and Cooper 1995) to estimate movement rates occurring during the hours between our evening and morning sampling periods. These data suggested that an additional 12.6% of the total combined evening

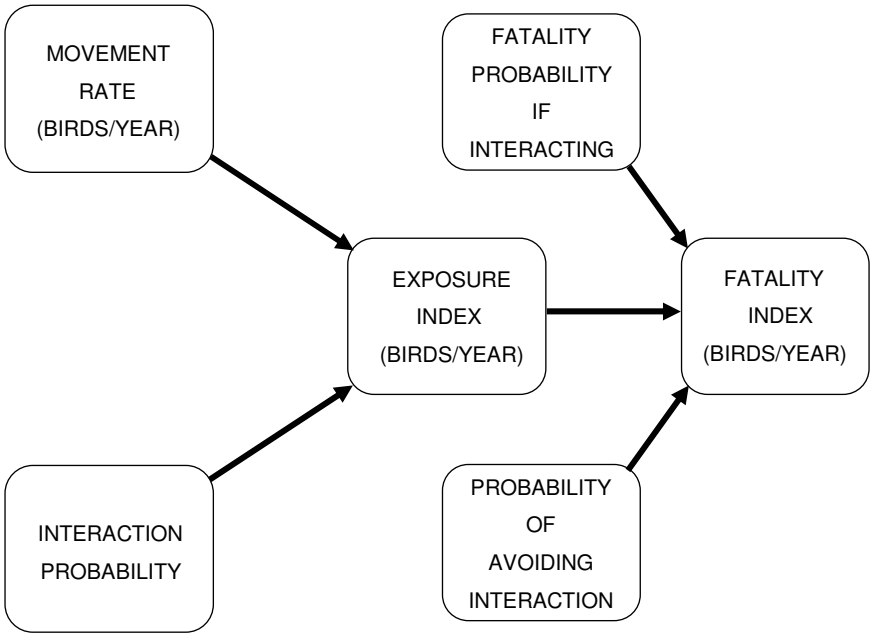


Figure 3. Major variables used in estimating possible fatalities of Hawaiian Petrels and Newell's Shearwaters at wind turbines at the proposed KWP II Down-wind Alternative wind energy facility, Maui, Hawaii. See Tables 2 and 3 for details on calculations.

landward movements and seaward morning movements occurred between the evening and morning peak-movement periods (Day and Cooper, unpubl. data). We also corrected the number of targets for flock size: mean flock sizes of petrels and shearwaters combined in Hawai'i are 1.05 ± SE 0.01 birds/flock (n = 2,062 flocks; Day and Cooper, unpubl. data). In addition, we used the timing of inland flights at the nearby Ukumehame site from Cooper and Day (2003) to correct for proportions of targets that were Hawaiian Petrels and those that were Newell's Shearwaters; those data suggested that 60% of the targets were Hawaiian Petrels and 40% of the targets were Newell's Shearwaters.

The number of petrels visiting breeding colonies tends to decline from summer to fall because attendance at colonies by nonbreeders and failed breeders declines as chick-rearing progresses (Serventy et al. 1971, Warham 1990, Ainley et al. 1997b, Simons and Hodges 1998). Although we do not yet have fall data for the site, we split the 255-d breeding season for Hawaiian Petrels (Simons and Hodges 1998) and 210-d breeding season for Newell's Shearwaters (Ainley et al. 1997b) into a spring/summer period of 180 days and 150 days for petrels and shearwaters, respectively, and a fall period of 75 days and 60 days for petrels and shearwaters, respectively. We corrected the seasonal estimates of nightly movement rates by the numbers of days for the spring/summer and fall seasons to generate estimates of movements for each season and species. We assume that the sum of these two estimates represents estimated movement rates for an entire breeding season (i.e., an average year).

Because the resulting estimate of the number of birds/yr is not an integer, we then round it upward to the next whole number to generate an estimate of the average number of birds passing within 1.5 km of the radar site during a year. This rounding technique results in slightly-inflated fatality estimates, but we choose to take a conservative approach in these studies associated with endangered species.

INTERACTION PROBABILITIES

Horizontal

Interaction probabilities consist of horizontal and vertical components. The horizontal-interaction probability is the probability that a bird seen on radar will pass through or over the airspace occupied by a met tower or turbine located somewhere on the radar screen. This probability is calculated from information on the two-dimensional area (side view) of the tower/turbine and the two-dimensional area sampled by the radar screen to determine the interaction probability. The 65-m, free-standing met-tower system consists of a central lattice tower without any supporting guy wires. The tower is 65 m high with a width at the base of ~6 m and a width at the top of ~0.5 m. The proposed wind turbines have ~65-m monopole towers and 35.25-m-long blades. Two calculations of area were made for turbines because of the large differences in area of the structure that depended on the orientation of the blades relative to the flight path of an approaching bird: a minimal area occupied by each proposed turbine if a bird approaches it from the side (i.e., side profile) and a maximal area occupied by each turbine if a bird approaches it from the front (i.e., front profile, including the rotor-swept area). The ensuing ratio of cross-sectional area of the proposed tower/turbine to the cross-sectional area sampled by the radar (1.5 km) indicates the probability of interacting with (i.e., flying over or through the airspace occupied by) the proposed tower or turbine.

Vertical

The vertical-interaction probability is the probability that a bird seen on radar will be flying at an altitude low enough that it might pass through the airspace occupied by a proposed met tower/turbine located somewhere on the radar screen. This probability is calculated from data on flight altitudes and from information on the proposed turbine heights. We used data from throughout the Hawaiian Islands (n = 2,010 birds; Cooper and Day, unpubl. data) to calculate the percentage of petrels/shearwaters with flight altitudes at or below the maximal height of the turbines (i.e., 51.0% ≤100 m agl) and met towers (i.e., 33.0% ≤65 m agl). We would have preferred to use flight-altitude data from the project area for the flight-altitude computations, but adequate sample sizes do not currently exist to do so.

FATALITY RATES

The annual estimated fatality rate is calculated as the product of: (1) the exposure rate (i.e., the number of birds that might fly within the airspace occupied by a tower/turbine); (2) the fatality probability (i.e., the probability of collision with a portion of the tower/turbine and dying while in the airspace occupied by the structure); and (3) the avoidance probability (i.e., the probability that a bird will detect and avoid entering the airspace containing the tower/turbine). The annual fatality rate is generated as an estimate of the number of birds killed/yr as a result of collisions with the tower/turbine, based on a 255-d breeding season for Hawaiian Petrels and a 210-d breeding season for Newell's Shearwaters.

Fatality Probability

The estimate of the fatality-probability portion of the fatality rate formula is derived as the product of: (1) the probability of dying if a bird collides with a tower/turbine; and (2) the probability of colliding with a turbine if the bird enters the airspace occupied by the structure (i.e., are there gaps big enough for birds to fly through the structure without hitting any part of it). Because any collision with a wind turbine or tower falls under the ESA definition of "take" we used an estimate of 100% for the first fatality-probability parameter. Note that the actual probability of fatality resulting from a collision is less than 100% because of the potential for a bird to hit a turbine component and not die (e.g., a bird could brush a wingtip but avoid injury/death). The second probability (i.e., striking the structure) needs to be calculated differently for met towers and turbines. In the met-tower design, the tower frame is a lattice structure, so we conservatively estimated the probability of hitting the tower if the bird enters the airspace at 100%. Similarly, a bird approaching a wind turbine from the side has essentially a 100% probability of getting hit by a blade; in contrast, a bird approaching from the back or front of a turbine may pass through the rotor-swept area without colliding with a blade, if it is flying fast enough. We calculated the probability of collision

for the "frontal" bird approach based upon the length of a petrel (43 cm; Simons and Hodges 1998); the average groundspeed of petrels on Maui (mean velocity = 42.5 mi/h; *n* = 347 probable petrel targets; Cooper and Day, unpubl. data) and the time that it would take a 43-cm-long petrel to travel completely through a 2-m-wide turbine blade spinning at its maximal rotor speed (22 revolutions/min); also see Tucker (1996). These calculations indicated that 19.5% of the disk of the rotor-swept area would be occupied by a blade sometime during the length of time (i.e., 0.13 sec) that it would take a petrel to fly completely past a rotor blade (i.e., to fly 2.43 m).

Avoidance Probability

The final parameter is the avoidance probability, which is the probability that a bird will see the turbine and change flight direction, flight altitude, or both, so that it completely avoids flying through the space occupied by a met tower/turbine. Because avoidance probabilities are largely unknown, we present fatality estimates for a range of probabilities of collision avoidance by these birds by assuming that 90%, 95%, or 99% of all petrels or shearwaters flying near a tower/turbine structure will detect and avoid it. See discussion for explanation of avoidance rates used.

RESULTS

VISUAL OBSERVATIONS

One Hawaiian Petrel was detected by visual observers (Table 1). This bird was heading eastward toward Haleakala at 40 m agl at 2126 on 24 July. That bird also was observed on radar. In addition, we had numerous observations of Short-eared Owls (*Asio flammeus sandwichensis;* Pueo), plus a few Barn Owls (*Tyto alba*), and one unidentified tropicbird (at 0542 on 22 July). No Hawaiian Hoary Bats (*Lasiurus cinereus semotus*; 'Ope'ape'a) were recorded.

MOVEMENT RATES

We recorded 37 radar targets during 25.0 h of sampling in summer 2009 that fit our criteria for petrels and shearwaters (Table 1). Passage rates tended to be higher in the evening than in the morning: only 8 (21.6%) of the 37 targets were recorded during the morning sampling period. Mean nightly movement rates during summer 2009 were 1.78 ± 0.14 targets/h. After adjusting our sampling results for hours of the night that we did not sample (i.e., non-peak periods), we estimated a mean movement rate of 10.0 petrel-like targets/ night during summer 2009 (Table 2).

We observed two different patterns of movement that depended on wind strength. During 20 and 21 July, there were strong Trade Winds (i.e., with average wind speeds mostly 20–35 mi/h), and we observed a pattern of 5–7 outbound targets in the evening followed by lower numbers of outbound targets in the morning (Table 1; Figure 4). During the final three nights of sampling, the winds were light (i.e., with average wind speeds mostly 0–5 mi/h [i.e., below turbine cut-in speed, since the KWP I turbine blades were not spinning]) and we observed a pattern of 4–6 inbound targets in the evening and lower numbers of targets in the morning (Table 1; Figure 5). Further, there appeared to be a shift in the spatial distribution of birds during low wind conditions that was not seen during strong winds: during the low winds, the majority of the inbound targets flew over the lower half of the proposed turbine string, and all were heading in the general direction of breeding colonies on Haleakala—not West Maui Mountain.

EXPOSURE RATES

The exposure rate is calculated as the product of three variables: annual movement rate, horizontal-interaction probability, and vertical-interaction probability. As such, it is an estimate of the number of birds flying in the vicinity of the wind turbine/met tower (i.e., crossing the radar screen) that could fly in a horizontal location and at a low-enough altitude that they could interact with a tower/turbine. Based on our summer 2009 movement rate data, we estimate that ~1,607 Hawaiian Petrels and 882 Newell's Shearwaters pass over the 1.5-km-radius radar sampling area in an average year (including birds at all altitudes; Tables 2 and 3). To generate annual exposure rates of birds exposed to each turbine or met tower (e.g., birds/tower/yr), we then multiplied the annual movement rate by the horizontal-interaction probability and the vertical-interaction probability. By applying those proportions to our data (and

Table 2. Estimated average exposure rates and fatality rates of Hawaiian Petrels (HAPE) and Newell's Shearwaters (NESH) at GE 1.5se wind turbines at the proposed KWP II Down-road Alternative wind-energy site, Maui, Hawaii, based on radar data collected in July 2009. Values of particular importance are in boxes.

Variable/parameter	HAPE		NESH	
	Minimum	Maximum	Minimum	Maximum
MOVEMENT RATE (MVR)				
A) Mean movement rate (targets/h)				
A1) Mean rate during nightly peak movement periods in spring/summer based on July 2009 data (targets/h)	1.776	1.776	1.776	1.776
A2) Mean rate during nightly peak movement periods in fall based on July 2009 data (targets/h)	1.776	1.776	1.776	1.776
B) Number of hours of evening and morning peak-period sampling	5	5	5	5
C) Mean number of targets during evening and morning peak-movement periods				
C1) Spring/summer (A1 * B)	8.88	8.88	8.88	8.88
C2) Fall (A2 * B)	8.88	8.88	8.88	8.88
D) Mean proportion of birds moving during off-peak h of night	0.126	0.126	0.126	0.126
E) Seasonal movement rate (targets/night) = ([C * D] + C)				
e1) Spring/summer	10.0	10.0	10.0	10.0
e2) Fall	10.0	10.0	10.0	10.0
F) Mean number of birds/target	1.05	1.05	1.05	1.05
G) Estimated proportion of each species	0.60	0.60	0.40	0.40
H) Daily movement rate (birds/day; = E * F * G)				
H1) Spring/summer	6.30	6.30	4.20	4.20
H2) Fall	6.30	6.30	4.20	4.20
I) Fatality domain (days/year)				
I1) Spring/summer	180	180	150	150
I2) Fall	75	75	60	60
J) Annual movement rate (birds/year; = ([H1 * I1] + [H2 * I2]), rounded to next whole number)	1,607	1,607	882	882
HORIZONTAL INTERACTION PROBABILITY (IPH)				
K) Turbine height (m)	100	100	100	100
L) Blade radius (m)	35.25	35.25	35.25	35.25
M) Height below blade (m)	29.5	29.5	29.5	29.5
N) Front-to-back width (m)	6	6	6	6
O) Minimal side profile area (m^2; = K * N)	600		600	
P) Maximal front profile area (m^2; = [M * N] + [π * L^2])		4,081		4,081
Q) Cross-sectional sampling area of radar at or below 100 m turbine height (= 3000 m * 100 m = 300,000 m^2)	300,000	300,000	300,000	300,000
R) Minimal horizontal interaction probability (= O/Q)	0.00200000		0.00200000	
S) Maximal horizontal interaction probability (= P/Q)		0.01360211		0.01360211
VERTICAL INTERACTION PROBABILITY (IPV)				
T) Proportion of petrels flying ≤ turbine height)	0.51	0.51	0.51	0.51

Table 2. Continued.

Variable/parameter	HAPE Minimum	HAPE Maximum	NESH Minimum	NESH Maximum
EXPOSURE INDEX (ER = MVR * IPH * IPV)				
U) Daily exposure index (birds/turbine/day; = H * (R or S) * T; rounded to 8 decimal places)				
U1) Spring/summer	0.00642528	0.04369870	0.00428352	0.02913247
U2) Fall	0.00642528	0.04369870	0.00428352	0.02913247
V) Annual exposure index (birds/turbine/year; = J * (R or S) * T; rounded to 8 decimal places	1.63914000	11.14788498	0.89964000	6.11850314
FATALITY PROBABILITY (MP)				
W) Probability of striking turbine if in airspace on side approach	1.00	1.00	1.00	1.00
X) Probability of striking turbine if in airspace on frontal approach	0.20	0.20	0.20	0.20
Y) Probability of fatality if striking turbine[1]	1.00	1.00	1.00	1.00
Z1) Probability of fatality if an interaction on side approach (= W * Y)	1.00000		1.00000	
Z2) Probability of fatality if an interaction on frontal approach (= X * Y)		0.19500		0.19500
FATALITY INDEX (= ER * MP)				
Annual fatality rate with 90% exhibiting collision avoidance (birds/turbine/year; = V * (Z1 or Z2) * 0.1)	0.16391	0.21738	0.08996	0.11931
Annual fatality rate with 95% exhibiting collision avoidance (birds/turbine/year; = V * (Z1 or Z2) * 0.05)	0.08196	0.10869	0.04498	0.05966
Annual fatality rate with 99% exhibiting collision avoidance (birds/turbine/year; = V *(Z1 or Z2) * 0.01)	0.01639	0.02174	0.00900	0.01193

[1] Used 100% fatality probability due to ESA definition of "take"; however, actual probability of fatality with collision <100% (see methods).

rounding up to the nearest whole number), we estimate that 2–12 Hawaiian Petrels and 1–7 Newell's Shearwater fly within the space occupied by each wind turbine in an average year (Tables 2 and 4) and estimate that 1 Hawaiian Petrel and 1 Newell's Shearwater fly within the space occupied by the 65-m-high met tower in an average year (Tables 3 and 4). Note that all these calculations are exposure rates and, thus, include an unknown proportion of birds that would detect and avoid the turbines and met towers. Hence, exposure rates estimate how many times/year a petrel or shearwater would be exposed to wind turbines or met towers and not necessarily the number that actually would collide with those structures.

FATALITY MODELING

The individual steps and estimates involved in calculating fatality rates are shown in Table 2 (turbines) and Table 3 (met tower). We speculate that the proportions of birds that detect and avoid turbines and towers is substantial (see Discussion), but limited petrel- or shearwater-specific data are available to use for an estimate of the avoidance rates for those types of structures. Because it is necessary to estimate the fatality of petrels and shearwaters at the proposed project, however, we assumed that 90%, 95%, or 99% of all birds will be able to detect and avoid the towers and turbines. If we also assume that 100% of the birds colliding with a turbine/tower die (although see above), the ranges of annual fatalities are 0.016–0.217 Hawaiian Petrel/turbine/yr and 0.009–0.119 Newell's Shearwaters/turbine/year (Table 2). For the 65-m met tower, we estimate a fatality rate of 0.008–0.081 Hawaiian Petrel/tower/yr and 0.004–0.044 Newell's Shearwaters/tower/year (Table 3). For cumulative annual fatalities, the

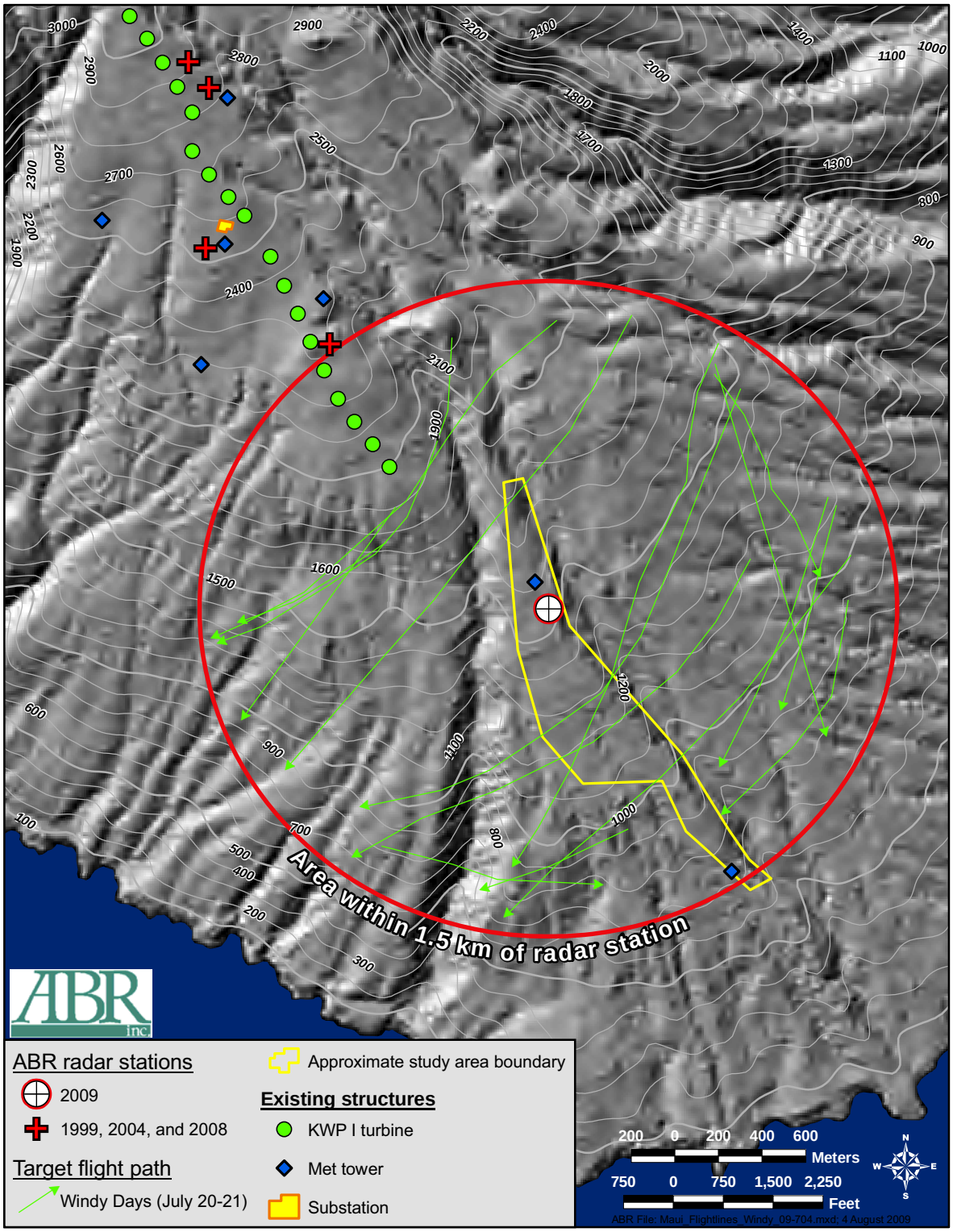


Figure 4. Location of flight paths of petrel-like radar targets observed during the strong wind conditions of 20–21 July 2009, at the KWP II Down-road Alternative wind energy facility, Maui, Hawaii.

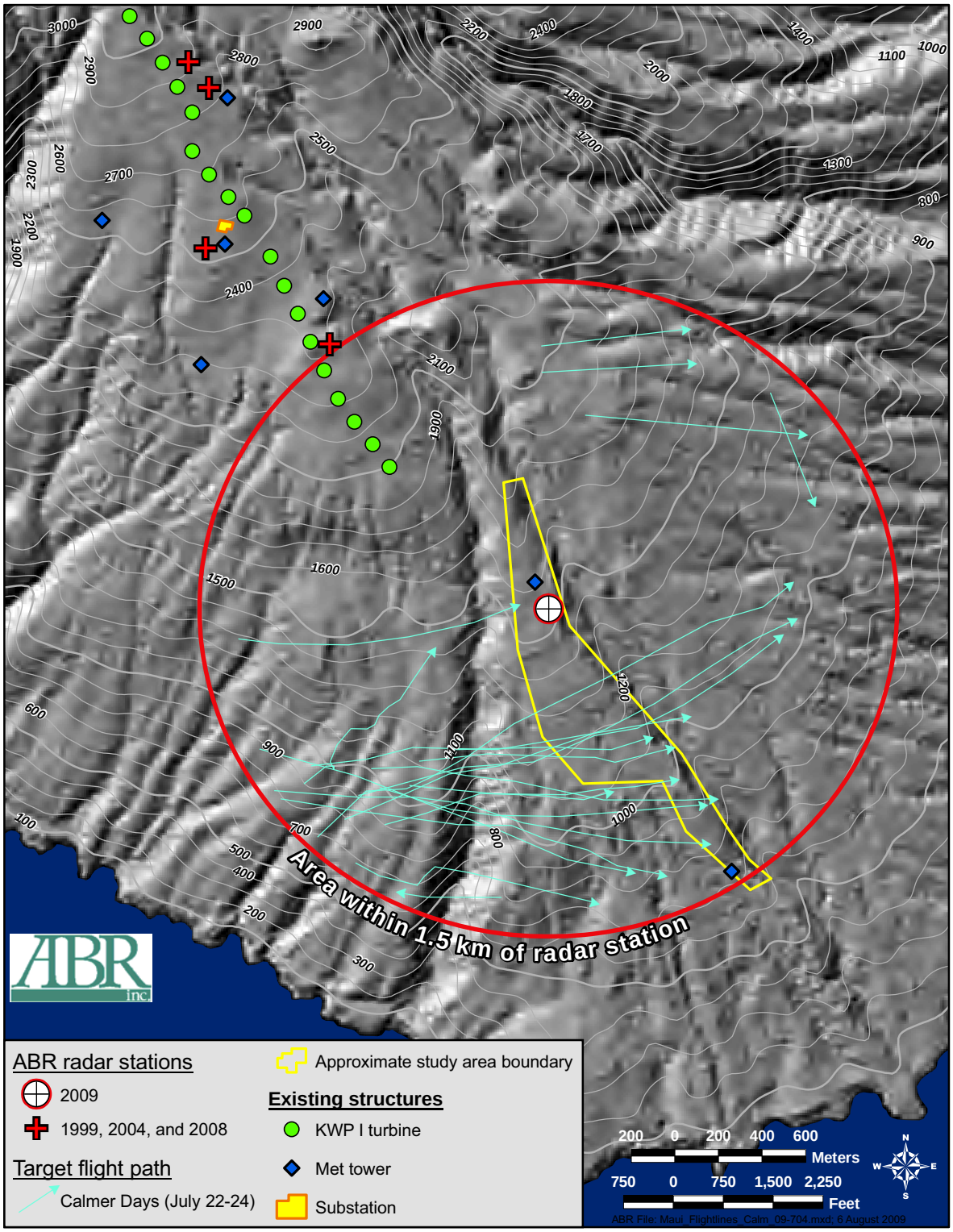


Figure 5. Location of flight paths of petrel-like radar targets observed during the light and variable wind conditions of 22–24 July 2009, at the KWP II Down-road Alternative wind energy facility, Maui, Hawaii.

Table 3. Estimated average exposure rates and fatality rates of Hawaiian Petrels (HAPE) and Newell's Shearwaters (NESH) at the proposed free-standing 65-m-tall met tower at the KWP II Down-road alternative wind-energy site, Maui, Hawaii, based on radar data collected in July 2009. Values of particular importance are in boxes.

Variable/parameter	HAPE	NESH
MOVEMENT RATE (MVR)		
A) Mean movement rate (targets/h)		
A1) Mean rate during nightly peak movement periods in spring/summer based on July 2009 data (targets/h)	1.776	1.776
A2) Mean rate during nightly peak movement periods in fall based on July 2009 data (targets/h)	1.776	1.776
B) Number of hours of evening and morning peak-period sampling	5	5
C) Mean number of targets during evening and morning peak-movement periods		
C1) Spring/summer (A1 * B)	8.88	8.88
C2) Fall (A2 * B)	8.88	8.88
D) Mean proportion of birds moving during off-peak h of night	0.126	0.126
E) Seasonal movement rate (targets/night) = ((C * D)+ C)		
e1) Spring/summer	10.0	10.0
e2) Fall	10.0	10.0
F) Mean number of birds/target	1.05	1.05
G) Estimated proportion of each species	0.60	0.40
H) Daily movement rate (birds/day =E*F*G)		
h1) Spring/summer	6.30	4.20
h2) Fall	6.30	4.20
I) Fatality domain (days/year)		
i1) Spring/summer	180	150
i2) Fall	75	60
J) Annual movement rate (birds/year; = ((H1*I1) + (H2*I2)), rounded to next whole number)	1,607	882
HORIZONTAL INTERACTION PROBABILITY (IPH)		
K) Maximal cross-sectional area of tower (side view =297 m²)	297.0	297.0
L) Cross-sectional sampling area of radar at or below 50 m tower height (= 3000 m * 65 m = 195,000 m²)	195000.000	195000.000
M) Average probability of radar target intersecting the met tower (= K/L, rounded to 8 decimal places)	0.00152308	0.00152308
VERTICAL INTERACTION PROBABILITY (IPV)		
N) Proportion of petrels flying ≤ tower height)	0.33	0.33
EXPOSURE INDEX (ER = MVR*IPH*IPV)		
O) Daily exposure index (birds/tower/day = H*M*N, rounded to 8 decimal places)		
O1) Spring/summer	0.00316612	0.00211075
O2) Fall	0.00316612	0.00211075
P) Annual exposure index (birds/tower/year = J*M*N, rounded to 8 decimal places)	0.80770292	0.44330677
FATALITY PROBABILITY (MP)		
Q) Probability of striking tower if in airspace	1.00	1.00
R) Probability of fatality if striking tower[1]	1.00	1.00
S) Probability of fatality if an interaction (= Q*R)	1.00000	1.00000
FATALITY INDEX (= ER*MP)		
T) Annual fatality rate with 90% exhibiting collision avoidance (birds/tower/year = P*S*0.1)	0.08077	0.04433
U) Annual fatality rate with 95% exhibiting collision avoidance (birds/tower/year = P*S*0.05)	0.04039	0.02217
V) Annual fatality rate with 99% exhibiting collision avoidance (birds/tower/year = P*S*0.01)	0.00808	0.00443

[1] Used 100% fatality probability due to ESA definition of "take", however actual probability of fatality with collision <100% (see methods).

annual fatality rate would be 0.229–3.043 Hawaiian Petrels/yr and 0.126–1.670 Newell's Shearwaters/yr for all 14 proposed wind turbines combined (Table 4). The cumulative annual fatalities at the one proposed met tower would be 0.008–0.081 Hawaiian Petrels/yr and 0.004–0.044 Newell's Shearwaters/yr (Table 4). We caution again, however, that the range of assumed avoidance rates of seabirds and turbines/towers (90–99%) is not fully supported by empirical data at this time.

DISCUSSION

MOVEMENT RATES AND FLIGHT BEHAVIOR

Within KWP, there has been some variation in mean movement rates among years and studies (Table 5), but all estimated rates have been low (i.e., between 0.5 and 1.8 targets/h). Thus, mean movement rates of Hawaiian Petrels recorded in the KWP study areas (i.e., ~1–2 targets/h; this study; Day and Cooper 1999, Cooper and Day 2004; Sanzenbacher and Cooper 2008, 2009) are much lower than those over the eastern and northern sides of Maui (Cooper and Day 2003).

Our limited data (i.e., five sampling nights) from the current study suggest that patterns of movement may have been affected by the wind regime. We found that shearwater/petrels mostly flew in an outbound movement towards the southwest during strong Trade Winds and flew inbound toward the east during light and variable winds (i.e., at wind speeds that apparently were below the cut-in speed of the KWP I turbines that were not spinning at the time). Our limited data also suggested that the passage rates might be higher over the lower (southern) end of the study area than elsewhere during calm conditions, though, again note that we only had two nights of sampling during strong winds and three nights during light winds. The flight directions of the targets observed during light winds suggest that they were birds approaching Maui from the west and "cutting the corner" of West Maui on their way to breeding colonies on Haleakala.

VISUAL OBSERVATIONS OF PETRELS AND SHEARWATERS

In total, we have had three visual observations of Hawaiian Petrels and two observations of unidentified shearwaters/petrels over the KWP study areas during 1999–2009 (Table 6; Day and Cooper 1999, Cooper and Day 2004a; Sanzenbacher and Cooper 2008, 2009; this study). The birds observed in the evening period were headed easterly or northeasterly, and the birds observed in the morning were heading southeasterly or southwesterly. These directions fit a pattern of inbound movements toward Haleakala in the evening and outbound movements from Haleakala and/or West Maui in the morning.

Flight altitudes of the two birds that we observed over the proposed turbine-string ridges were within turbine heights (i.e., one was at 40 m agl and the other was at 65 m agl; Table 6). The flight altitudes of the other three birds were much higher (i.e., 300–500 m agl), but they were measured over the valley to the east; hence, we not know what their flight altitudes were as they flew over the ridges on which the turbine strings lie. Thus, it is possible that visual altitude data is biased to detecting lower-flying birds, the very limited data that we have for known flight altitudes (n = 2) suggest that a substantial proportion of petrels may have flown within the turbine-height zone.

In our fatality models, we used the timing of inland flights at the nearby Ukumehame site from Cooper and Day (2003) to correct for proportions of targets that were Hawaiian Petrels and those that were Newell's Shearwaters; those data suggested that 60% of the targets were Hawaiian Petrels and 40% of the targets were Newell's Shearwaters. However, the timing of two of the three Hawaiian Petrels that we saw over the site (Table 6) occurred during the late evening, a period when Cooper and Day (2003) assumed that only Newell's Shearwaters would occur. Thus, these visual observations suggest the possibility that more than 60% of the radar targets we observed in the current study could have been Hawaiian Petrels. We do not recommend changing the relative proportions of Hawaiian Petrels vs. Newell's Shearwaters in the fatality model, however, unless further data are collected to confirm this pattern.

Table 4. Summary of exposure rates, fatality rates, and cumulative fatality rates for Hawaiian Petrels (HAPE) and Newell's Shearwaters (NESH) at wind turbines and meteorological (met) towers at the proposed KWP II Down-road Alternative wind-energy site, Maui, Hawaii, based on radar data collected in July 2009.

	Exposure rate/structure (birds/structure/yr)			Fatality rate/structure (birds/structure/yr)			Cumulative fatality rate (birds/yr)	
Structure type	HAPE	NESH	Avoidance rate	HAPE	NESH	No. structures	HAPE	NESH
GE 1.5 MW turbine	1.639 (min)	0.900 (min)	0.90 (min)	0.164	0.090	14.00	2.295	1.259
	11.148 (max)	6.119 (max)	0.90 (max)	0.217	0.119	14.00	3.043	1.670
			0.95 (min)	0.082	0.045	14.00	1.147	0.630
			0.95 (max)	0.109	0.060	14.00	1.522	0.835
			0.99 (min)	0.016	0.009	14.00	0.229	0.126
			0.99 (max)	0.022	0.012	14.00	0.304	0.167
65-m free-standing met tower	0.808	0.443	0.90	0.081	0.044	1.00	0.081	0.044
			0.95	0.040	0.022	1.00	0.040	0.022
			0.99	0.008	0.004	1.00	0.008	0.004

Table 5. Mean (± SE) movement rates of petrel-like targets measured with radar at the KWP wind-energy site and proposed KWP II wind-energy sites, Maui, Hawaii, during 1999–2009 studies.

		Movement rate (targets/h)		
Year	Site	Summer	Fall	Source
1999	KWP I	1.2 ± 0.3	–	Day and Cooper (1999)
2004	KWP I	–	1.0 ± 0.2	Cooper and Day (2004)
2008	KWP II	0.46 ± 0.15	0.09 ± 0.07	Sanzenbacher and Cooper (2008. 2009)
2009	KWP II Alternate	1.78 ± 0.14	–	current study

Table 6. Records of Hawaiian Petrels and unidentified shearwaters/petrels at the proposed KWP II wind-energy site and nearby KWP I wind-energy site, Maui, Hawaii, during 1999–2009 studies.

Date	Time	Species[1]	Number	Altitude (m agl)	Flight direction
28 May 1999	2150	HAPE	1	300[2]	NE
28 May 1999	0608	UNSP	2	500[2]	SE
12 October 2004	0608	HAPE	1	500[2]	SE
15 October 2004	0454	UNSP	1	65	SW
24 July 2009	2126	HAPE	1	40	E

[1] HAPE = Hawaiian Petrel; UNSP = unidentified shearwater/petrel.
[2] Flight altitude measured over the valley to east of the proposed turbine string ridge, not over the proposed turbine string ridge itself; measurements were done that way because that is where birds were first seen.

EXPOSURE RATES AND FATALITY ESTIMATES

We estimated that 2–12 Hawaiian Petrels and 1–7 Newell's Shearwater would fly within the space occupied by each wind turbine in an average year and estimated that 1 Hawaiian Petrel and 1 Newell's Shearwater would fly within the space occupied by the 65-m-high met tower in an average year (Table 4). We used these estimated exposure rates as a starting point for developing a complete avian risk assessment; however, we emphasize that it currently is unknown whether bird use (i.e., exposure) and fatality at windfarm structures are strongly correlated. For example, Cooper and Day (1998) found no relationship between movement rates and fatality rates of Hawaiian Petrels and Newell's Shearwaters at powerlines on Kaua'i, indicating that other factors had a much greater effect on causing fatality than movement rates did. For example, other factors such as proximity to the ocean or poor weather could be more highly correlated with fatality rates than is bird abundance. As an example, collisions of Laysan Albatross with a large array of communication-tower antenna wires and guy wires adjacent to large, high-density albatross breeding colonies on Midway Atoll occurred at a far higher rate during periods of high winds, rain, and poor visibility than during periods of better weather: 838 (>25%) of the 2,901 birds killed during the study were killed during two storms (Fisher 1966). To determine which factors are most relevant, future studies that collect concurrent data on movement rates, weather, and fatality rates would be useful to begin to determine whether movement rates and/or weather conditions can be used to predict the

likelihood of petrel fatalities at wind turbines and other structures across the entire proposed windfarm.

In addition, few data are available on the proportion of petrels and shearwaters that do not collide with wind turbines or met towers because of collision-avoidance behavior (i.e., birds that completely alter their flight paths horizontally and/or vertically to avoid flying through the space occupied by a turbine/tower). Clearly, the detection of wind turbines or other structures could result in collision-avoidance behavior by these birds and reduce the likelihood of collision. There also appear to be differences between petrels and shearwaters in their ability to avoid obstacles. For example, Cooper and Day (1998) indicated that Hawaiian Petrels have flight characteristics that make them more adept at avoiding powerlines than Newell's Shearwaters, suggesting that Hawaiian Petrels might also be more likely to avoid collisions with other structures such as wind turbines. These authors also suggested that the tendency for Hawaiian Petrels to approach and leave nesting colonies primarily during crepuscular periods enables these birds to see and avoid structures (e.g., wind turbines) more easily than do Newell's Shearwaters that approach and leave nesting colonies primarily during nocturnal periods.

Some collision-avoidance information is available on petrels and shearwaters from earlier work that we conducted on Kaua'i (Cooper and Day 1998; Day et al., *In review*). In summary, those data suggest that the behavioral-avoidance rate of Hawaiian Petrels and Newell's Shearwaters near powerlines is high. For example, across all 207 Hawaiian Petrels observed flying within 150 m of transmission lines on Kauai, 40 exhibited behavioral responses; of those 40 birds that exhibited collision-avoidance responses, none (0%) collided with a transmission line. Thus, the collision-avoidance rate for Hawaiian Petrels was 100% (i.e., 40 of 40 interactions). Across all 392 Newell's Shearwaters observed flying within 150 m of transmission lines, 29 exhibited behavioral responses; of those 29 birds that exhibited collision-avoidance responses, none (0%) collided with a transmission line. However, one Newell's Shearwater that did not exhibit a collision-avoidance response hit a transmission line. Thus, the collision-avoidance rate for Newell's Shearwaters was 97% (i.e., 29 of 30 interactions).

There also is some information available on collision-avoidance of Hawaiian Petrels on Lana'i, where the behavior of petrels was studied as they approached large communication towers near the breeding colony (TetraTech 2008; Day et al., *In review*). In that study, all 20 (100%) of the Hawaiian Petrels seen on a collision-course toward communication towers exhibited avoidance behavior and avoided collision.

Additional data that provides some insight on collision-avoidance behavior of petrels and shearwaters at windfarm structures (e.g., wind turbines and met towers) are available from other studies associated with the operational KWP I wind facility. There was 1 Hawaiian Petrel fatality and 0 Newell's Shearwater fatalities observed at the 20-turbines and three met towers in the first 3.5 years of operation (G. Spencer, FirstWind, pers. comm.). Calculations using data for scavenging bias and searcher efficiency collected at the KWP I wind facility indicate that the one observed fatality equates to a corrected direct take of 0.5 Hawaiian Petrels/yr and 0 Newell's Shearwaters/yr (Kaheawa Wind Power LLC 2009, *in prep*). Cooper and Day (2004b) modeled seabird fatality for the KWP I wind turbines, based on movement rates from radar studies at the site (Day and Cooper 1999; Cooper and Day 2004a, 2004b), and estimated that the combined annual fatality of Hawaiian Petrels and Newell's Shearwaters at the KWP I turbines would be ~3–18 birds/yr with a 50% avoidance rate, ~1–2 birds/yr with a 95% avoidance rate, and <1 bird/yr with a 99% avoidance rate. Thus, the fatality model that used a 99% avoidance value was a closer fit with the measured fatality rates than was the fatality models that used a 50% or 95% avoidance rate.

In summary, currently available data from Kaua'i, Lana'i, and Maui suggest that the avoidance rate of petrels and shearwaters at transmission lines and communications towers is high and approaches 100% (Day et al., *in review*). Data from the fatality searches at turbines and met towers on Maui are more difficult to interpret because they suggest high avoidance but are not a direct measure of avoidance; however those data also suggest that avoidance of those structures must be occurring because only one Hawaiian

Petrel has been found during regular fatality searches of those structures over a 3.5-year period. Thus, the overall body of evidence, while incomplete, is consistent with the hypothesis that the average avoidance rate of wind turbines and met towers is substantial and potentially is ≥95%. The ability of Hawaiian Petrels and Newell's Shearwater to detect and avoid most objects under low-light conditions makes sense from a life-history standpoint, in that they forage extensively at night and are adept at flying through forests near their nests during low light conditions.

In addition to the limited data available for Hawaiian Petrels and Newell's Shearwaters, there is evidence that many other species of birds detect and avoid structures (e.g., wind turbines, met towers) during low-light conditions (Winkelman 1995, Dirksen et al. 1998, Desholm and Kahlert 2005, Desholm et al. 2006). For example, seaducks in Europe have been found to detect and avoid wind turbines >95% of the time (Desholm 2006). Further, natural anti-collision behavior (especially alteration of flight directions) is seen in migrating Common and King eiders (*Somateria mollissima* and *S. fischeri*) approaching human-made structures in the Beaufort Sea off of Alaska (Day et al. 2005) and in diving ducks approaching offshore windfarms in Europe (Dirksen et al. 1998). Collision-avoidance rates around wind turbines are high for Common Eiders in the daytime (Desholm and Kahlert 2005), gulls (*Larus* spp.) in the daytime (>99%; Painter et al. 1999, cited in Chamberlain et al. 2006), Golden Eagles (*Aquila chrysaetos*) in the daytime (>99%; Madders 2004, cited in Chamberlain et al. 2006), American Kestrels (*Falco sparverius*) in the daytime (87%, Whitfield and Band [in prep.], cited in Chamberlain et al. 2005), and passerines during both the day and night (>99%; Winkelman 1992, cited in Chamberlain et al. 2006).

We agree with others (Chamberlain et al. 2006, Fox et al. 2006) that species-specific, weather-specific, and site-specific avoidance data are needed in models to estimate fatality rates accurately. However, the currently available avoidance data from Kaua'i and Lana'i for Hawaiian Petrels and Newell's Shearwaters and the petrel fatality data at KWP I wind turbines and met towers while incomplete, is consistent with the notion that a substantial proportion of petrels detect and avoid wind turbines, marked met towers, communication towers, and powerlines under normal ranges of weather conditions and visibility (but note that avoidance rates could be lower under inclement conditions). Until further petrel- and shearwater-specific data on the relationship between exposure and fatality rates are available for structures at windfarms, we continue to provide a range of assumptions for avoidance rates in our fatality models (i.e., 90%, 95%, and 99% avoidance), along with a discussion of the body of evidence that, while incomplete at this time, is consistent with the notion that the average avoidance-rate value is substantial and potentially is ≥95%. With an assumption of a 95% avoidance rate, the estimated average annual take at the KWP II Downroad Alternative would be ≤0.1 Hawaiian Petrel/turbine/yr and ≤0.06 Newell's Shearwaters/ turbine/yr and, for met towers, fatality would be 0.04 Hawaiian Petrel/tower/yr and 0.02 Newell's Shearwaters/tower/yr.

Other factors could affect our estimates of fatality in either a positive or a negative direction. One factor that would have created a positive bias was the inclusion of targets that were not petrels or shearwaters. Our visual observations of several other species with similar target characteristics to petrels (especially during crepuscular periods, when we could use binoculars) helped to minimize the inclusion of these non-target species, but it is possible (especially during nocturnal conditions) that some of our radar targets were other fast-flying species that were active during the sampling period (e.g., Pacific Golden-Plover [*Pluvialis fulva*]). A second positive bias in our fatality model is our simplistic assumption that movement rates of seabirds do not fall as individual fatalities occurred (i.e., we assumed sampling with replacement for fatalities). Given the low movement rates observed in this study, it is likely that the fatality of just a single bird would substantially reduce the average nightly movement rates. A third positive bias is the assumption that turbines are operating at maximal rotor speed; this assumption clearly is incorrect because of variability in winds, but using it results in maximal estimates of collision rates for birds flying through the turbine rotors.

There also are factors that could create a negative bias in our fatality estimates. One example would be if targets were missed because

they flew within radar shadows. Because the sampling stations provided good coverage of the surrounding area, we believe that the proportion of targets that was missed because they passed through the entire area of coverage of the study area within a radar shadow was minimal.

A factor that could affect the predictive value of our fatality estimates in either direction is interannual variation in the number of birds visiting nesting colonies on Maui. Average hourly movement rates for the current study (= ~1.8 targets/h), from 2004 (summer = ~0.5 targets/h; fall = ~0.1 targets/h; Sanzenbacher and Cooper 2008, 2009), from summer 1999 (1.2 targets/h; Day and Cooper 1999), and from fall 2004 (1.0 targets/h; Cooper and Day 2004a) all suggest that rates are consistently low at the KWP project areas relative to other areas on Mauai, and that interannual variation in that overall level of bird use of the area is minimal. Some caution in extrapolation of movement rates across years is still warranted, however, because there are examples of other sites with high interannual variation in counts, such as the three sites on Kaua'i where counts were ~100–300 birds/hr lower (~four times lower) in fall 1992 than in fall 1993; the lower counts in 1992 were attributed to the effects of Hurricane Iniki (Day and Cooper 1995). Oceanographic factors (e.g., El Niño–Southern Oscillation events) also vary among years and are known to affect the distribution, abundance, and reproduction of seabirds (e.g., Ainley et al. 1994, Oedekoven et al. 2001). Another factor that could cause interannual variation in counts in either direction is overall population increases or declines. For example, there was a ~60% decline in radar counts on Kaua'i between 1993 and 1999–2001 that was attributed to population declines of Newell's Shearwaters (Day et al. 2003b).

CONCLUSIONS

We used our risk-assessment model to estimate the number of Hawaiian Petrels and Newell's Shearwaters that might be killed by collisions with wind turbines and met towers at the proposed KWP II Down-road Alternative facility. The model is affected by several input variables, including the collision-avoidance rate. The absence behavioral studies to fully quantify avoidance rates at wind turbines and met towers precludes determination of actual avoidance rates; however, a growing body of evidence suggests that a high percentage of petrels and shearwaters detect and avoid structures such as communication towers, transmission lines, and wind turbines (see above). We also suspect high rates of anti-collision behaviors because petrels must rely upon acute nocturnal vision for foraging and other flight activities under varying weather conditions. In conclusion, we believe that the proportion of petrels that would see and avoid proposed wind turbines at the KWP II Down-road Alternative will be high, but until studies are conducted to quantify avoidance behavior at wind turbines and met towers, we provide a range of assumptions for avoidance rates in our fatality models (i.e., 90%, 95%, and 99% avoidance rates) along with a discussion of the body of evidence that is consistent with the hypothesis that the average avoidance-rate value is substantial and potentially ≥95%. With an assumption of 95% avoidance, the estimated average annual take at the proposed KWP II Down-road Alternative wind turbines would be ≤0.1 Hawaiian Petrel/turbine/yr and ≤0.06 Newell's Shearwaters/turbine/yr. The estimated average annual take at the proposed KWP II Down-road Alternative met tower (with an assumption of 95% avoidance) would be 0.04 Hawaiian Petrel/tower/yr and 0.02 Newell's Shearwaters/tower/yr.

LITERATURE CITED

Ainley, D. G., R. Podolsky, L. DeForest, and G. Spencer. 1997a. New insights into the status of the Hawaiian Petrel on Kauai. Colonial Waterbirds 20: 24–30.

Ainley, D. G., R. Podolsky, L. DeForest, G. Spencer, and N. Nur. 1995. Kauai Endangered Seabird Study, Vol. 2: The ecology of Dark-rumped Petrels and Newell's Shearwaters on Kauai, Hawaii. Electric Power Research Institute, Palo Alto, CA. Final Report No. TR-105847-V2. 74 pp.

Ainley, D. G., W. J. Sydeman, S. A. Hatch, and U. W. Wilson. 1994. Seabird population trends along the west coast of North America: causes and extent of regional concordance. Studies in Avian Biology 15: 119–133.

Ainley, D. G., T. C. Telfer, and M. H. Reynolds. 1997b. Townsend's and Newell's Shearwater (*Puffinus auricularis*). *In* A. Poole and F. Gill, eds. The birds of North America, No. 297. Academy of Natural Sciences, Philadelphia, PA, and American Ornithologists' Union, Washington, DC. 20 pp.

American Ornithologists' Union. 1998. Check-list of North American birds. 7th ed. American Ornithologists' Union, Washington, DC. 829 pp.

Banko, W. E. 1980a. Part I. Population histories—species accounts. Sea birds: Hawaiian Dark-rumped Petrel ('Ua'u). Cooperative National Park Resources Studies Unit, University of Hawaii at Manoa, Honolulu, HI. CPSU/UH Avian History Report 5B: History of Endemic Hawaiian Birds. 42 pp.

Banko, W. E. 1980b. Part I. Population histories—species accounts. Sea birds: Newell Shearwater ('A'o). Cooperative National Park Resources Studies Unit, University of Hawaii at Manoa, Honolulu, HI. CPSU/UH Avian History Report 5B: History of Endemic Hawaiian Birds. 35 pp.

Brandt, C. A., J. K. Parrish, and C. N. Hodges. 1995. Predictive approaches to habitat quantification: Dark-rumped Petrels on Haleakala, Maui. Auk 112: 571–579.

Chamberlain, D. E., S. Freeman, M. R. Rehfisch, A. D. Fox, and M. Desholm. 2005. Appraisal of Scottish Natural Heritage's wind farm collision risk model and its application. British Trust for Ornithology, Norfolk, United Kingdom. Report No. 401. 51 pp.

Chamberlain, D. E., M. R. Rehfisch, A. D. Fox, M. Desholm, and S. J. Anthony. 2006. The effect of avoidance rates on bird mortality predictions made by wind turbine collision risk models. Ibis 148: 198–202.

Conant, S. 1980. Recent records of the 'Ua'u (Dark-rumped Petrel) and the 'A'o (Newell's Shearwater) in Hawaii. 'Elepaio 41: 11–13.

Cooper, B. A., and R. H. Day. 1995. Kauai Endangered Seabird Study, Vol. 1: Interactions of Dark-rumped Petrels and Newell's Shearwaters with utility structures on Kauai, Hawaii. Electric Power Research Institute, Palo Alto, CA. Final Report No. TR-105847-V1. 170 pp.

Cooper, B. A., and R. H. Day. 1998. Summer behavior and mortality of Dark-rumped Petrels and Newell's Shearwaters at power lines on Kauai. Colonial Waterbirds 21: 11–19.

Cooper, B. A., and R. H. Day. 2003. Movement of Hawaiian Petrels to inland breeding sites on Maui Island, Hawaii. Waterbirds 26: 62–71.

Cooper, B. A., and R. H. Day. 2004a. Results of endangered bird and bat surveys at the proposed Kaheawa Pastures Wind Energy Facility, Maui Island, Hawaii, fall 2004. Unpublished report prepared for Kaheawa Windpower LLC, Makawao, HI, and UPC Wind Management LLC, Newton, MA, by ABR, Inc., Forest Grove, OR, and Fairbanks, AK. 16 pp.

Cooper, B. A., and R. H. Day. 2004b. Modeling annual seabird use and fatality at the proposed Kaheawa Pastures Wind Energy Facility, Maui Island, Hawaii, fall 2004. Unpublished report prepared for Kaheawa Windpower LLC, Makawao, HI, and UPC Wind Management LLC, Newton, MA, by ABR, Inc., Forest Grove, OR, and Fairbanks, AK. 7 pp.

Cooper, B. A., R. H. Day, R. J. Ritchie, and C. L. Cranor. 1991. An improved marine radar system for studies of bird migration. Journal of Field Ornithology 62: 367–377.

Day, R. H., and B. A. Cooper. 1995. Patterns of movement of Dark-rumped Petrels and Newell's Shearwaters on Kauai. Condor 97: 1011–1027.

Day, R. H., and B. A. Cooper. 1999. Results of endangered bird and bat surveys at the proposed Kaheawa Pastures Windfarm on Maui Island, Hawaii, summer 1999. Unpublished report prepared for Zond Pacific, Wailuku, HI, by ABR, Inc., Fairbanks, AK, and Forest Grove, OR. 26 pp.

Day, R. H., and B. A. Cooper. 2002. Petrel and shearwater surveys near Kalaupapa, Molokai Island, June 2002. Unpublished report prepared for National Park Service, Hawaii National Park, HI, by ABR, Inc.—Environmental Research & Services, Fairbanks, AK, and Forest Grove, OR. 17 pp.

Day, R. H., B. A. Cooper, and R. J. Blaha. 2003a. Movement patterns of Hawaiian Petrels and Newell's Shearwaters on the island of Hawai'i. Pacific Science 57: 147–159.

Day, R. H., B. A. Cooper, T. J. Mabee, J. H. Plissner, P. M. Sanzenbacher, and A. Oller. In review. Collision-avoidance behavior of Hawaiian Petrels and Newell's Shearwaters in the Hawaiian Islands. Waterbirds.

Day, R. H., B. A. Cooper, and T. C. Telfer. 2003b. Decline of Newell's Shearwaters on Kauai, Hawaii. Auk 120: 669–679.

Day, R. H., A. K. Prichard, and J. R. Rose. 2005. Migration and collision avoidance of eiders and other birds at Northstar Island, Alaska, 2001–2004. Unpublished final report prepared for BP Exploration (Alaska), Inc., Anchorage, AK, by ABR, Inc.—Environmental Research and Services, Fairbanks, AK. 142 pp.

Desholm, M. 2006. Wind farm related mortality among avian migrants. Ph.D. thesis, University of Copenhagen, Copenhagen, Denmark. 128 pp.

Desholm, M., A. D. Fox, P. D. L. Beasley, and J. Kahlert. 2006. Remote techniques for counting and estimating the number of bird-wind turbine collisions at sea: a review. Ibis: 148: 76–89.

Desholm, M. and J. Kahlert. 2005. Avian collision risk at an offshore windfarm. Biology Letters 1: 296–298.

Dirksen, S. E., A. L. Spaans, and J. Winden. 1998. Nocturnal collision risks with wind turbines in tidal and semi-offshore areas. Pp. 99–108 *In* Proceedings of International Workshop on Wind Energy and Landscape, Genua, 26–27 July 1997. Balkema, Rotterdam, The Netherlands.

First Wind. 2008. Kaheawa Pastures wind energy generation facility Habitat Conservation Plan: Year 2 HCP Implementation, July 2007–June 2008. Unpublished report prepared by First Wind, Newton, MA and Kaheawa Wind Power, Wailuku, HI. 26 pp. + appendices.

Fisher, H. I. 1966. Midway's deadly antennas. Audubon Magazine, July–August 1966. Pp. 220–223.

Fox, A. D., M. Desholm, J. Kahlert, T. K. Christensen, and I. K. Petersen. 2006. Information needs to support environmental impact assessment of the effects of European marine offshore wind farms on birds. Ibis 148: 129–144.

Gon, S. M., III. 1988. Observations of the 'Ua'u (Hawaiian Petrel) in the Hono O Pali Natural Area Reserve, Island of Kauai. 'Elepaio 48: 113.

Hirai, L. T. 1978a. Native birds of Lanai, Hawaii. Western Birds 9: 71–77.

Hirai, L. T. 1978b. Possible Dark-rumped Petrel colony on Lanai, Hawaii. 'Elepaio 38: 71–72.

Hodges, C. S. N. 1992. 'Ua'u observation at proposed site for antenna farm. Unpublished memorandum by Haleakala National Park, Makawao, HI, 2 pp.

Hu, D., C. Glidden, J. S. Lippert, L. Schnell, J. S. MacIvor, and J. Meisler. 2001. Habitat use and limiting factors in a population of Hawaiian Dark-rumped Petrels on Mauna Loa, Hawai'i. *In* J. M. Scott, S. Conant, and C. van Riper III, eds. Evolution, ecology, conservation, and management of Hawaiian birds: a vanishing avifauna. Studies in Avian Biology 22: 234–242.

Kaheawa Wind Power LLC. 2006. Kaheawa Pastures Wind Generation Facility Habitat Conservation Plan. Kaheawa Wind Power, LLC, Ukumehame, Maui, HI. 87 pp. + attachments.

Kaheawa Wind Power, LLC. 2009 (*in prep*). Kaheawa Pastures Wind Energy Generation Facility, Habitat Conservation Plan: Year 3 Annual Report. First Wind Energy, LLC, Environmental Affairs, Newton, MA.

Mabee, T. J., J. H. Plissner, B. A. Cooper, and D. P. Young. 2006. Nocturnal bird migration over an Appalachian ridge at a proposed wind power project. Wildlife Society Bulletin 34: 682–690.

Nishibayashi, E. 1997. Downed wildlife surveys at six leeward West Maui monitoring towers. Unpublished report prepared for Zond Pacific, Wailuku, HI, by Eric Nishibayashi Biological Consulting, Kahului, HI. 10 pp.

Oedekoven, C. S., D. G. Ainley, and L. B. Spear. 2001. Variable responses of seabirds to change in marine climate: California Current, 1985–1994. Marine Ecology Progress Series 212: 265–281.

Podolsky, R., D. G. Ainley, G. Spencer, L. DeForest, and N. Nur. 1998. Mortality of Newell's Shearwaters caused by collisions with urban structures on Kauai. Colonial Waterbirds 21: 20–34.

Pyle, R. L. 1983. Hawaiian Islands Region (1 June–31 July 1983). American Birds 37: 1028–1029.

Pratt, T. K. 1988. Recent observations, March–May 1988. 'Elepaio 48: 65–66.

Reynolds, M. H., B. A. Cooper, and R. H. Day. 1997. Radar study of seabirds and bats on windward Hawaii. Pacific Science 51: 97–106.

Reynolds, M. H., and G. L. Richotte. 1997. Evidence of Newell's Shearwater breeding in Puna District, Hawaii. Journal of Field Ornithology 68: 26–32.

Richardson, F., and D. H. Woodside. 1954. Rediscovery of the nesting of the Dark-rumped Petrel in the Hawaiian Islands. Condor 56: 323–327.

Sanzenbacher, P. M., and B. A. Cooper. 2008. Radar and visual studies of seabirds at the KWP I and KWP II wind energy facilities, Maui Island, Hawaii: use of 2008 data to model annual collision fatalities at meteorological towers. Unpublished report prepared for FirstWind, Newton, MA, by ABR, Inc.—Environmental Research & Services, Forest Grove, OR. 21 pp.

Sanzenbacher, P. M., and B. A. Cooper. 2009. Radar and visual studies of seabirds at the KWP II wind energy facility, Maui Island, Hawaii: use of 2008 data to model annual collision fatalities at proposed wind turbines. Unpublished report prepared for FirstWind, Newton, MA, by ABR, Inc.—Environmental Research & Services, Forest Grove, OR. 20 pp.

Serventy, D. L., V. Serventy, and J. Warham. 1971. The handbook of Australian seabirds. A. H. and A. W. Reed, Sydney, Australia. 254 pp.

Shallenberger, R. J. 1974. Field notes. 'Elepaio 35: 18–20.

Simons, T. R. 1984. A population model of the endangered Hawaiian Dark-rumped Petrel. Journal of Wildlife Management 48: 1065–1076.

Simons, T. R. 1985. Biology and behavior of the endangered Hawaiian Dark-rumped Petrel. Condor 87: 229–245.

Simons, T. R., and C. N. Hodges. 1998. Dark-rumped Petrel (*Pterodroma phaeopygia*). *In* A. Poole and F. Gill, eds. The birds of North America, No. 345. Academy of Natural Sciences, Philadelphia, PA, and American Ornithologists' Union, Washington, DC. 24 pp.

Sincock, J. L., and G. E. Swedberg. 1969. Rediscovery of the nesting grounds of Newell's Manx Shearwater (*Puffinus puffinus newelli*), with initial observations. Condor 71: 69–71.

SPSS. 2005. SPSS for Windows, version 14.0. SPSS, Inc., Chicago, IL.

Telfer, T. C., J. L. Sincock, G. V. Byrd, and J. R. Reed. 1987. Attraction of Hawaiian seabirds to lights: conservation efforts and effects of moon phase. Wildlife Society Bulletin 15: 406–413.

TetraTech EC. 2008. Draft Habitat Conservation Plan for the construction and operation of Lanai met towers, Lanai, Hawaii (Revised February 8, 2008, TTEC-PTLD-2008-080). Unpublished report prepared by Tetratech EC, Honolulu, HI, for Castle and Cooke LLC, Lanai City, HI. 52 pp. + appendices. Available at: http://www.state.hi.us/dlnr/dofaw/pubs/Lana'i_Met_Towers_HCP.pdf.

USFWS (U.S. Fish & Wildlife Service). 2008. Midway Atoll National Wildlife Refuge. USFWS refuge website. Available at: http://www.fws.gov/midway/.

Warham, J. 1990. The petrels: their ecology and breeding systems. Academic Press. New York, NY. 440 pp.

Winkelman, J. E. 1995. Bird/wind turbine investigations in Europe. Pages 43–47 and 110–140 *in* LGL Ltd., ed. Proceedings of National Avian–Wind Power Planning Meeting I, Denver, CO. Available at: http://www.nationalwind.org/publications/wildlife/avian94/default.htm.