TTEC-PTLD 2008-220

Final 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

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Prepared for: U.S. Fish and Wildlife Service
ATTN: Bill Standley
Pacific Islands Fish and Wildlife Office
300 Ala Moana Blvd., Room 3-122
Honolulu, Hawaii 96850
(808) 792-9423

Location: Lanai, Maui County, Hawaii

Applicant/Address: ***Castle & Cooke Resorts, LLC***
P.O. Box 630310
1311 Fraser Avenue
Lanai City, Hawaii 96763
(808) 565-3820

Prepared by: Tetra Tech EC, Inc.
1750 SW Harbor Way, Suite 400
Portland, OR 97201
(503) 221-8636

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List of Acronyms and Abbreviations

AMSL	Above mean sea level
APE	Area of potential effect
BLNR	Board of Land and Natural Resources
Castle & Cooke	Castle & Cooke Resorts, LLC
CDUP	Conservation District Use Permit
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
DLNR	Hawaii Department of Land and Natural Resources
DOFAW	Hawaii Department of Forestry and Wildlife
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FR	Federal Register
HAR	Hawaii Administrative Rules
HCP	Habitat Conservation Plan
HRS	Hawaii Revised Statutes
ITL	Incidental take license
ITP	Incidental take permit
LCA	Land Claim Award
LUC	Land Use Commission
MBTA	Migratory Bird Treaty Act
MISC	Maui Invasive Species Committee
NCSS	National Cooperative Soil Survey
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NRCS	Natural Resource Conservation Service
PM10	Particles of 10 micrometers or less in diameter
PM2.5	Particles of 2.5 micrometers or less in diameter
PVC	Polyvinyl chloride
SHPD	State Historic Preservation Division

List of Acronyms and Abbreviations (continued)

SMA	Special Management Area
Tetra Tech	Tetra Tech EC, Inc.
TNC	The Nature Conservancy
U.S.C.	United States Code
USDA	United States Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WRA	Wind Resource Area
WWTP	Wastewater treatment plant

Lanai Meteorological Towers Project

1.0 Purpose and Need for the Proposed Action

This Environmental Assessment (EA) for the Lanai Meteorological Towers Project evaluates potential impacts to the environment as a result of the Proposed Action: a decision regarding issuance of an incidental take permit (ITP) by the U.S. Fish and Wildlife Service (USFWS) under section 10(a)(1)(B) of the Endangered Species Act (ESA) of 1973 as amended. This permit would allow for incidental take of listed wildlife species that have the potential to be injured or killed as a result of collision with one of seven meteorological (met) towers within the project area on Lanai, Hawaii. Six met towers have been erected and are in operation and the seventh met tower is not yet installed. The applicant, Castle & Cooke Resorts, LLC (Castle & Cooke), has submitted a Habitat Conservation Plan (HCP) to the USFWS that identifies the potential take and compensating mitigation for the Hawaiian petrel (*Pterodroma sandwichensis*), Newell's shearwater (*Puffinus auricularis newelli*), Hawaiian stilt (*Himantopus mexicanus knudseni*), and Hawaiian hoary bat (*Lasiurus cinereus semotus*) as a result of operation of the seven met towers on land owned by an affiliate of the applicant, Castle & Cooke, Inc. (landowner), through March 1, 2010 (see **Figures 1-1 and 1-2**). The met towers will collect data on wind speeds and patterns throughout the northern portion of the island and assess the potential of the action area to provide wind energy in an economical fashion. This EA serves as a means for interdisciplinary review of the Proposed Action, identifies appropriate mitigation measures, and is a decision document to determine if an Environmental Impact Statement is necessary for this Proposed Action. Otherwise, a Finding of No Significant Impact would be issued.

The met towers are critical to making an informed decision on whether a wind energy facility is feasible on Lanai. Hawaii established a renewable portfolio standard (Hawaii Revised Statutes [HRS], Chapters 269-91 through 269-95) so that the electric utilities are to provide 10 percent of their electricity from renewable sources by the year 2010, 15 percent by 2015, and 20 percent by 2020. It is anticipated that the addition of renewable energy would reduce the need for imported fossil fuels and would result in dependable electricity which would benefit the public. Wind energy is among the most cost-competitive renewable resources, but limited land is available on the Hawaiian Islands for this use. With a steadily increasing demand for power, Hawaii currently uses fossil fuels for 90 percent of its electric generation, which results in very high electricity prices.

1.1 Relationship to Statutes, Regulations, or Other Plans and Policies

This document has been prepared in accordance with the National Environmental Protection Act (NEPA) (42 United States Code [U.S.C.], §4321 *et seq*.); Council on Environmental Quality (CEQ) regulations, as amended (40 Code of Federal Regulations [CFR] §1500 *et seq*.); section 10(a)(1)(B) of the ESA as amended, and the conditions imposed by Hawaii Department of Land and Natural Resources (DLNR) in approving the Conservation District Use Permit (CDUP). Castle & Cooke is required to comply with the USFWS ITP requirements, including preparation of a HCP in accordance with the ESA. An incidental take license (ITL) must also be obtained from DLNR in accordance with Chapter 195-D of the HRS.

No additional federal permits or approvals were required for erection of the met towers since no other potential impacts were identified associated with NEPA, the National Historic Preservation

Act (NHPA), the Clean Water Act, and the Migratory Bird Treaty Act (MBTA). However, a notice to construct was submitted to and reviewed by the Federal Aviation Administration (FAA) who found that the towers pose no hazard to air navigation.

At the state and local level, private land use in Hawaii is regulated by a dual system of state and county laws under a statewide zoning law. This State Land Use law (Chapter 205, HRS) establishes an overall framework of land use management whereby all lands in the State of Hawaii are classified into one of four districts: Conservation, Agricultural, Rural, and Urban. Except for land that is also in the Special Management Area (SMA), the Conservation District is solely under state jurisdiction, meaning that the county has no jurisdiction over any portion of the project within the State Conservation District. However, the county has jurisdiction over the remaining state land districts.

The Conservation District is further divided into four main subzones: Protective, Limited, Resource, and General. The Protective subzone contains the most land use restrictions, whereas the General subzone is the most permissive. A special subzone can accommodate unique projects.

A limited range of uses are authorized within the Conservation District, and most require a CDUP from the Board of Land and Natural Resources (BLNR), a seven-member board appointed by the governor. The BLNR can approve, through a CDUP, such things as highways, infrastructure for utilities, and resource-dependent power plants such as hydro or geothermal power. DLNR has administrative responsibility over the Conservation District.

A large portion of the proposed project area is located in the Limited subzone of the Conservation District land. Under this subzone, met towers can be approved with a CDUP. Under Hawaii Administrative Rules (HAR) §13-5-22 and §13-5-22, land in the Protective and Limited subzones requires a departmental permit for data collection (P-1) and a board permit for public purpose uses (P-6).

To comply with these regulations, Castle & Cooke applied to the DLNR for a CDUP to construct and operate the seven proposed met towers pursuant to HAR, Chapter 13-5. The DLNR issued CDUP No. LA-3419 on August 8, 2007, to conditionally approve installation of one met tower at site 6 and approved on a preliminary basis installation of the remaining six met towers. Met tower 6 was erected on August 28, 2007 and five met towers were erected between January and February 2008. Met tower number 7 has not yet been erected. Two of the permit conditions provided below and subsequent coordination with Hawaii Department of Forestry and Wildlife (DOFAW) and USFWS resulted in the decision that an EA and HCP were required for the construction and operation of the met towers to address potential impacts to listed wildlife species under section 10 of the ESA. The agencies further concluded that an ITP and ITL must be obtained. The pertinent CDUP conditions state:

"7. Should an impact with flying wildlife occur, the applicant shall remove the tower(s) until such time as the tower(s) are covered by an Incidental Take License and accompanying (amended) Habitat Conservation Plan;

8. Subsequent tower construction shall proceed only after review and approval by the Division of Forestry and Wildlife and the Office of Conservation and Coastal Lands, based on positive avian survey results and the successful actions of the applicant to mitigate potential avian impacts."

DLNR clarified Condition 7 in a letter dated September 27, 2007, that "flying wildlife" pertained only to listed wildlife species (**Appendix A**). An amendment of one of the CDUP conditions

states that the towers will be decommissioned if the ITL and ITP are not obtained, and no other amendment to the CDUP has been approved. The Proposed Action is consistent with other federal, state, and local laws, regulations, plans and programs to the maximum extent possible.

P:\GIS_2007_PROJECTS\CC_Lanai\maps\Met_Tower_HCP\Figure1-1_Vicinity_Map_021208.mxd

Kaneohe Bay
Kailua
Honolulu
Pearl Harbor
Kaiwi Channel
Kalaupapa Natl Hist Park
Kalohi Channel
Pailolo Channel
Auau Channel
Kahului Bay
Kahului
Haleakala Natl Park
Lanai City
Kealaikahiki Channel
Alenuihaha Channel
Kawaihae Bay
Kailua
Hawaii Volcanoes
Manuka State Park
Pacific Ocean

TETRA TECH EC, INC.

Figure 1-1. Vicinity Map

Castle and Cooke Lana'i Meteorological Towers Project
Maui County, Hawaii

- Project Boundary
- Cities
- Rivers/Streams
- Interstate
- Highway
- Major Road

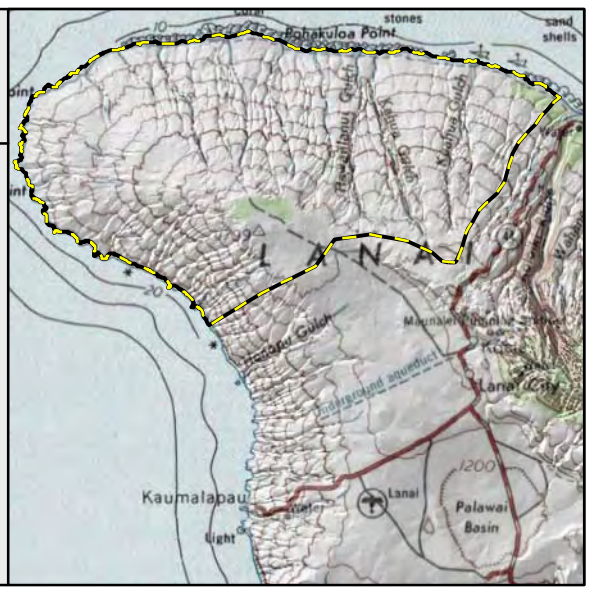
1:1,000,000

0 5 10 20

Miles

Data Sources: ESRI, National Geographic Maps.

February 12, 2008



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Met 1
Met 2
Met 3
Met 4
Met 5
Met 6
Met 7
Awalua
Polihua
Kaena
Lapalki
Kahua
Kuahua
Mahana
Keomuku
Kanepuu
Lanaihale
Lanai
Kaumalapau
Kaupili
Manele
Hoike
Awehi
440
Lanai
PACIFIC OCEAN
TETRA TECH EC, INC.

Figure 1-2. Lana'i Meteorological Tower Locations

Castle and Cooke Lana'i Meteorological Towers Project
Maui County, Hawaii

Project Facilities
- Proposed Met Towers
- Project Boundary

Water Bodies
- Streams

Existing Transportation
- Highway
- Major Road
- Local Road

1:70,000

0 0.5 1 2

Miles

June 30, 2008

2.0 Proposed Action and Alternatives

2.1 Proposed Action

As of mid-February 2008, six met towers are operational, and the installation of the seventh tower is pending. The Proposed Action is for the USFWS to make a decision regarding issuance of an ITP under the ESA to authorize potential incidental take of four listed wildlife species as a result of installation of a seventh met tower and operation of seven met towers on northwest Lanai, Hawaii. The applicant, Castle & Cooke, has submitted an application (including a HCP) requesting authorization for incidental take of Hawaiian petrel, Newell's shearwater, Hawaiian stilt, and Hawaiian hoary bat should one collide with one of the seven met towers during the operation period on Lanai, through March 1, 2010. This action would also address the conditions in the CDUP issued August 8, 2007 (**Appendix A**), by the Hawaii DLNR to conditionally install seven 165-foot-tall (50-meter-tall) met towers on private land owned by Castle & Cooke, Inc. (**Figure 1-2**).

As stated previously, six met towers have been installed. DLNR authorized the first tower, met tower 6, to be installed on August 28, 2007. The DLNR later authorized Castle and Cooke to install the additional six met towers on December 10, 2007. Met towers 1 through 5 were installed between January 7 and February 8, 2008, and met tower 7 is pending installation. The met towers would be used through March 1, 2010 to collect data on wind patterns; these data would be used to assess the suitability of the wind regime to sustain a wind energy facility. Minor adjustments to these locations (micrositing) were implemented in the field as necessary to avoid unexpected sensitive resources or installation issues. Should Castle & Cooke be required to take down the existing met towers for any reason while waiting for the ITP, the Proposed Action considered herein would include their reinstallation.

The project area is remote and is located on the northwestern portion of the island (**Figure 1-2**). The Tax Map Key is 2-4-9-002:001. The met tower footprints are bounded by open lands currently owned and managed by Castle & Cooke. No portion of the project is located on land owned by the federal government. The existing six met towers are located within a combined footprint area of approximately 9.8 acres (3.94 hectares). Met tower 7 would have a footprint of approximately 1.6 acres (0.66 hectares).

The six existing met towers (met towers 1 to 6) and the proposed met tower (met tower 7) are discussed below:

- **Met tower Site 1** is located at an elevation of 1,563 feet above mean sea level (AMSL); the tower is approximately 165 feet tall, for an overall height of 1,728 feet AMSL. The latitude and longitude coordinates for the site are: 20 degrees, 52 minutes, 59.58 seconds north; and 156 degrees, 58 minutes, 25.44 seconds west. This met tower is located about 5 miles northwest of Lanai City and about 7 miles north of Lanai Airport. This tower site is located about 220 feet west of an existing road, Lapaiki Road.

- **Met tower Site 2** is located at an elevation of 682 feet AMSL; the tower is approximately 165 feet tall, for an overall height of 847 feet AMSL. The latitude and longitude coordinates for the site are: 20 degrees, 54 minutes, 19.02 seconds north; and 156 degrees, 58 minutes, 25.98 seconds west. This tower site is located about 6 miles northwest of Lanai City and about 8 miles north of Lanai Airport. This site is located about 125 feet east of an existing road, Lapaiki Road.

- **Met tower Site 3** is located at an elevation of 370 feet AMSL; the tower is approximately 165 feet tall, for an overall height of 535 feet AMSL. The latitude and longitude coordinates for the site are: 20 degrees, 54 minutes, 56.34 seconds north; and 156 degrees, 59 minutes, 43.92 seconds west. This tower site is located about 7 miles northwest of Lanai City and about 9 miles north-northwest of Lanai Airport. This site is located about 535 feet east of an existing road, Awalua Road.

- **Met tower Site 4** is located at an elevation of 1,459 feet AMSL; the tower is approximately 165 feet tall, for an overall height of 1,624 feet AMSL. The latitude and longitude coordinates for the site are: 20 degrees, 53 minutes, 8.7 seconds north; and 157 degrees, 0 minutes, 23.46 seconds west. This tower site is located about 7 miles northwest of Lanai City and about 7 miles northwest of Lanai Airport. This site is located 165 feet east of an existing road, Polihua Road.

- **Met tower Site 5** is located at an elevation of 492 feet AMSL; the tower is approximately 165 feet tall, for an overall height of 657 feet AMSL. The latitude and longitude coordinates for the site are: 20 degrees, 54 minutes, 33.96 seconds north; and 157 degrees, 1 minutes, 37.2 seconds west. This tower site is located about 9 miles northwest of Lanai City and about 10 miles northwest of Lanai Airport. This site is located 270 feet west of an existing road, Polihua Road.

- **Met tower Site 6** is located at an elevation of 565 feet AMSL; the tower is approximately 165 feet tall, for an overall height of 730 feet AMSL. The latitude and longitude coordinates for the site are: 20 degrees, 53 minutes, 31.08 seconds north; and 157 degrees, 2 minutes, 28.92 seconds west. This tower site is located about 9 miles northwest of Lanai City and about 9 miles northwest of Lanai Airport. This site is located 460 feet west of an existing road and 200 feet from an existing four-wheel-drive trail.

- **Met tower Site 7** would be located at an elevation of 132 feet AMSL; the tower is approximately 165 feet tall, for an overall height of 297 feet AMSL. The latitude and longitude coordinates for the site are: 20 degrees, 55 minutes, 6.12 seconds north; and 156 degrees, 56 minutes, 16.26 seconds west. This tower site is located about 6 miles north of Lanai City and about 9 miles north of Lanai Airport. This site is located 55 feet east of an existing road, Kuaua Road.

The met towers are a standard design and made specifically for wind energy resource measurements. These lightweight towers are made of galvanized steel tubing. The tubes slide together without bolts or clamps and are made from a combination of 5-foot (1.5-meter) and 10-foot (3-meter) sections. The sections are assembled horizontally on the ground and then tilted up using a ginpole and winch; the solar panel and communications equipment are then installed. The towers rest on a steel base plate approximately 9 square feet (0.8 square meters) in size and are supported by 6 aircraft cable guy wires in four directions at each guy level for a total of 24 guy wires. The guy wires are attached to dead-man type earth-anchors buried to a depth of 5 to 8 feet (1.5 to 2.4 meters). Two anchor points are installed on each of the 4 sides and hold 3 wires each. The tower specifications are outlined in **Table 2-1,** and a figure illustrating a typical met tower structure with associated guy wire locations is included as **Figure 2-1**.

Table 2-1. Lanai Met Tower Dimensions

Tower Height	Guy Wire Radius	Tube Diameter	Base Plate Dimensions	Anchor Depth
165 feet (50 meters)	100 feet (30.5 meters) to 110 feet (33.5 meters)	6 inches (15.2 centimeters) to 8 inches (20.3 cm)	3 feet x 3 feet (0.91 meter x 0.91 meter)	5-8 feet (1.5 to 2.4 meters) deep

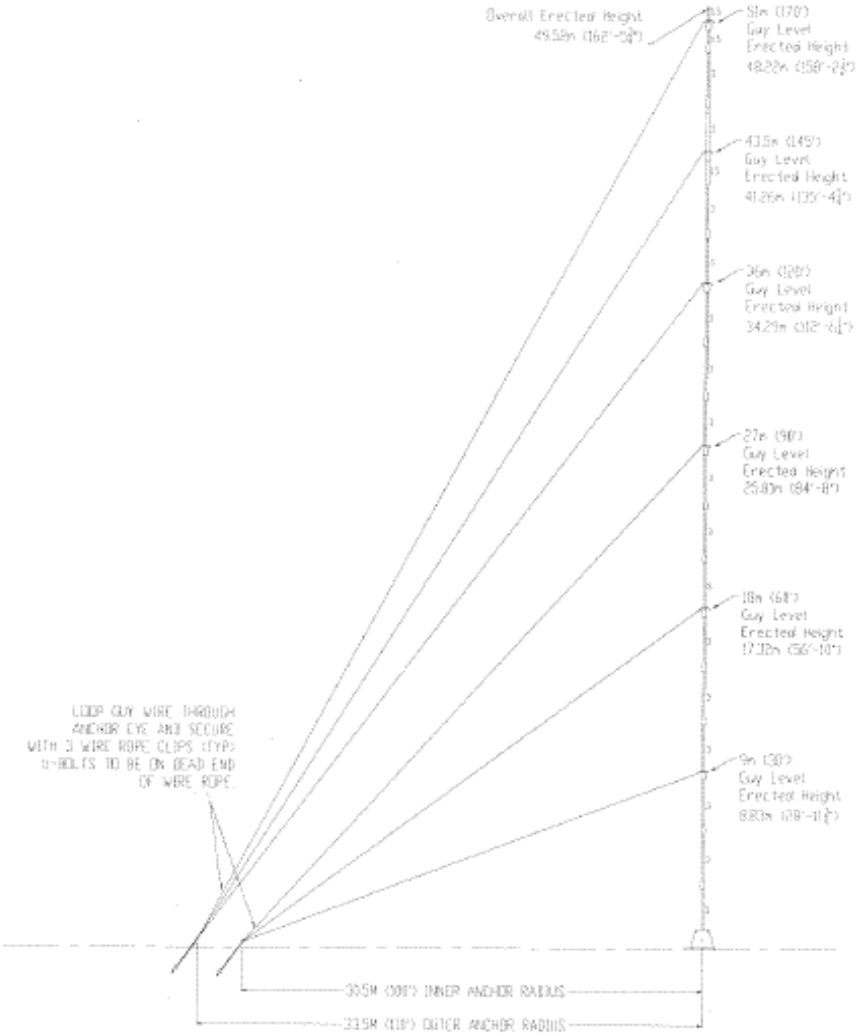

Figure 2-1. Drawing of a 50-m Tall Tower Assembly

Installation of the towers requires minimal ground disturbance. No cranes or concrete foundations are required for installation, and no new access roads are created. Furthermore, only minimal excavation is required with a small backhoe to install the anchor points. A small trench approximately 2 feet (0.61 m) wide by 6 feet (1.8 meter) long by 4 to 6 feet (1.2 to 1.8 meters) deep is excavated so the guy wire steel rod anchors can be inserted into the ground at each site. A total area of 84 square feet (7.8 square meters) will be disturbed from installation of the anchor points for the seven towers. Tower installation personnel access each tower site via existing roads, existing four-wheel-drive trails, and by foot. A pickup-sized flatbed truck with a trailer is

used although some locations may require manual transport of materials. Low-lying brush at each tower site is removed by hand except where the backhoe is used to install the guy wire anchor points. Brush is also removed within the temporary tower assembly areas outside of the guy wire areas. The width of these temporary tower assembly areas is approximately 10 feet (3 meters) to accommodate assembly of the tower sections. No fencing is proposed for tower sites, although some non-native vegetation may be cleared to improve the ability to locate carcasses during monitoring surveys.

Castle & Cooke implemented measures to make the towers more visible to flying wildlife. White, 1-inch wide polyvinyl tape was fitted to the guy wires to increase visibility and subsequently increase the likelihood of avoidance. The polyvinyl tape fitted to the guy wires has proven effective in minimizing petrel collisions with fencing and other structures at the Lanai colony when wrapped along the length of the fencing (USFWS and DOFAW, pers. comm. 2007). The method of attaching flagging to the guy wires required modification since wrapping the wires along their length would interfere with the wind data collection. The polyvinyl tape was cut into 4-foot-long strips, folded in half over the wire, and attached using zip ties that are resistant to ultra-violet light. Tape was not used within 6-feet above and below the anemometers. Bird diverters, coiled lengths of solid polyvinyl chloride (PVC) tubing, were added between the taped sections. Additionally, two 3-foot sections of PVC tubing were placed on each guy wire, starting at the anchor points.

The only permanent areas of disturbance from construction are to the ground under the 9-square-foot baseplate and at the guy wire anchor points. Disturbed areas will be restored once the towers are removed by March 1, 2010. Although technicians may access the seven tower sites approximately every 3 months to maintain the towers, all installation equipment is removed from the site following construction.

The environmental effect of installation and operation of the met towers would be the potential for a Hawaiian petrel, Newell's shearwater, Hawaiian stilt, or Hawaiian hoary bat to be injured or killed if one would fly into one of the towers or guy wires. The HCP prepared in support of the ITP requirements identifies the potential take and compensating mitigation for these four species. Rather than estimating a take limit per year for each listed species, USFWS and DLNR recommended establishing maximum take for each species over the 2-year period that the towers will operate. A take limit of two individuals has been established for each the Hawaiian stilt, Hawaiian hoary bat, and Newell's shearwater. Based on radar data and expected avoidance behavior, a tiered approach to the take limit and associated compensatory mitigation was established for Hawaiian petrel. Should the Tier 1 take limit of seven petrels be reached prior to March 1, 2010, a higher Tier 2 take limit of 14 petrels would be initiated. Therefore, a two-tiered comprehensive mitigation plan would be implemented for the Hawaiian petrel, depending on the level of take.

For this mitigation program, Castle & Cooke would provide funding to DOFAW to enhance its predator control program and implement a habitat restoration program at the petrel colony located on the Lanaihale. Under Tier 1 mitigation, three acres (1.2 hectare) of invasive plant species would be removed and restored to native habitat and trapping efforts of predators in the vicinity of the petrel colony would be increased. Tier 2 mitigation expands the habitat restoration area to include an additional three acres. At its discretion, DOFAW has the option to utilize the authorized Tier 1 funding to implement work within both three-acre parcels. To mitigate for potential take of Hawaiian stilt, Castle & Cooke will provide 12 traps for DOFAW to use at the wastewater treatment plant (WWTP) where the Hawaiian stilt population is located. These

mitigation measures would have an immediate and long-term benefit to Hawaiian petrel, Newell's shearwater, Hawaiian stilt and Hawaiian hoary bat. Castle & Cooke made an initial payment to DOFAW for Year 1 of the Tier 1 mitigation of $143,138 so that the habitat restoration could begin in 2008.

At the mitigation parcel on the Lanaihale, invasive vegetation is being removed and native plant species would be reintroduced if necessary to increase breeding habitat for the Hawaiian petrel and Newell's shearwater. The habitat restoration will increase roosting and foraging habitat for Hawaiian hoary bat. DOFAW surveyed for listed plant and animal species in the proposed restoration area prior to initiating work. Clearing of invasive plant species has been completed in approximately one acre of the first three-acre parcel. Any native plants, snails, or petrel burrows will be mapped and protected throughout restoration and maintenance activities. Vegetation clearing will take place in areas not in close proximity to known locations of birds and/or burrows thereby eliminating disturbance to the birds or breeding activities. Additionally, the sensitive annual period for Hawaiian bats is July 1 through September 30 when dependent young are with the mothers. No trees taller than 9.8 feet (3 meters) will be cut unless bats have not been detected for five consecutive days of audio bat detector surveys. Vegetative clearing and noise disturbance will be limited in duration. DOFAW's scope of work for the mitigation plan is provided in the HCP. The removal of invasive species from the Lanaihale is expected to be a positive impact on the environment, and have a net benefit over time for the Hawaiian petrel, Newell's shearwater, and Hawaiian bat.

A post-construction monitoring program is being conducted at each of the installed towers to document if birds or bats are injured or killed as a result of tower operation and to ensure the level of take is within authorized limits. Searcher efficiency and scavenging removal adjustments will be applied to the observed direct take (carcasses found, if any, during searches) to quantify adjusted take (direct and unobserved direct take combined). Adjusted take will be compared to the take limits authorized in the HCP. To maximize searcher efficiency during these surveys, management of existing vegetation may be considered. This would include cutting, mowing or otherwise maintaining vegetation within the survey plot limits.

Temporary effects on vegetation that may occur from the downed wildlife monitoring will be limited to the search plots that are centered on each met tower. Most of the vegetative species within the search plots are not native or considered invasive such as kiawe. Temporary trampling of vegetation while conducting the surveys is expected to be a less than significant impact. If vegetation management is implemented, native species would regenerate after management activities are stopped. Removal of invasive plant species would be a positive impact for the ecosystem. Rare plant surveys were also conducted at each met tower location to verify that no impacts to protected plant species would occur. Management or trampling of vegetation during the surveys would be a less than significant impact.

2.2 Alternatives to the Proposed Action

The alternatives considered to the Proposed Action includes: 1) the No Action alternative and 2) the use of monopole met towers in place of guyed towers. The 196 feet (60 meter) tall monopole met tower is a permanent single-pole structure which requires a concrete base to support the tower in lieu of guy wires in the temporary type of met tower installation. Heavy equipment such as cranes, cement trucks, and back hoes are required to install a monopole tower and wider, engineered access roads would be needed to bring heavy equipment to the seven met tower locations. Such roads would be cleared to the base of each tower, and a crane pad would be constructed. Although the post-installation pad footprint could be an area of approximately 15 x

15 feet, in actuality, the area of disturbance to access and construct the tower would be much greater.

Based on available information, monopole towers could pose a lower collision risk to petrels, shearwaters, stilts, and bats because of their smaller three-dimensional structure and reduced exposed surface area due primarily to the lack of guy wires. However, other permanent environmental impacts would occur as a result of installing a monopole type tower. The spring and summer radar data collected that was used to model estimated annual fatality with guyed met towers was also applied to monopole structures. The estimated range of petrel fatalities at met towers 1 through 7 over a 2-year period is 5 to 25 birds for guyed met towers and 0.1 to 0.4 birds for monopole met towers, respectively, for 95 and 99 percent avoidance rates. Avoidance rates and methods are further discussed in this report (see Section 3.4.2). Although petrels have a much lower estimated fatality rate over a 2-year period with the monopole towers, there is potentially a higher overall environmental impact as a result of installing the monopole towers. A much larger footprint is permanently disturbed at each monopole tower, thereby potentially increasing the impacts to biological (vegetation and wildlife) and cultural resources. Access roads would need to be significantly improved or new roads constructed to provide access for the crane and other required large equipment. These activities for monopole tower installation would also increases the area of impact for biological and cultural resources as well as generate greater noise and dust.

Furthermore, monopole towers cost three to four times more than the purchase and installation costs of the preferred tower type. The cost of the self-supporting guyed met towers plus the mitigation costs for the covered listed species would be less than half of the total installation cost of monopole met towers. Additionally, there is potential that restoration or mitigation would still be required for monopole tower installation associated with biological or cultural resources impacts. Castle & Cooke decided not to use monopole towers based on 1) the greater area of ground disturbance; 2) the permanence of the structures and disturbance; 3) the increased road upgrades required for access; and 4) the greater expense of the structures.

No other alternatives to the Proposed Action were evaluated. Alternative locations for the seven tower sites were considered and dismissed because the towers must be located where the representative wind resource is likely to occur. In addition to considering topography, cultural and biological resources, and access by existing roads, minor adjustments to these locations were implemented in the field, if necessary, to avoid unexpected installation issues (Adams, pers. comm. 2008). The No Action Alternative, is therefore the only other alternative that was considered.

NEPA requires the evaluation of a No Action Alternative, defined in CEQ regulations as a continuation of present conditions (40 CFR § 1502.14). Under the No Action Alternative for this project, the ITP/ITL would not be granted. Thereby, the conditions of the CDUP permit would not be met which require the ITL/ITP to be obtained before August 31, 2008. As a result, the six installed towers would be removed, and no additional information on wind patterns would be available to assess the area's potential to provide wind-generated electricity. Without additional information on wind resources in the area, Castle & Cooke would be unable to evaluate whether this site meets standards for a viable operation to provide renewable energy to energy consumers.

3.0 Environmental Consequences of the Proposed Action

3.1 Introduction

The critical elements are assigned to three categories for simplicity in discussing the affected human and natural environment:

- Uses or resources not present and not affected by the Proposed Action;
- Uses or resources present that may be affected by the Proposed Action; and
- Uses or resources affected and therefore considered in detail.

The sections below discuss first those elements that are not present, followed by elements that are present and may be affected by the Proposed Action, and finally those elements that are present and are likely to be affected by the Proposed Action.

3.2 Uses or Resources Not Present and Not Affected by the Proposed Action

The following critical elements were determined not to be present and will not be discussed further.

3.2.1 Floodplains

U.S. Executive Order 11988 addresses floodplain management related to public safety, conservation, and economics. It requires avoidance of incompatible floodplain development, consistency with the standards and criteria of the National Flood Insurance Program, and restoration and preservation of the natural and beneficial floodplain values.

Federal Emergency Management Agency (FEMA) maps are not available for the island of Lanai (FEMA 2007). The seven met towers are located on ridges and are not located in floodplains. Additionally, existing roads do not appear to be located in any major floodplains. The mitigation restoration area is located at one of the highest points on the island so it is not located in any floodplains.

Lanai can receive heavy rainfall associated with seasonal storms or as a result of tropical storms and hurricanes. Lanai lies in the rain shadow of Molokai and, as a result, receives less precipitation. On average, the island receives up to 35 inches (89 centimeters) of rain a year, whereas the majority of the project area receives less than 10 inches (25 centimeters) a year. Data on floods caused by rainfall and storm events are limited, but the majority of the project area is located in a relatively low-risk part of the island for stream flooding. The exception is the low coastal terraces along the northwest tip of the island and the bay areas lying at the stream mouths along the southwest and northern shores, which are not a part of the project area.

Implementation of the Proposed Action would have no effect on floodplain capacity or ecological values or the coastal zone because the met towers would be located on higher lands. Therefore, this element will not be discussed further.

3.2.2 Environmental Justice and Socioeconomic Characteristics

The nearest populated area to the project area is Lanai City, about 4.8 miles southeast of the nearest met tower site. The population of the city was 2,688 at the 2000 census (U.S. Census Fact Finder 2007), which accounts for approximately 84 percent of the total population of the island. The majority of the remaining 16 percent of the island's population resides on the southern side of the island, where other resorts and tourism-based amenities are located.

Labor used during the construction period to erect the met towers included staff brought in from other Islands and local construction workers. In either case, few workers were required, and for a short timeframe. Therefore, the Proposed Action is not expected to have a significant impact on the economy of Lanai City or of Maui County as a result of housing, increased retail or services required, or transportation needs.

U.S. Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (59 Federal Register 7629, 16 February 1994) directs federal agencies to "make…achieving environmental justice part of its mission" and to identify and address "…disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations."

Because the Proposed Action would not be located near the population center of Lanai City or the southern portion of the island, it is expected to have a less than significant impact on human health or environmental effects on the minority or low-income population of the island of Lanai. Therefore, this element will not be discussed further.

3.2.3 Public Health and Safety

The Proposed Action has been reviewed to evaluate whether it would have either a direct or an indirect impact on the health and safety of the public. As with the existing towers, met tower 7 would be located away from typical vehicle and foot traffic travel corridors, though it would be encountered on longer vehicle or bicycle trips to the northern beaches. The met towers are static and are not considered an impact on the health and safety of the public. Guy wires near anchor points are clearly marked with yellow tubing from the ground up to a height of six-feet, and white tape and bird diverters are employed on the upper sections.

No impacts to the health and safety of the public are anticipated. Therefore, this element will not be discussed further.

3.2.4 Hazardous or Solid Wastes

The Proposed Action is located on private land, owned by Castle & Cooke, in Maui County. No hazardous or solid waste would be generated by construction or operation of the met towers. Gasoline and diesel fuel was used to power the vehicles needed to erect the six towers and to conduct downed wildlife surveys at the tower sites. However, neither gasoline nor diesel fuel would be stored at any of the sites. Vehicles are fueled at approved fueling stations and driven to the sites.

When the data collection efforts have been completed, the seven met towers would be removed from the sites and put into storage. Any components deemed unrecoverable would be disposed of in approved landfills.

No significant impacts are expected from the use or management of hazardous or solid wastes. Therefore, this element will not be discussed further.

3.3 Uses or Resources Present that May Be Affected by the Proposed Action

The following critical elements are present but after evaluation, the Proposed Action would not affect them, as described below.

3.3.1 Noise

Noise is generally defined as unwanted or excessive sound. Some land uses are considered more sensitive to intrusive noise than others based on the type of activities involved at the receptor location. Specifically, sensitive human noise receptors normally include residences, schools, libraries, religious institutions, hospitals and nursing homes, daycare centers, and other businesses in the vicinity of the project area. In light of the remote nature of this project location, receptors near the project area would be limited to a few recreation sites and beaches.

The Proposed Action would produce basic construction-related noise associated with the use of hand tools and a small backhoe during the construction period. The existing met towers make no perceptible noise when in operation and thus no additional operation noise would be anticipated as a result of the operation of met tower 7.

The habitat restoration program includes clearing vegetation at the Lanaihale, particularly invasive strawberry guava (*Psidium cattleianum*), with chain saws and by-hand. Chain saws typically produce 90-110 decibel noise during their period of operation. The clearing is conducted in areas away from active nesting areas so the seabirds are not disturbed. Vegetation removal began March 10, 2008 and is ongoing. Vegetative clearing will be limited in duration, and would have a less than significant impact on other wildlife in the vicinity.

It is anticipated that construction of the met tower 7 and operation of the seven met towers would have less than significant noise impact to the area, and therefore, this resource will not be discussed further.

3.3.2 Air Quality

Air quality in Hawaii is among the best in the United States, and criteria pollutant levels remain well below state and federal ambient air quality standards. The State Department of Health, Clean Air Branch, monitors ambient air in Hawaii and has established a statewide system of monitoring stations. The primary purpose of the monitoring stations is to ensure that air quality standards are met (State of Hawaii 2007).

Air quality is good in the project area because of the virtual absence of emissions from vehicles and the almost continuous persistence of trade winds or onshore breezes. There are no point sources of airborne emissions in the project area. Air quality is affected primarily by regional and local climate, together with the amount and type of human activity in any given location at a particular time. Federal and state ambient air quality standards have been established to regulate particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, and lead.

Implementation of the Proposed Action would generate low levels of emissions of reactive organic gases, nitrogen oxides, and particulate matter 2.5 micrometers in diameter or less ($PM_{2.5}$) and particulate matter less than 10 microns in diameter (PM_{10}) from one or two vehicles during both the construction period and post-construction monitoring surveys, similar to that which occurred during the construction of the existing six met towers and ongoing post-construction monitoring. These emissions would be generated by combustion of gasoline and diesel fuel. Operation of vehicles on exposed soils would release some fugitive PM_{10} dust and may release

some $PM_{2.5}$ dust. Construction associated with met tower 7 would likely take 3-5 days. Pollutants emitted by construction and monitoring would be considerably below the federal conformity significance thresholds.

Implementation of the Proposed Action would have a less than significant impact on air quality. Therefore, this element will not be discussed further.

3.3.3 Geology and Soils

3.3.3.1 Geology

The island of Lanai was formed by a single volcano and covers a land area of about 90,000 acres. It is a generally hilly island that rises gradually to 3,369 feet (1,027 meters) AMSL at Lanaihale, or Mount Palawai. Lands within the project area are best categorized by Stearns (1940) in his description of the northwest rift zone of the island of Lanai. He states that the lands rise gradually to the northwest from the Palawai Basin for about 6 miles, resulting in an area of shallow broad undrained depressions that measure approximately 1.5 by 3 miles wide. These lands are bounded on the northeast by a fault scarp that dies out to the northwestward. The landscape is punctuated by Kanepuu, a massive ridge that rises to an elevation of 1,780 feet (543 meters) AMSL (Stearns 1940).

The surface geology varies greatly across the project area, from exposed bedrock to small sandy beaches. The majority of the surficial soils consist largely of rocks and boulders with a depth of 4 to 35 inches (10 to 89 centimeters) above bedrock. These soils exist almost uniformly along the sloping elevations from the plateau, tending to contain less soil along the steeper elevations, where runoff has carved gorges in the earth's surface. The higher elevations along the plateau still contain mostly rocky soil but tend to see a mix of shallow rock and small alluvial sediment deposits in a mixed badlands landscape. These deposits are formed by soils carried by high winds that cross the site and by streams that carry eroded soils from higher elevations. The rock formations in the project area appear to be predominantly a tuff of volcanic ash composition rather than the silica basalt that is prevalent over most of Lanai (Stearns 1940).

The underlying bedrock of the soils lies from 0 to 5 feet (0 to1.5 meters) below the island surface and is made primarily of Pleistocene-age basaltic lavas. Like other shield volcanoes, Lanai formed from a series of lava flows and dikes. These flows and dikes leave behind very little pyroclastic or fragmented material, and as a result, form relatively uniform layers of lava from 1 to 50 feet (0.3 to 15 meters) thick. The absence of soils intermixed with the lava flows indicates that the Lanai volcano flowed rapidly and steadily when it was active and that the bedrock is expected to be relatively uniform across the project area. In addition to the mainly igneous rocks, there are some sedimentary rock deposits on Lanai. These sedimentary deposits are mostly a result of erosion and weathering of the already present igneous rocks, but can also be attributed to deposits from wind and the sea (Stearns 1940).

Basaltic lava bedrock has been observed to be present near the surface over most of the rest of the island. The only exception is within the former pineapple growing areas in the middle of the island. Cliffs of basalt are present along the southern and eastern shores, as opposed to the relatively uniform slope all the way down to the shoreline near the project area. These cliffs are formed by the near-surface basaltic lava formations in these areas. On the northern shore, the bedrock was observed to consist mostly of volcanic ash where there are no cliffs, and the land surface slopes more or less uniformly to the shore (Stearns 1940).

3.3.3.2 Soils

The general soil association of the project area is defined as a "Very stony land–Rock land association" and described as gently sloping to very steep, rocky and stony land types on uplands and in gulches and valleys. The predominant soils of the project area in the ahupuaa of Kaa and Paomai are classified as "rVT2 Very Stony Land Eroded" and "rRK Rock Land." The "rVT2" strongly weathered soils consist of large areas of severely eroded soils on Molokai and Lanai. The predominant soils of the ahupuaa of Kamoku and Mahana are classified as "rVS Very Stony Land" and "KRL Koele Badland Complex." The "rVS" land type consists of stones and boulders underlain by soft, weathered rock and bedrock (USDA 1972).

Based on United States Department of Agriculture (USDA) mapping, soils are generally between less than 1 foot and 5 feet (0.3 to1.5 meters) in depth, consisting mostly of silt to clay with some sand and boulders. In most areas, the soil grades into bedrock and consists predominantly of volcanic ash (tuff) throughout the project area.

The only disturbance to soils that would result from construction of the met tower is to the area under the 9-square-foot baseplate and guy wire anchor points. When the anchor points are being installed, the work would be completed during dry conditions so soil erosion would not be an issue. Once anchor points are installed, the soils would be restored, as well as when the towers are removed by March 1, 2010.

The post-construction monitoring surveys conducted at each of the met towers sites may temporarily trample plants and soil over the project period. However, there are no anticipated impacts due to foot searches.

As invasive plant species are cleared from the Lanaihale habitat restoration area, standard management practices must be implemented to prevent the potential for erosion due to the removal of vegetation. DOFAW will apply erosion control measures during the initial phase of vegetation removal and ongoing maintenance as needed. Erosion controls include the use of appropriate Best Management Practices so as to prevent erosion during storm events on the steep slopes. Restoration during mitigation will therefore have a less than significant impact to geology and soils and will not be discussed further.

Overall, construction and operation of the towers, implementing habitat restoration activities at the Lanaihale mitigation area, and conducting downed wildlife surveys at met tower sites would have a less than significant impact to geology and soils. Therefore, this element will not be discussed further.

3.3.4 Water Quality

Installation of the met towers would have a negligible adverse effect on surface and groundwater because of the minor extent of construction, limited area of ground disturbance, and short duration period of met tower operation. During the time of wind data collection, the only impervious surfaces present are the small base plates to which the tower tubing is attached. This small impervious surface would have a negligible effect on surface water flow and groundwater recharge. In addition, the project would have no effect on groundwater quality because no hazardous materials would be involved in project construction or operation.

Construction of the met towers consisted of tower assembly, installation of a base plate, guy wire anchoring, raising the tower poles, and installing the guy wires. Tower construction and removal would disturb only a few square feet of ground surface, so impacts from soil erosion would likely be insignificant. No grading or excavation would be required beyond the small trench

excavated to secure guy wire anchors into the ground. Vegetation would be restored around the anchor points to eliminate any potential for erosion. Furthermore, no new roads would be constructed. Any clearance of brush or low-growing vegetation required would leave the roots intact, thus reducing the potential for soil erosion. Vegetation is expected to grow back from the remaining roots and low-lying vegetation.

As invasive plant species are cleared from the Lanaihale habitat restoration area, Best Management Practices will be followed to prevent the potential for erosion due to the removal of vegetation. DOFAW will implement erosion control measures during the initial phase of vegetation removal and ongoing maintenance if needed. Erosion control would include the use of appropriate Best Management Practices so as to prevent erosion during storm events on the steep slopes.

Overall, construction and operation of the met towers would have a less than significant impact on the quality of surface or groundwater. Therefore, this element will not be discussed further.

3.3.5 Cultural Resources

An archaeological literature review for large portions of Kaa, Paomai, Kamoku, and Mahana Ahupuaa, Lahaina District, Lanai Island, was conducted by Cultural Surveys Hawaii Inc. (March 2007) to determine if historic properties may be present within the entire WRA project area including the met tower locations. The scope of work for this review included research on historic and archaeological background and searches of historical maps, written records, and Land Commission Award documents. This research focused on the WRA, with background on the traditional district, and individual ahupuaa, with special emphasis on settlement patterns.

A variety of resources devoted to historical perspectives of the region and traditional stories and accounts were reviewed. Research venues included the State Historic Preservation Division (SHPD) of the DLNR and the Survey Division of the Department of Accounting and General Services. All relevant Land Claim Awards (LCA) and Royal Patents were researched using resources associated with the Waihona ‘Aina online database (Waihona ‘Aina Corp. 2002). Maps were obtained that showed previously recorded archeological sites.

Based on these reviews, it was determined that there was potential for cultural resources to be present in the vicinity of the locations proposed for the met towers. Site surveys were conducted to assess the potential impact of met tower placement on any cultural resources and are summarized in the report provided in **Appendix B**. A total of five historic properties and two, likely modern era, sites were identified during an archaeological field inspection of the proposed met tower locations. **Table 3-1** summarizes these findings in relation to each of the seven proposed met tower locations. (Met tower 8 was later deleted from consideration.)

The met towers have a small footprint (9 square feet base plates with a 150-foot radius to accommodate guy wire anchors and lay down radius). Although there were several areas of interest near Met towers 1, 3, and 4, these identified features occur outside the temporary construction area and footprint for each tower. These towers were relocated away from the identified features to accommodate a close vicinity (100 feet or less) of an area of interest to a construction radius (for Met towers 3 and 4). However, Castle & Cooke monitored construction and installation of Met towers 1, 3, and 4 with on-site cultural resource staff to ensure no impacts would occur. No cultural resource issues were found during construction. In the proposed restoration area, MISC and DOFAW conducted a detailed site assessment in order to identify

Table 3-1. Descriptive Summary of Potential Cultural Resources at the Proposed Met Tower Locations

Tower Number	General Observations
Met tower 1	Overall area consists of barren, clay hardpan. Overall visibility was excellent. Two historic properties (CSH-1 and -2) were identified outside of the area of potential effect (APE) for this location. One modern petroglyph (CSH-3) was identified within the APE.
Met tower 2	Vegetation varied from bare to knee-high grasses, lending to ground visibility ranging from excellent to fair. Aeolian and alluvial deposits appear to be fairly shallow, as bedrock outcrops were visible on the surface. Observed materials included modern trash, empty gun shell casings, and fragment of milled wood. No historic preservation concerns were noted for this area.
Met tower 3	Overall vegetation consisted of knee-high grass, lending to fair ground visibility. Soil deposits appear to be fairly shallow, as low-lying bedrock outcrops were exposed on the surface. One historic property (CSH-4) was identified at this location. Based on the proximity of the site to the original location of the proposed tower, the footprint of the tower was moved approximately 100 feet southwest.
Met tower 4	Overall vegetation ranged from bare to shoulder-high grasses, indicating fairly deep soil in the low-lying areas. Two historic properties (CSH-5 and -6) as well as a modern hunting blind (CSH-7) were noted along the periphery of the lay-down area for this tower location. Based on concerns regarding the proximity of the historic properties to the APE, the footprint of the tower was moved approximately 90 feet southeast of the original location.
Met tower 5	Overall vegetation consisted of ankle- to knee-high grasses. No historic preservation concerns were noted for this area.
Met tower 6	Overall vegetation consisted of ankle-high grasses. One apparently recent burn area and evidence of recent hunting were noted. No historic preservation concerns were noted for this area.
Met tower 7	Overall vegetation consisted of ankle-high grasses in an area of exposed basalt bedrock outcrops. Outcrops within the APE and approximately 50 feet surrounding the APE were closely investigated. While there are some naturally occurring terraces in the area, no evidence of cultural modifications was evident, and no cultural material remains were observed. No historic preservation concerns were noted for this area.

any known cultural resources in the area prior to initiating vegetation removal. No cultural resources were identified in the mitigation area (Appendix C). Thus, the Proposed Action would have a less than significant impact on cultural resources and is not discussed further.

3.3.6 Recreation

Recreation opportunities are abundant on the island of Lanai. Recreation in the vicinity of the project area includes seasonal hunting, trail hiking and biking, and four-wheel-drive touring.

All legal hunting takes place on weekends during the following seasons: game birds from November to January, axis deer (rifle and bow) in February and March, and Mouflon sheep (rifle and bow) from late July to October. Guy wires would be clearly marked and maintenance of the met towers will occur on weekdays. Thus, the met towers will not affect, nor will they be affected by, hunting activities.

In the vicinity of but not within the met tower project area, Polihua Beach and Shipwreck Beach are white sand beaches accessible by four-wheel-drive vehicle or bicycle. Polihua Beach provides good views of the island of Molokai, a famous green sea turtle nesting area, and whale watching. Shipwreck Beach is a tourist destination where two shipwrecks and lighthouse ruins are visible. The beach offers sunbathing, picnicking, fishing, walking, and exploring. The remote hiking trail Kaiolohia-Kahue originates from this beach, and petroglyphs can be seen nearby. These beach areas have dangerous currents and are not safe for swimming. Surfing is appropriate for expert surfers only, which limits the number of recreational users to the beach.

Within the project area is Keahikawelo, commonly known as the Garden of the Gods. It is characterized by boulders of varying sizes, shapes, and colors. These formations are the result of thousands of years of erosion that created pinnacles and buttes in one remote canyon area. From this area, visitors have views of the Pacific Ocean, the island of Molokai, and on clear days, the island of Oahu. The Garden of the Gods is accessible by bicycle or four-wheel-drive vehicle.

In the vicinity of the project area is the 590-acre (239-hectare) The Nature Conservancy (TNC) Kanepuu Preserve, a dry land forest that contains rare native Hawaiian plants. This preserve is located about 6 miles northwest of Lanai City, on the island's western plateau. The Nature Conservancy states that "several patches of an old, extremely rare Hawaiian dry land forest still remain. This forest region, protected as part of Kanepuu Preserve, represents one of the last remaining examples of a type of forest that once covered the dry lowlands of the main Hawaiian Islands" (TNC 2007).

No loss of recreation potential is anticipated. No impact to campers, hikers, or hunters or these recreation areas will occur because the met towers occupy a relatively small area, are located away from beaches, and the guy wires are clearly marked. The habitat restoration area is also located away from active tourist locations and would not impact residents or tourists. Because the Proposed Action would have a less than significant impact on recreation opportunities in the area, this element will not be discussed further.

3.3.7 Visual Resources

Visual sensitivity depends on viewer attitudes, the types of activities people are engaged in when they view a site, and the distance from which the site is viewed. Overall, higher degrees of visual sensitivity are correlated with areas where people live, are engaged in recreational outdoor pursuits, or participate in scenic or pleasure travel. Conversely, visual sensitivity is considered low to moderate in industrial or commercial areas, where the scenic quality of the environment does not affect the value of the activity.

The met towers are arranged along areas of higher elevation within the project area, in proximity to existing roadways and four-wheel-drive trails. Each tower required approximately 5 days to construct and would require 3 days to remove. Although these construction activities may be visible from nearby trails, roads, or beaches, the short-term nature of the activities would not result in a substantial or significant impact on existing viewsheds. The towers are not visible from the developed areas of the island.

The towers are not lighted and will not create glare that would affect day or nighttime views in an area. The towers are not highly reflective and are located in remote areas that are not visible from residences and popular recreational areas. Certain conditions may apply if a Lanai Land Use Commission (LUC) Special Use Permit is granted.

For the reasons stated above, implementation of the Proposed Action would have a less than significant impact on visual resources, and will therefore not be discussed further.

3.3.8 Noxious Weeds

The vegetation surrounding and within the tower locations contains a variety of well-established non-native grasses and shrub/scrub vegetation. The dominant exotic shrub/scrub species within the met tower project area include kiawe (*Prosopis pallida*), verbena (*Lantana camara*), bull thistle (*Cirsium vulgare*) and native ilima (*Sida fallax*). The open grassland areas are dominated by alien invasive species such as buffel grass (*Cenchrus ciliaris*) as well as native grass species such as pili grass (*Heteropogon contortus*). The procedures detailed below were in place during the installation of the towers, operation of the towers, and during downed wildlife surveys to prevent the introduction or spread of noxious weeds.

- The sites are accessible to personnel from existing roads, so no new access roads would be created.
- Castle & Cooke and its contractors would limit the size of any disturbance of vegetation or ground to the absolute minimum necessary to carry out the activity safely and as designed. Castle & Cooke would avoid creating soil conditions that promote weed germination and establishment. Disturbance during the construction phase would be limited to that required for the base plate, anchor insertion, tower assembly, and for four-wheel-drive vehicle entry to the site. Potential vegetation management (cutting or mowing grasses or some of kiawe and other non-native shrubs) may be used on an as needed basis to facilitate searches during post-construction monitoring surveys. Control of noxious weeds would have a positive effect on native habitat.
- Castle & Cooke would begin project operations in weed-free areas whenever feasible before operations move to weed-infested areas to prevent dispersing nonnative seed to native areas. However, most of the met tower locations are dominated by non-native vegetative species.
- No grading or excavation would occur during operation of the met towers. Limited excavation was required to insert the guy anchors into the ground. The deadman-type anchors were inserted into the ground using a small backhoe and hand tools. Soils were restored when the work was completed.
- As part of the mitigation program, DOFAW is removing non-native vegetation such as strawberry guava from two, three-acre parcels in the Lanaihale area. DOFAW will cut and treat stumps and reseed these areas with native plants if there is not natural regeneration from the seedbank.
- After working in the habitat restoration area, DOFAW and other project workers would take care to remove, and dispose of weed seed and plant parts found on their clothing and personal equipment, and dispose of it properly.

Therefore, the proposed action would have a less than significant impact on noxious weeds and ultimately a positive impact to the natural communities by removal of invasive plant species.

3.4 Uses or Resources Affected and Therefore Considered in Detail

The following critical elements are present, may be affected by the Proposed Action, and are considered in detail below.

3.4.1 Biological Resources

This section analyzes potential impacts on biological resources, including special-status plant and animal species. Special-status species are legally protected under Hawaii state law and the ESA. This EA defined special-status species as:

- Species listed or proposed for listing as threatened or endangered under the ESA (50 CFR 17.12 for listed plants, 50 CFR 17.11 for listed animals, and various notices in the Federal Register [FR] for proposed species);
- Species that are candidates for possible future listing as threatened or endangered under ESA (72 FR 10710, March 9, 2007);
- Species that are listed or proposed for listing by the State of Hawaii as threatened or endangered (HRS 195D-4);
- Animal species fully protected in Hawaii;
- Animal species of concern to the DOFAW and the Hawaii Biodiversity and Mapping Program (formerly the Hawaii Natural Heritage Program).

Methods

Tetra Tech biologists reviewed existing information on biological resources in the project area vicinity (**Figure 3-1**). This review included federally protected species listed by USFWS (**Appendix D**; USFWS 2007), Hawaii Comprehensive Wildlife Conservation Strategy (DOFAW 2005), and the Hawaii Biodiversity and Mapping Program (**Appendix D**). Special-status plant and animal species with the potential to occur in the project area are summarized in **Table 3-2** based on review of this information and coordination with USFWS and DOFAW staff.

Tetra Tech conducted a reconnaissance-level, habitat-based assessment of the seven met tower sites in the project area on April 11 and 12, 2007. The assessment consisted of inspecting the area within the footprint of each met tower site, along with the associated access routes. Existing plant communities, potential habitat for special-status species, and presence or evidence of special-status species were documented when detected. This survey was conducted too early in the season for some annual and herbaceous perennial plants to be evident. A botanical survey was therefore conducted on November 26 through 28, 2007, to assess the presence of federally or state-protected species during the rainy season. Surveys were conducted within a minimum 330 by 330-foot (100-meter by 100-meter) area surrounding the location of each of the seven met towers and access routes. The summary report is provided in **Appendix F**. In addition to plant surveys, Tetra Tech conducted weekly avian point counts during the spring and fall of 2007 to identify the bird community and use of the project area by bird species (**Figure 3-2**).

Table 3-2. Special-Status Species Potentially Occurring in the Project Area

Resource	Status[1/]		Habitat and Distribution	Breeding Season/ Bloom Period	Occurrence Probability
	Federal	State			
PLANTS*					
Tetramolopium remyi	E	E	Found in red, sandy, loam soil in dry *Dononaea viscose-Heteropogon contortus* communities at elevations between 213 and 1,591 ft (65 and 485 m). Current range on Lanai and known historically from west Maui.	April- Jan; dependent on precipitation	Moderate. Known from one occurrence on Lanai near Awehi Road, with a total of approximately 150 plants. No *Tetramolopium remyi* were observed during the field reconnaissance, but seeds can stay dormant during periods of drought. No observations of this species in the met tower footprint during 2007 rare plant surveys.
Native Yellow Hibiscus (Mao hau hele) *Hibiscus brackenridgei* ssp.*brackenridgei*	E	E	Short-lived perennial shrub found in lowland dry to mesic forest and shrubland between 0 and 2,116 feet (645 meters) in elevation in ridges and gulches, and old lava flows. Current populations on Lanai, Maui, and Hawaii. Historical record on Molokai.	Year-round; dependent on precipitation	Moderate. The field survey did not detect the presence of any individuals of this species. Records exist for this species from Keamuku Road and Kaena Point (**Appendix D**). Re-introduced individuals are also naturally reproducing at the TNC preserve Kanepuu. No observations of this species in the met tower footprint during 2007 rare plant surveys.
Hidden-petaled Abutilon *Abutilon eremitopetalum*	E	E	Perennial shrub found in dry forest and shrublands in gulches. Endemic to Lanai, with no additional range. Currently about seven individual plants observed in Kahea gulch in NE Lanai. Total population estimate less than 1,000 plants.	February	Moderate. No known records for this species exist in the project area (**Appendix D**). However, dry shrubland habitat is present in the project area for this species, and this species may be dormant in the seed bank. No observations of this species in the met tower footprint during 2007 rare plant surveys.
BIRDS					
Hawaiian petrel (Uau) *Pterodroma sandwichensis*	E	E	Occurs over open seas; nest in burrows along large rock outcrops, under cinder cones or ferns, or under old lichen-covered lava at elevations above 6,890 feet (2,100 meters).	Mar-Dec	Present. The Castle & Cooke radar survey results included radar and visual observations of petrels. A petrel colony was documented in the central portion of the island in 2006.
Hawaiian coot (Alae keokeo) *Fulica alai*	E	E	Coots are found in fresh and brackish-water marshes and ponds.	Mar-Nov	Low. No individuals observed during site assessments and wetland/stream habitat is lacking on site.
Hawaiian stilt (Aeo) *Himantopus mexicanus knudseni*	E	E	Use a variety of aquatic habitats; nest sites are frequently separated from feeding sites, adjacent to or on low islands within bodies of fresh, brackish, or salt water. Stilts are residents at the wastewater treatment plant on Lanai.	Mar-Nov	Present. One individual was observed flying over the met tower project area during the spring/summer 2007 radar surveys.
Hawaiian duck (Koloa-maoli) *Anas wyvilliana*	E	E	Found in lowland wetlands, river valleys, and mountain streams.	Jan-May	Low. No individuals observed during site assessments and wetland/stream habitat is lacking on site.
Ou *Psittirostra psittacea*	E	E	Restricted to wet to mesic ohia forest between 2,625 and 6,234 feet (800 and 1,900 m), mainly 3,937 feet to 4,921 feet (1,200-1,500 m). On Lanai, it may have been may have been restricted exclusively to the akoko (*Chamaesyce* spp.)– and öpuhe (*Urera glabra*)–dominated montane dry forest.	Year-round	Low. This species is believed to have been extirpated from Lanai between 1899 and 1931. It may still exist in critically low numbers on Kauai and Hawaii.
Newell's shearwater (Ao) *Puffinus auricular's newelli*	T	T	Occurs over open tropical seas and offshore waters near breeding grounds; during the breeding season the shearwaters live in burrows under ferns on forested mountain slopes.	Mar-Nov	High. The shearwaters' presence has been documented by DOFAW in the Hawaiian Petrel colony at Lanaihale by hearing shearwater vocalizations (Penniman, pers. comm. 2007). Breeding status not verified.

Table 3-2. Special-Status Species Potentially Occurring in the Project Area

Resource	Status[1/]		Habitat and Distribution	Breeding Season/ Bloom Period	Occurrence Probability
	Federal	State			
Ruddy turnstone (Akekeke) *Arenaria interpres*		SoC	Migratory shorebird that over-winters in Hawaii from breeding grounds in Alaska. Found along the coastline on sandy beaches, mudflats, and estuaries.	Over-winters in Hawaii	Present. Observed during the fall avian point count surveys.
White-tailed tropicbird (Koae kea) *Phaethon lepturus*		SoC	Occurs over open seas. Nests in tree and rock cavities in three locations on Lanai in the southern and eastern portions of the island.	March-October	Present. Observed during the spring and fall avian point count surveys.
Great frigatebird (Iwa) *Frigata minor*		SoC	Occurs over open seas. Nests in colonies on the northwestern Hawaiian Islands and roosts on offshore islets in large numbers.	March-October	Present. Observed during the spring and fall avian point count surveys.
Hawaiian short-eared owl (Pueo) *Asio flammeus sandwichensis*		SoC	Wet and dry forests, but are most common in open habitats such as grasslands, shrublands, and montane parklands.	Year-round	Present. Observed during the spring and fall avian point count surveys.
Pacific Golden Plover (Kolea) *Pluvialis fulva*		SoC	Migratory shorebird that over-winters in Hawaii from breeding grounds in Alaska and are found in short-grass prairie, pastures, mudflats, sandy beaches, and flooded fields.	Over-winters in Hawaii	Present. Observed during the fall avian point count surveys.
MAMMALS					
Hawaiian Hoary Bat (opeapea) *Lasiurus cinereus semotus*	E	E	Roosts among trees in areas near forests; not known if bat prefers native vegetation over introduced species.	Year-round	Present. Bats observed at Lanaihale (5 sightings) during summer and fall 2007 radar surveys. Also observed at met tower 6 (2 sightings) by Jay Penniman, DOFAW, September 2007.
INVERTEBRATES					
Orange-black damselfly *Megalagrion xanthomelas*	C	C	Found in streams pools and ponds on Lanai, at up to 580 m above sea level.	Year-round	Low. The damselfly is known from four locations on Lanai, Koele Lodge, Maunalei Gulch, Keomoku fishpond and Lopa Fishpond on the western side of the island. Lack of wet habitat on the project area for damselfly populations.
Lanai tree snail (*Partulina semicarinata*)	C	C	Inhabits wet forests on the island of Lanai on tree trunks, stems, and leaves.	Year-round	Low. Lack of forest land in the met tower area and within the met tower footprints.
Lanai tree snail (*Partulina variabilis*)	C	C	Inhabits wet forests on the island of Lanai on tree trunks, stems, and leaves.	Year-round	Low. Lack of forest land in the met tower area and within the met tower footprints.

Status:
Plants* = All 37 sensitive plant species on Lanai are listed in **Appendix D.**

FEDERAL
- E = Endangered
- T = Threatened
- C = Candidate for Federal listing as endangered or threatened
- SoC = Species of concern

STATE
- E = Endangered
- T = Threatened
- SoC = Species of Concern

Sources: NatureServe 2007, DOFAW 2005, **Appendix D**

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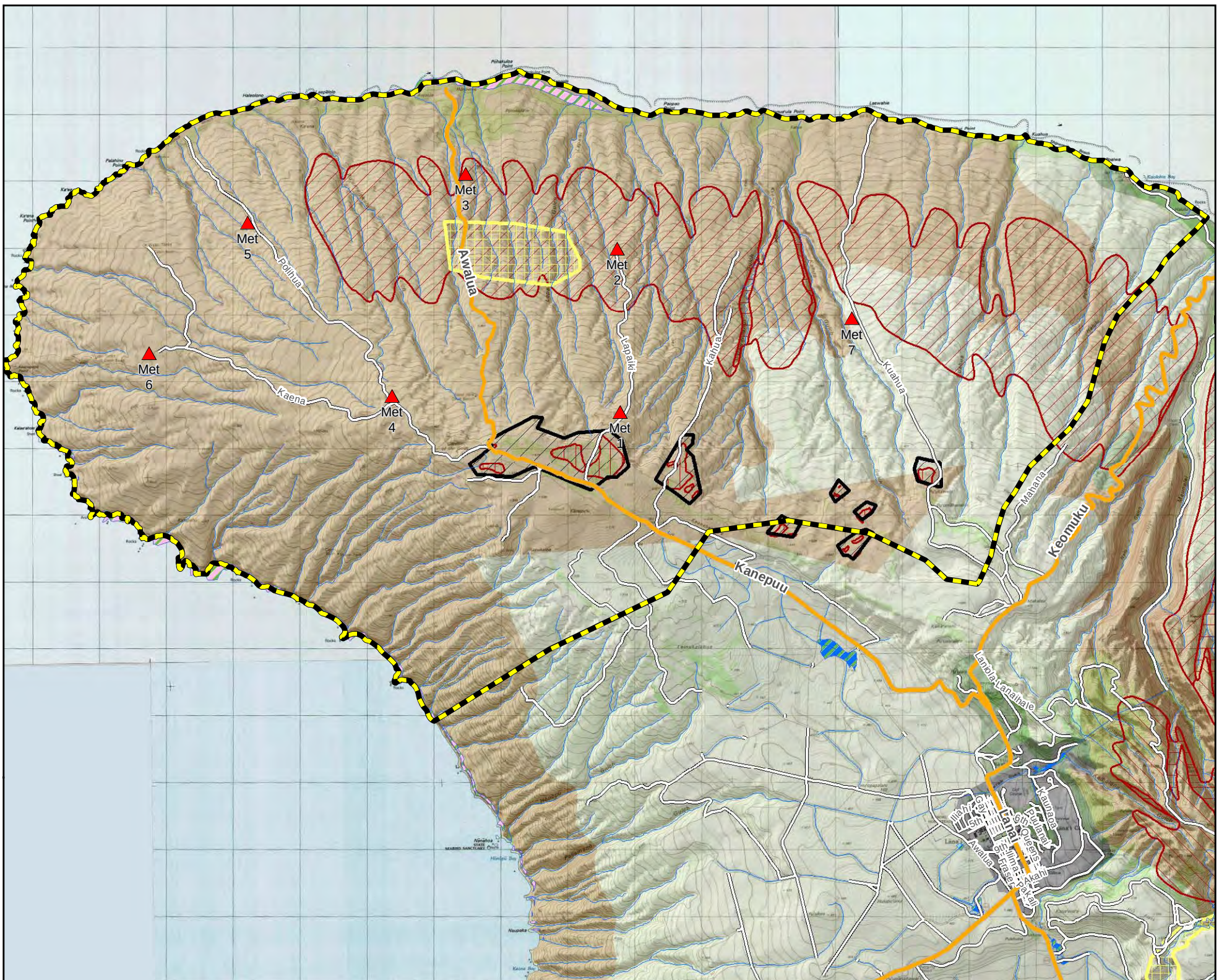


Figure 3-1. Biological and Land Use Constraints

Castle and Cooke Lana'i Meteorological Towers Project

Maui County, Hawaii

- Proposed Met Towers
- Project Boundary
- Nature Conservancy Preserve
- USFWS Designated Critical Habitat

NWI Wetlands

- Freshwater Pond
- Freshwater Emergent Wetland
- Estuarine and Marine Deepwater
- Streams

State Land Use Districts

- Conservation
- Agriculture
- Rural
- Urban

Remaining Native Vegetation

- Lowland Dry Shrubland & Grassland
- Lowland Dry Forest & Shrubland
- Lowland Mesic Forest & Shrubland
- Dry Cliff

Existing Transportation

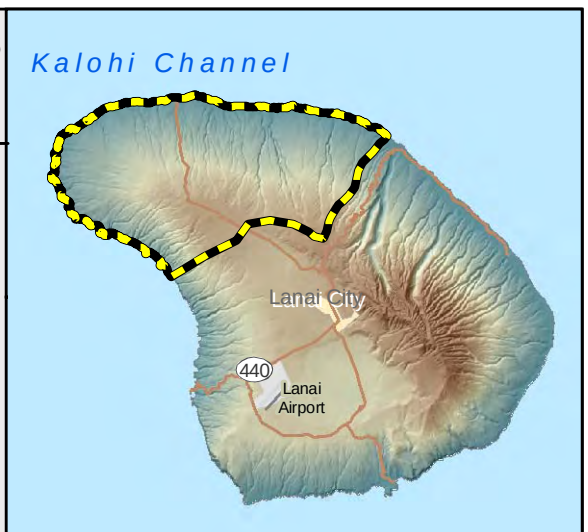
- Highway
- Major Road
- Local Road

1:70,000

0 0.5 1

Miles

June 30, 2008



P:\GIS_2007_PROJECTS\CC_Lanai\maps\EA_and_HCP\EA_Revised_063008\Figure3-2_Survey_Sampling_Locations_063008.mxd

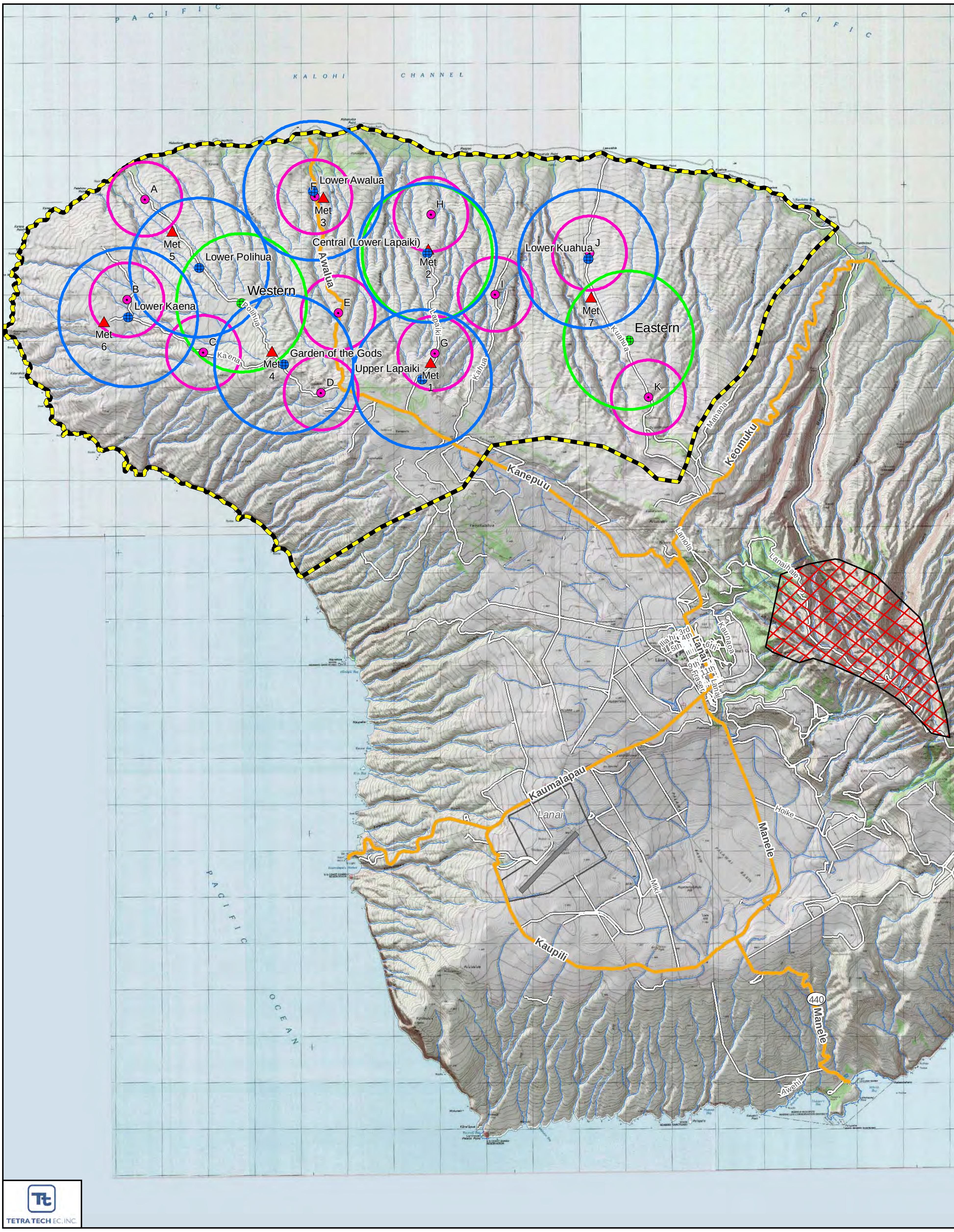


Figure 3-2. Lana'i Survey Sampling Locations

Castle and Cooke Lana'i Meteorological Towers Project
Maui County, Hawaii

Project Facilities

- Proposed Met Towers
- Project Boundary
- Radar Sampling Locations (May/June 2007)
- Radar Sampling Coverage - 1.5 km radius
- Radar Sampling Locations (June/July 2007)
- Radar Sampling Coverage - 1.5 km radius
- Avian Point Count Locations
- 800m Buffer Avian Point Counts

Petrel Colony

Water Bodies

- Streams

Existing Transportation

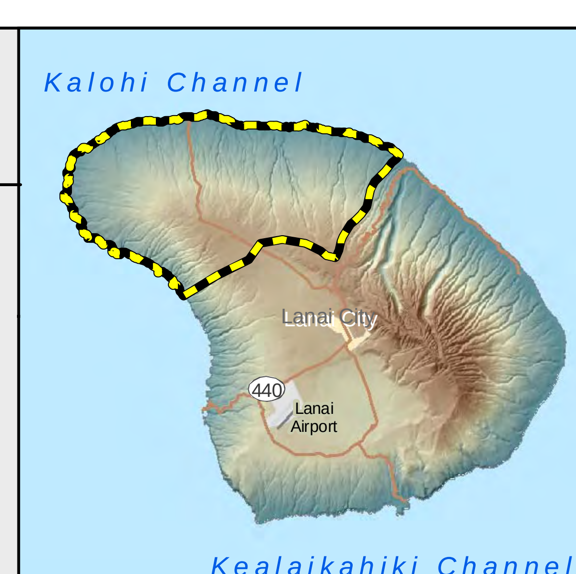
- Highway
- Major Road
- Local Road

1:80,000

0 0.5 1 2

Miles

June 30, 2008



All seven met tower sites were surveyed (tower and guy wire footprints and access routes that deviated from maintained dirt access roads), and the location of each site was documented using a Trimble Geo Explorer Global Positioning System unit to ensure positional accuracy. The following assumptions were made to assess the potential impacts of the Proposed Action on biological resources:

- Construction activities at each site would be confined to the area under the base plate, the guy wire areas, and temporary assembly areas;
- Construction of the met towers would be completed in approximately 30 to 45 days;
- Construction activities would not require grading or scraping the ground surface except at the guy wire anchor points;
- All vegetation for met tower installation was cleared by hand except at anchor points;
- Vegetation at the mitigation site will be cleared with chain saws and other small equipment and mulched with a chipper;
- Should vegetation management be deemed necessary at some of the met tower sites to facilitate post construction monitoring, vegetation would be mowed or cut with a mower, trimmer or other small powered equipment;
- No new access roads would be constructed;
- Met towers would be removed no later than March 1, 2010; and
- Trampling effects on vegetation that may occur during downed wildlife monitoring would be limited to the 126-square-meter search plots centered on each met tower and would be expected to be a less than significant impact.

3.4.1.1 Vegetation

Mixed shrub and grassland occur throughout the project area. Habitat within the footprint of the met towers ranges from barren eroded soils to shrub/scrub interspersed with open grassland areas (**Appendix E**). The dominant shrub/scrub species included the non-native kiawe, verbena, bull thistle, and the native ilima. The open grass areas included alien invasive species such as buffel grass and native grass species such as pili grass. The shallow soils at the sites at the higher elevations (**Figure 1-2**) were often eroded and intermixed with open areas of barren soils. Soils at the lower elevations were generally deeper, and plants were more robust and dominated by non-native grasses. At the lowest elevations, kiawe is denser and grows from 10 to 15 feet (3 to 5 meters) in height. The following provides a brief summary of the vegetation and wildlife observed during the April 2007 site assessment of each met tower location. A photograph of each met tower location prior to installation is provided in **Appendix E**.

Met tower Site 1

Met tower site 1 is located on open, eroded soils; no vegetation was observed within the tower footprint. The dominant vegetation surrounding the project footprint included non-native grasses, verbena, bull thistle, and low-growing kiawe. Two common mynahs (*Acridotheres tristis*) were observed in the area; northern cardinals (*Cardinalis cardinalis*) were heard calling and what appeared to be a short-eared owl (*Asio flammeus sandwichensis*) pellet was observed in the immediate area of the tower footprint. No federally listed species were identified, and no sensitive habitat was present within the tower footprint.

Met tower Site 2

Met tower site 2 consists primarily of open grasslands dominated by non-native grasses, interspersed with ilima, verbena, and open soil areas. A wash is located north of the project footprint with larger kiawe trees, but the wash is well outside the tower footprint. No birds were observed during the field reconnaissance. No federally listed species were identified, and no sensitive habitat was present within the tower footprint.

Met tower Site 3

Met tower site 3 is within an open grassland area dominated by non-native grasses interspersed with small kiawe plants. No birds were observed during the survey. No federally listed species were identified, and no sensitive habitat was present within the tower footprint.

Met tower Site 4

Met tower site 4 is composed predominantly of grassland with small patches of dense kiawe. No birds were observed during the survey. No federally listed species were identified, and no sensitive habitat was present within the tower footprint.

Met tower Site 5

Met tower site 5 is within an open grassland area dominated by non-native grasses interspersed with small kiawe plants. No birds were observed during the survey. No federally listed species were identified, and no sensitive habitat was present within the tower footprint.

Met tower Site 6

Met tower site 6 is covered by shrub/scrub habitat dominated by kiawe. Grass areas consist primarily of non-native grasses interspersed with verbena and ilima. A potential wetland area (vernal pool) was identified west of the original tower footprint, and the met tower location was moved and resurveyed to establish an approximate 200-foot (61-meter) buffer between the site and the potential wetland. No birds were observed during the survey. No federally listed species were identified, and no sensitive habitat was present within the tower footprint.

Met tower Site 7

Met tower site 7 is located within open grassland with large mature kiawe. The area is very rocky with open areas of deeper soils and is heavily used by deer and mouflon sheep, as evidenced by the amount of scat identified. Game trails were easily identified, and large areas appeared to have been disturbed by rooting. Common mynahs were observed during the survey. No federally listed species were identified, and no sensitive habitat was present within the tower footprint.

Potential Impacts to Vegetation

Construction of the met towers requires minor vegetation clearing with hand tools and a small backhoe for digging anchor points at each location. No new access roads are required. Most likely, the vegetation disturbed by the backhoe would be exotic species. The vegetation is expected to naturally recover at the tower sites. Although no listed plant species were observed during previous field assessments, Castle & Cooke conducted a second survey of rare plants in the area surrounding the location of each of the seven met towers. No rare or listed plant species were observed within the vicinity of the met tower locations during this survey (**Appendix E**).

The post construction monitoring surveys to be conducted at each of the sites may temporarily trample plants at some of the more heavily vegetated locations. Where vegetation occurs at the met tower sites, the species are predominantly non-native or invasive plant species. The met towers will be removed by March 1, 2010.

Vegetation management activities deemed necessary at the met tower locations to facilitate surveys would be conducted so as to focus on the non-native species that dominate the project area. The vegetation would ultimately regenerate after management activities no longer occur. Only non-native shrubs would be considered for herbicide if that is determined to be required at select locations.

The Maui Invasive Species Committee (MISC) and DOFAW staff conducted a detailed site assessment of the habitat restoration area to identify any known native and listed plant species. DOFAW staff recognized strawberry guava as a serious threat to the Lanaihale watershed and the petrel in early 2006. DOFAW contracted MISC to conduct the initial phase of vegetation removal within the restoration parcel(s). Vegetation removal will focus on stems greater than 0.4 in (1 cm). Trees will be cut with chain saws, and cut stumps will be immediately treated with herbicide. All cut material will be chipped, and chips will be distributed on and adjacent to the site in a manner which will minimize the area impacted. Stems larger than 6 inches will be offered to Castle & Cooke for their use or used on site for erosion control if such need is identified. Material of this size having no other use will be placed in such a way that it is naturally recycled into the forest soil. Once the invasive plant species are removed, native species will either naturally regenerate or be planted by DOFAW to encourage restoration of the native communities.

Therefore, the Proposed Action at the met towers and mitigation site would have a less than significant effect on vegetation. The effect of removing invasive vegetative species at the mitigation site will have a positive impact on the ecosystem by restoring the natural community.

3.4.1.2 Wildlife

The project area occurs in a “dry tropical forest/tropical low shrublands” ecoregion (National Geographic 2007) that supports various birds, invertebrates, and plant species. Mixed shrub and grassland occurs throughout the project area on Lanai and supports a variety of native and non-native wildlife. No native terrestrial reptiles and amphibians occur on the Hawaiian Islands.

Endemic birdlife on Lanai was historically abundant (Hirai 1978a), although the native forest of Lanai was much reduced by 1900. By the 1930s, the native avifauna had been virtually eliminated, and few native bird species are considered to be reliably present at the current time. The causes of bird extinctions on Lanai are not known, but most likely are a combination of the destruction of the native mountain forest habitat, mosquito-born avian disease, and invasive species such as feral cats, rats, sheep, and pigs. Non-native species that might be expected to occur in the project area include axis deer, Norway rat, black rat, and mouflon sheep.

Nineteen bird species were observed during the spring and fall 2007 avian surveys conducted by Tetra Tech (**Table 3-3**). No threatened or endangered species were observed during the avian surveys, although five state species of concern were noted, including the short-eared owl, Pacific golden plover, white-tailed tropicbird, ruddy turnstone, and great frigatebird. Additionally,

Table 3-3. Bird Species Observed at the Proposed Met Tower Sites during Spring and Fall Point Count Surveys and Radar/Audio-Visual Surveys

Scientific Name	Common Name	Survey	Season	Status
Birds				
Acridotheres tristis	common myna	Avian	S/F	
Alauda arvensis	sky lark	Avian	S/F	
Arenaria interpres	ruddy turnstone	Avian	F	
Asio flammeus sandwichensis	short-eared owl	Avian	S/F	
Cardinalis cardinalis	northern cardinal	Avian	S/F	
Carpodacus mexicanus	house finch	Avian	S/F	
Cettia diphone	Japanese bush-warbler	Avian	S	
Francolinus pondicerianus	gray francolin	Avian	S/F	
Fregata minor	great frigatebird	Avian	S	
Geopelia striata	zebra dove	Avian	S/F	
Himantopus mexicanus knudseni	Hawaiian stilt	Radar	S	E
Lonchura malabarica	Indian silverbill	Avian	S	
Lonchura punctulata	nutmeg manikin	Avian	F	
Meleagris gallopavo	wild turkey	Avian	S	
Mimus polyglottos	northern mockingbird	Avian	S/F	
Phaethon lepturus	white-tailed tropicbird	Avian	S/F	
Phasianus colchicus	ring-necked pheasant	Avian	S/F	
Pluvialis fulva	Pacific golden plover	Avian	F	
Pterodroma sandwichensis	Hawaiian petrel	Radar	S	E
Streptopelia chinensis	spotted dove	Avian	F	
Zosterops japonicus	Japanese white-eye	Avian	S/F	
Season: S=spring/summer, F=fall; Status : SoC= state species of concern, E= state and federally endangered				

dawn-dusk and nocturnal visual and radar surveys conducted by ABR Inc. detected the presence of the endangered Hawaiian petrel and Hawaiian stilt flying over the proposed met tower project area (**Appendix G**).

3.4.1.3 Federally Listed, Special Status, and/or Sensitive Species

Federally Listed Plant Species

Critical habitat exists for 37 plant species on Lanai (**Figure 3-3**; USFWS 2003). The critical habitat designations on Lanai are located in six separate critical habitat units that are designated for three species: *Bidens micrantha* ssp. *Kalealaha, Portulaca sclerocarpa,* and *Tetramolopium remyi*. One of the six designated critical habitat units is located in the dry native shrub and grassland habitat in the met tower project area and is the largest of the six units (Critical Habitat Unit 1; 373 acres or 151 hectares; USFWS 2003). This critical habitat unit is designated for *Tetramolopium remyi*, a multi-island species. Met tower 3 was moved downslope and outside of the critical habitat unit and is located 2,297 feet (700 meters) from the boundary of the critical habitat unit. Met tower 2 is located 1,903 feet (580 meters) east of the critical habitat unit boundary.

In addition to *Tetramolopium remyi*, there is potential for the occurrence of other listed plant species, including *Hibiscus brackenridgei* and *Abutilon eremitopetealum,* within the vicinity of a proposed met tower (**Table 3-2**; full list of 37 USFWS listed species in **Appendix D**). Conversations with DOFAW revealed that its primary concern was for these three species (DOFAW, pers. comm. 2007). Several of these rare species can lie dormant in the seed bank until a major rain event.

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Figure 3-3. Project Area Sensitive Species

Castle and Cooke Lana'i Meteorological Towers Project
Maui County, Hawaii

Hawaii Biodiversity and Mapping Program

- 1, Abutilon menziesii
- 2, Acacia koaia
- 3, Bidens micrantha subsp. kalealaha
- 4, Bobea sandwicensis
- 5, Bonamia menziesii
- 6, Canavalia pubescens
- 7, Chamaesyce celastroides var. laehiensis
- 8, Chelonia mydas
- 9, Cyperus fauriei
- 10, Cyperus trachysanthos
- 11, Eragrostis deflexa
- 12, Gardenia brighamii
- 13, Haplostachys munroi
- 14, Hibiscus/subsp. brackenridgei
- 15, Nesoluma polynesicum
- 16, Nestegis/Diospyros sandwicensis
- 17, Nothocestrum latifolium
- 18, Santalum freycinetianum var. lanaiense
- 19, Scaevola coriacea
- 20, Sesbania tomentosa
- 21, Spermolepis hawaiiensis
- 22, Tetramolopium/subsp. lepidotum
- 23, Tetramolopium remyi
- 24, Vigna o-wahuensis
- 4, 5, 15, 17, 18 Occur Throughout this Area

Project Boundary
Proposed Met Towers
Streams

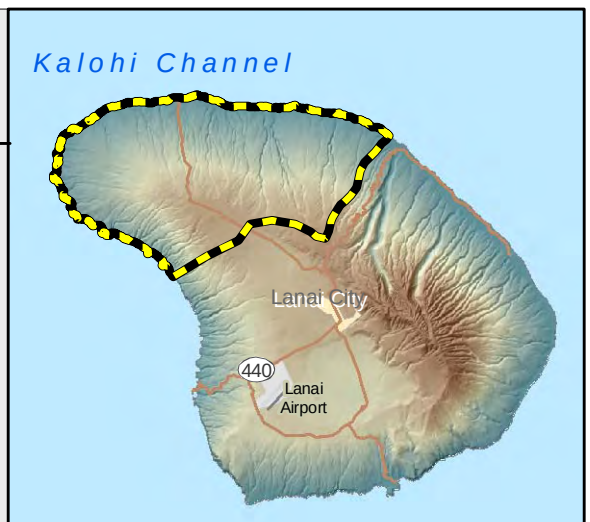
Existing Transportation

Highway
Major Road
Local Road

1:70,000

0 0.5 1
Miles

June 30, 2008



TETRA TECH EC, INC.

Tetramolopium remyi

Tetramolopium remyi (no common name) is a short-lived member of the sunflower family (Asteraceae). *Tetramolopium remyi* is found in red, sandy, loam soil in dry *Dodonaea viscose-Heteropogon contortus* communities at elevations between 213 and 1,591 feet (65 and 485 meters). This species flowers between April and January but can lie dormant in the seed bank until a drought has ended. Historically, the species was known from Maui and Lanai. Currently, the species is known from one occurrence on Lanai on private land near Awehi Road, with a total of approximately 150 plants (USFWS 2003**; Appendix D**).

Mao hau hele

Mao hau hele or *Hibiscus brackenridgei* ssp. *brackenridgei* is a short- lived perennial shrub or small tree and a member of the mallow family (Malvaceae). This species is known to flower from early February through late May and intermittently at other times of the year. The subspecies *brackenridgei* occurs in lowland dry to mesic forest and shrubland between 0 and 2,116 feet (0 and 645 meters) in elevation. Historically, *Hibiscus brackenridgei* was known from all the main Hawaiian Islands, and currently the subspecies *brackenridgei* is known from Lanai, Maui, and Hawaii.

On Lanai, there are two known occurrences with an unknown number of individuals from Keamuku Road and the dry plains of Kaena Point (**Appendix D**). Re-introduced individuals are also naturally reproducing at TNC preserve Kanepuu.

Hidden-petaled abutilon

Hidden-petaled abutilon (*Abutilon eremitopetalum*) is a perennial shrub found in lowland dry forest at elevations between 354 and 2,165 feet (108 and 660 meters) that occurs in gulches in dry forest and shrubland habitat. The current range for this species exists only on Lanai. Currently, about seven occurrences of plants have been observed on Lanai, with estimates of fewer than 1,000 total plants.

The second rare plant survey conducted during the rainy season (November 26 to 28, 2007) at each of the seven met towers did not document any rare or listed plant species within the vicinity of the met tower locations.

Federally Listed Wildlife Species

Ten federally listed wildlife species potentially occur on Lanai (**Appendix D**). These species are the Hawaiian monk seal (*Monachus schauinslandi*), Hawaiian hoary bat, Pacific green sea turtle (*Chelonia mydas*), Hawksbill sea turtle (*Eretmochelys imbricate*), Hawaiian petrel, Hawaiian coot (*Fulica alai*), Hawaiian duck (*Anas wyvilliana*), Ou (*Psittirostra psittacea*), Hawaiian stilt, and Newell's shearwater. The met towers would be located on upland portions of the island and are not expected to affect marine animals, therefore the Hawaiian monk seal and sea turtles are excluded from further consideration. The Hawaiian coot and Hawaiian duck have a low potential for occurrence as no open water or significant wetland habitat occurs at the met tower sites. The Ou is believed to be extinct on Lanai. Two Lanai tree snail species and the orange-black damselfly (*Megalagrion xanthomelas*) were documented as candidates for listing and are discussed below. Of those species identified by USFWS as threatened, endangered, or a candidate species for listing, the four species with the highest potential for occurrence in the project area are the Hawaiian petrel, Hawaiian hoary bat, Hawaiian stilt, and Newell's shearwater.

Hawaiian petrel

The Hawaiian petrel was listed by the USFWS as an endangered species under the federal ESA on March 11, 1967 (USFWS 1983). The Hawaiian petrel is also one of Hawaii's state -protected species. This species formerly nested in large numbers on all the main islands in the Hawaiian chain except Niihau. Currently, Hawaiian petrels nest at high elevations on Maui, primarily in Haleakala National Park, and in smaller colonies on Kauai, Hawaii, Molokai and in a more recent discovery, on Lanai. Population estimates for this species are mainly based on at-sea numbers, with the total population of Hawaiian petrels estimated to be 20,000, with an estimated 4,500 to 5,000 nesting pairs on Kauai and Maui (DOFAW 2005).

A colony of Hawaiian petrels was confirmed in 2006 on the Lanaihale ridge on Lanai. Although the petrel colony was historically known to occur, its status was unknown and expected to have dramatically declined until surveys were conducted in 2006 (DOFAW, pers. comm. 2008). The Hawaiian petrel colony is located approximately 7 miles from the nearest met tower and approximately 11 miles from the western-most (farthest) met tower. DOFAW has been conducting studies of the colony since it was identified to better understand the size and dynamics of the population. Preliminary nesting data from DOFAW indicate that the breeding season in the Lanai colony may occur up to one month later than other colonies in the Hawaiian Islands. While the population size has not been estimated with statistical confidence, it is estimated that at least a thousand birds are using the habitat within the Lāna'ihale (Penniman, pers. comm. 2007).

To better understand the potential presence and movement of Hawaiian petrel, Newell's shearwater, and Hawaiian hoary bat within the WRA, Castle & Cooke contracted to have radar and audio-visual surveys conducted within the project vicinity. ABR, Inc. conducted surveys to collect data on the movements, behavior, and flight altitudes of the seabirds and bat to estimate fatality rates, exposure risks, and use of the area by these species. The initial survey was conducted in late May-June 2007 at 3 sites within the WRA (**Figure 3-2**). The late May-June sampling was conducted at three sites for 15 nights of sampling. During subsequent meetings with DOFAW and USFWS, the agencies requested revisions to the survey protocol. DOFAW and USFWS recommended that the surveys be conducted to correspond with the periods of time when the maximum number of birds are expected to be on the island, during the fledging period, and at all seven proposed met tower locations. Three survey windows were established: pre-breeding/spring (April–May), breeding/summer (July–August), and fledging/fall (late October–December). DOFAW's initial studies of the petrel colony indicated this population may breed and fledge approximately one month behind petrel colonies on other islands (Penniman, pers. comm. 2007).

Additional surveys were then scheduled to comply with agency recommendations. The summer sampling survey was conducted late June to July 2007 at the seven proposed met tower sites for 35 nights of sampling. Radar surveys were conducted early November through early-December 2007 (fledging) and are scheduled for April through May 2008 (spring). Fledging season radar surveys ended on December 7, 2007 upon confirmation from DOFAW that petrels had fledged and most birds had left the island. A summary report for the May-June and June-July 2007 surveys is provided in (**Appendix G)**. The summary report for all data collected to date is not yet available.

During the spring and summer surveys by ABR, audio-visual observations recorded 33 petrels and 2 unidentified petrels/shearwaters. Radar sampling recorded 170 petrel/shearwater targets

and 427 probable petrel targets in spring and summer surveys. Movement rates showed that fewer targets flew over the western portion of the study area during both surveys.

Newell's shearwater

Newell's shearwater is a pelagic seabird listed by the USFWS as a threatened species under the federal ESA on October 28, 1975. Newell's shearwater is also a state-threatened species and is protected in the State of Hawaii. Historically, Newell's shearwater was once abundant on all the main Hawaiian Islands. Newell's shearwater is currently known to nest on Kauai and Hawaii and may also nest in small numbers on Molokai and Oahu. However, breeding has not been confirmed on these smaller sites. On Kauai, Newell's shearwaters nest in mountainous terrain between elevations of 500 and 2,300 feet (152 and 701 meters) (USFWS 2007). From at-sea counts conducted in 1994, the total population for Newell's shearwater was estimated to be 84,000 birds (Spear et al. 1995). Recent radar target data (Day et al. 2003), however, from 1993 to 1999-2001 indicate the population may have declined approximately 60 percent from those estimates (Day et al. 2003; Nick Holmes pers. comm. 2008). The current population breeding size is estimated to be 14,600 birds (DOFA 2005 unpubl.), with approximately 75 percent occurring on the island of Kauai.

DOFAW has heard Newell's shearwater calls on occasion during nighttime surveys at the Hawaiian petrel colony on Lanai but breeding at the colony by shearwaters has not been documented. ABR, Inc. (see **Appendix G**) indicated that other researchers consider Newell's shearwater to be rare and doubt that the species nests on Lanai. No Newell's shearwaters were observed during the 2007 audio-visual survey or confirmed during the radar surveys on Lanai. The fledging and spring 2008 season radar surveys would document any shearwater observations.

Hawaiian hoary bat

The Hawaiian hoary bat was listed by the USFWS as an endangered species under the federal ESA on October 13, 1970 (USFWS 1998). The Hawaiian hoary bat is also a state-endangered species. Relatively little research has been conducted on this endemic Hawaiian bat and data regarding its habitat and population status are very limited. Most of the available documentation suggests that this solitary bat roosts among trees in areas near forests and forages in a variety of habitats, including open pastures and more heavily forested areas in both native and non-native habitats. The Hawaiian hoary bat until recently has been documented on the islands of Hawaii, Maui, Oahu, Kauai, and Molokai, but it may breed only on Hawaii and Kauai (Kepler and Scott 1990). Population estimates for this species have ranged from hundreds to a few thousand; however, these estimates are based on limited and incomplete data (USFWS 2007).

At the beginning of the met tower project planning phase, Hawaiian hoary bats were believed to have the potential to occur on Lanai because of its proximity to Maui, where hoary bats have been documented. ABR, Inc. made one visual sighting of a Hawaiian bat near the Garden of the Gods. This one sighting was the only bat recorded during 485 radar sampling sessions (0.005 bats/hour) (**Appendix G**). During an avoidance behavior study, ABR Inc. recorded four sightings of Hawaiian bats during that survey period near the summit of Lanaihale. Jay Penniman, a DOFAW biologist, noted two bat visual sightings near Met tower 6 in September 2007 (Penniman, pers. comm. 2007). Although Hawaiian hoary bat presence has been documented on Lanai, their breeding status is not known. The fledging and spring season radar surveys, as described above, will continue to document any bat observations.

Hawaiian stilt

The federally endangered Hawaiian stilt was historically documented on all the major islands except Lanai and Kahoolawe. Currently, Hawaiian stilts inhabit seven of the Hawaiian Islands: Hawaii, Kauai, Maui, Molokai, Oahu, Niihau, and Lanai (Reed et al. 1998). This wading bird forages in ephemeral wetlands and feeds opportunistically on a variety of shallow-water animals. The Hawaiian stilt frequently moves between wetland habitats, although little is known of its movement patterns on Lanai. The Lanai population consists of permanent breeding residents at the Lanai City Wastewater Treatment Plant (WWTP) ponds. Nesting and foraging habitat differ, and the stilts move between these two habitat types daily during the breeding season. Hawaiian stilts nest on freshly exposed mudflats interspersed with vegetation or on islands in fresh or brackish ponds. The Hawaiian stilt uses ephemeral wetlands, below 660 feet, for foraging and they are quick to colonize newly created wetlands. The nesting season extends between March and August but varies between years based on water levels. Semi-annual waterbird counts for all the islands between 1993 and 2003 document an average annual population of approximately 1,300 Hawaiian stilts. The population on Lanai is small, with a yearly average of 55 adults between 1999 and 2003 from winter counts, with a high of 100 birds (USFWS 2005). The main threats to the population include habitat loss of coastal plain wetlands and introduced predators such as feral cats, rats, and dogs.

Although Hawaiian stilts are known to occur in Lanai City, they are believed to have a low potential for occurrence in the project area. Spring and summer 2007 radar surveys recorded one Hawaiian stilt flying near Met tower site 1 (Cooper et al. 2007). The Hawaiian stilt was observed flying south at 200 m above ground level at dusk on July 3, 2007. Only one stilt was recorded during 485 radar sampling sessions (0.005 stilts/hour), and no stilts were observed during spring and fall avian point count surveys. The radar surveys described above will continue to document any Hawaiian stilt observations.

Hawaiian coot

The federally endangered Hawaiian coot inhabits all the main Hawaiian Islands, except Kahoolawe. Maui Nui (Maui, Molokai, and Lanai) has the second largest population in the state (Oahu has the largest population). The entire population is estimated between 2,000 and 4,000 individuals. The Hawaiian coot is an endangered species found in fresh- and brackish-water marshes and ponds. This species was not observed during the avian surveys to date.

The Hawaiian coot is associated with open water and wetlands with standing water. There are small vernal pools in the met tower project area, but they are not likely to provide habitat for this species because of their small size and seasonal impermanence. Based on the lack of wetlands and open water in the project vicinity, this species is not expected to occur or be affected by the met tower project.

Hawaiian duck

The endemic Hawaiian duck is federally and state endangered. The Hawaiian duck's former range included all of the Hawaiian Islands except Lanai and Kahoolawe but is currently distributed on Oahu, Hawaii, and Kauai. Current estimated populations are 2,000 Hawaiian ducks on Kauai-Niihau, 300 on Oahu, 25 on Maui, and 200 on the Big Island. Hawaiian ducks are found in lowland wetlands, river valleys, and mountain streams in both natural and man-made ponds and wetlands. Kauai's network of streams has been estimated to provide habitat for 96 percent of the Hawaiian duck population.

There are no known Hawaiian duck sightings from Lanai. The Hawaiian duck is associated with wetland, pond, and stream habitats, which are not present in the met tower project area. Therefore, this species is not expected to be affected by the met tower project.

Lanai tree snails

These species of tree snail are candidates for listing because populations are restricted to 12 locations, of which only 2 are sizable and have multiple threats. Qualitative accounts indicate *P. semicarinata* was once widespread and abundant, but it is now restricted to several viable populations. Survey work completed in 1994 uncovered *Partulina semicarinata* at 12 locations, and a total of 105 individuals were observed (32 adult, 56 juvenile, and 17 newborn snails). Some of the sightings occurred with a closely related and equally rare species, *P. variabilis*. These species inhabit wet forests on Lanai on tree trunks, stems, and leaves that provide the fungi that the snails eat.

The two species of rare tree snail on Lanai were not observed during the proposed met tower footprint reconnaissance. It is unlikely the tree snails are present in the met tower footprints because of the lack of trees in the area. The mitigation site at the Lanaihale is forested, and therefore has a greater potential for tree snails. DOFAW will survey for Lanai tree snail species prior to the clearing of vegetation. Any snails that are observed during surveys will be mapped and protected By DOFAW throughout restoration and maintenance activities. This species would not be expected to be affected by the met tower project or mitigation activities.

Orange-black damselfly

The orange-black damselfly is a candidate for listing and is historically known from all the main Hawaiian Islands except Kahoolawe. Its range is now reduced to 25 populations on Oahu, Lanai, Molokai, and Hawaii islands. On Lanai, the damselfly breeds mostly in coastal wetlands but also in perennial streams and can breed in reservoirs and ornamental ponds. The damselfly is known from four locations on Lanai on the western side of the island: Koele Lodge, Maunalei Gulch, Keomoku Fishpond, and Lopa Fishpond.

Based on the lack of permanent wet habitat, the orange-black damselfly is unlikely to occur within the project area. The project is unlikely to affect current damselfly populations on Lanai.

3.4.1.4 Hawaii State Species of Concern

Federally listed species on Lanai (described above) that have a higher likelihood of occurrence in the project area are also Hawaii Species of Greatest Conservation Need. The Hawaii Species of Greatest Conservation Need lists an additional five species that occur in the met tower project area: Hawaiian short-eared owl, Pacific golden plover, ruddy turnstone, white-tailed tropicbird, and great frigatebird (DOFAW 2005).

Hawaiian short-eared owl

The Hawaiian short-eared owl (called *pueo*) is found on all the main Hawaiian Islands from sea level to 8,000 feet (2,450 meters) and is protected only on Oahu. Little is known about the breeding biology of the short-eared owl, but nests have been found throughout the year. The current population status is unknown because of the few detections, although Hawaiian short-eared owls were widespread at the end of the 19th century and are thought to be declining. This owl species occupies a variety of habitats, including wet and dry forests, but is most common in open habitats such as grasslands, shrublands, and montane parklands.

During both the spring and fall avian point count surveys, the Hawaiian short-eared owl was observed in the met tower project area. During the spring surveys, there were 11 separate observations and 12 observations during the fall 2007 point count surveys.

Pacific golden plover

The Pacific golden plover is a migratory shorebird, previously considered a subspecies of the lesser golden plover. The winter range of this species is wide-ranging, from the South Pacific and Japan through southern Asia and the Middle East to northeast Africa. This species over-winters in Hawaii from breeding grounds in Alaska and are found in short-grass prairie, pastures, mudflats, sandy beaches, and flooded fields. The Pacific golden plover was observed during the fall 2007 avian point count surveys.

Ruddy turnstone

The ruddy turnstone is a migratory shorebird that over-winters across a large area that includes the Hawaiian Islands. In winter, this species is almost exclusively coastal, foraging mostly along stony or rocky shorelines with abundant seaweed. In Hawaii and other Pacific Islands, the ruddy turnstone is also common on sandy shorelines and in mudflats and river deltas. Preferred habitats include ocean beaches along sheltered coastlines or bordering estuaries and other wetlands. Global population has been estimated at approximately 445,000 individuals, of which about 60 percent (267,000) breed in North America. During the fall 2007 avian surveys, nine observations of this species were recorded flying over the northeastern portion of the met tower project area.

White-tailed tropicbird

The white-tailed tropicbird is a native seabird to the Hawaiian Islands that forages on the open ocean. This species is known to nest in the Kaholo Pali, Maunalei Gulch, and Hauola Gulch on Lanai, outside of the met tower project area. Nests are built on cliffs as well as in caves and tree hollows. In Hawaii, breeding occurs March through October. Outside the breeding season, adults are solitary and pelagic, and their range is poorly known. This species was observed once each in the spring and fall avian surveys and also occurred in incidental observations. Based on flight-altitude data from the point count surveys, white-tailed tropicbirds were flying at altitudes higher than the proposed met towers.

Great frigatebird

The great frigatebird is a native seabird to the Hawaiian Islands that forages on the open ocean. Flight is characterized by long periods of soaring. An adept aerial flier, the species obtains some of its food by harassing other seabirds until they regurgitate their prey. These birds nest in colonies, often with other species, ranging from ten to thousands of pairs, and construct platform nests in low bushes. The great frigatebird was observed once each in the spring and fall avian surveys. Based on flight-altitude data from the point count surveys, great frigatebirds were flying at altitudes higher than the proposed met towers.

Although these species are not expected to be affected by the proposed met towers, bird diverters, flagging, and fluorescent tubing would make the guy wires more visible to these avian species of concern and minimize the risk of collision.

3.4.1.5 Migratory Birds

The MBTA of 1918, as amended (16 U.S.C. 703 *et. seq.*), protects all migratory birds. Under the MBTA, nests (nests with eggs or young) of migratory birds may not be harmed, nor may migratory birds be killed.

Bird species observed during two avian point count seasons are listed in **Table 3-3**. No nests from previous breeding seasons were found near the proposed met tower sites. The Pacific oceanic route is used by the Pacific golden plover, bristle-thighed curlew, ruddy turnstone, wandering tattler, and other shorebirds. The ruddy turnstone, and probably other shorebirds migrating from the islands of the Bering Sea, have an elliptical route that takes them southward via the islands of the central Pacific and northward along the Asiatic coast.

Bird diverters, flagging and fluorescent tubing are added to the tower guy wires to minimize the potential for collision and increase the visibility of the met towers and associated guy wires to migratory species. Removal of native vegetation would be avoided or minimized to the extent practical. With implementation of these avoidance measures, impacts to migratory birds are expected to be less than significant.

3.4.2 Potential Impacts to Listed Species

3.4.2.1 Plants

During the September 2007 coordination meeting with DOFAW and USFWS, DOFAW stated that of the 37 listed plant species known to have historically occurred on Lanai, *Hibiscus brackenridgei, Tetramolopium remyi,* and *Abutilon eremitopetalum* were considered to have the most potential to occur at the proposed met tower sites. No listed plant species were observed during biological surveys of the met tower locations conducted in April 2007 and November 2007. Therefore, no impacts to federally listed plant species are anticipated as a result of met tower installation and operation.

As part of the mitigation area to be discussed in Section 3.4.3.1, habitat restoration would be implemented in three- or six-acre parcels at the petrel colony on the Lanaihale. Surveys for listed species were conducted before restoration activities were initiated. Should any listed plant species be identified, measures would be taken to avoid areas where individuals or populations are documented.

3.4.2.2 Wildlife

The Hawaiian petrel, Hawaiian hoary bat, Newell's shearwater, and Hawaiian stilt are four federally listed wildlife species with the potential to fly in the vicinity of the proposed met tower sites. Individuals may collide with a met tower or a guy wire while in flight. Complete avoidance of risk to the four listed wildlife species is not possible for this alternative. Therefore, Castle & Cooke plans to minimize the risk of collision as much as possible by maximizing the visibility of the met towers and guy wires while ensuring that met data collection is not compromised. These measures include the following:

- Towers are sited primarily on the western side of the WRA to maximize the distance from the petrel colony.
- Each of the met towers is marked with white, 1-inch polyvinyl tape fitted to the guy wires to increase visibility and subsequently increase the likelihood of avoidance by the seabirds and bat. The polyvinyl tape is cut into 4-foot segments, folded in half over the

wire, and attached using ultra-violet light resistant zip ties, leaving at least 6-foot gaps above and below the anemometers. Bird diverters are added between the taped sections. Additionally, two 3-foot sections of yellow PVC tubing are placed on each guy wire, starting at the anchor points. This amount of PVC tubing is the maximum that can be applied to the guy wires without causing excessive loading and drag. This tape has reduced petrel collisions with fences on other projects within the Hawaiian Islands when wrapped along the length of the wire (USFWS and DOFAW, pers. comm. 2007).

- Castle & Cooke removed Met tower 8 from further consideration to minimize the number of towers erected and to reduce the potential for collision with a met tower or guy wire.
- The met towers are scattered throughout the WRA so they are not concentrated in one location.
- No lighting was needed for the met towers because they are less than 200 feet high (FAA 2007).

Hawaiian petrel

Using movement-rate (see **Appendix G**) and flight height data collected during the spring and summer of 2007, Castle & Cooke developed a range of estimated annual fatality rates for each met tower by assuming that 0, 50, 95, and 99 percent of all Hawaiian petrels flying near a met tower see and avoid the tower. Flight height data indicated that of birds flying through the WRA, 64 percent fly at altitudes low enough to interact with a met tower. This percent is the midpoint of the landward (87%) and seaward (41.7%) percentages of targets at or below tower height. This assumes that roughly equal numbers of landward and seaward targets will pass within the wind project area. The estimated range of petrel fatalities at met towers 1 through 7 over a 2-year period is 5 to 25 birds, using avoidance rates of 95 and 99 percent. These fatality rates do not take into account the results of the recent 2007 fledging season radar surveys, where lower numbers of birds were observed compared with spring and summer. In addition, the petrels had fledged by December 7, and the model used to estimate the fatality rates assumed that the fledging period ends later in December. Finally, the model assumptions do not consider the use and effects of flagging, diverters, and tower painting, all of which increase tower visibility and likely reduce the risk of collisions. Thus, these three factors would likely lower estimated annual fatality rates presented for the spring and summer surveys (Cooper, pers. comm. 2007).

Based on radar data and expected avoidance behavior, Castle & Cooke established Tier 1 and Tier 2 take limits of seven and 14 Hawaiian petrels, respectively, as a result of collision with one or more of the met towers prior to March 1, 2010, which trigger different mitigation obligations (see Section 3.4.3.1). Since an active breeding colony of petrels exists at the Lanaihale, there is the potential that indirect take of petrels could occur if an adult is killed while incubating an egg or rearing a chick. However, loss of an adult during the nesting season may not always be associated with the loss of that year's young because petrels can abandon young several weeks before they fledge, and young die from other causes such as predation. During the spring season, a large number of non-breeders may also be present on the island.

If Tier 2 take limits are reached without an approved amendment to the HCP, the towers will be taken down. However, if Tier 2 take limits are reached at the end of the fledging season but prior to the following years' spring breeding season, the met towers would be removed approximately two weeks prior to the beginning of the seabird breeding season, pending approval by DLNR and USFWS. In the event towers need to be removed before project

completion, tower removal would be initiated within three days and be completed 10 days after initiation of tower removal.

Newell's shearwater

Radar and visual studies to date have not verified the presence of Newell's shearwaters within the WRA, although a few unidentified petrel and shearwater targets were documented. This species has not been confirmed to breed on Lanai. Thus, the potential for take of shearwaters as a result of collision with the met towers is extremely low. However, the potential for take must be considered because DOFAW has documented their presence on at least one occasion in the Lanaihale petrel colony. In consultation with USFWS and DOFAW, Castle & Cooke established a take limit of two Newell's shearwaters as a result of collision with one or more of the met towers prior to March 1, 2010.

Hawaiian hoary bat

One Hawaiian hoary bat was recorded during 485 radar sampling sessions (0.005 bats/hour) within the WRA (**Appendix G**), and there have been limited observations of the bat on the island. Thus, the potential for take of a hoary bat as a result of collision with the met towers is low. Hawaiian hoary bats forage for insects in open areas such as grasslands and shrublands at variable heights but tend to roost in tree foliage, which is absent from the met tower locations. Hawaiian hoary bats are not known to roost on Lanai and are believed to occur on the other Hawaiian Islands in greater numbers. Population estimates range from hundreds to a few thousand (USFWS 2007).

A Hawaiian hoary bat would have the potential to collide with the tower or guy wires while foraging. Hawaiian hoary bats have been found, both dead and alive, after colliding with barbed-wire fences on the Big Island of Hawaii (Gorresen, pers. comm. 2008). Reports of bat fatalities associated with met towers are scarce, but some studies discuss bat mortality as a result of collision with turbines. Monitoring studies completed since 2001 have indicated that some wind energy facilities have killed a number of bats. Studies seem to indicate that bats are struck by the moving rotor blades rather than collide with the turbine or non-operational turbine (Kunz et al. 2007). Therefore, it may be that moving parts represent the larger threat to the bats rather than collisions with stationary structures such as met towers. Furthermore, tree-roosting bats that migrate long distances are more commonly killed by turbines than are other bat species. The highest number of bat fatalities in North America at wind energy facilities appears to be along forested ridgetops in the eastern U.S. and lowest in relatively open landscapes in the mid-west and western states (Kunz et al. 2007). Hawaiian hoary bats roosting habitat is absent from the met tower locations. Therefore, potential impacts from collision with met towers are expected to be very low, if any. However, in the slight chance that a bat would collide with one of the met towers, the Hawaiian hoary bat has been included as a covered species by the HCP. In consultation with USFWS and DOFAW, Castle & Cooke established a take limit of two hoary bats, as a result of collision with one or more of the met towers prior to March 1, 2010.

Hawaiian stilt

Hawaiian stilts on Lanai reside at the WWTP ponds in Lanai City, which are roughly 12 miles from the closest met tower. Although no foraging or nesting habitat occurs within the vicinity of the met tower locations, Hawaiian stilt would have the potential to collide with met towers or guy wires while they travel between wetland sites or to tidal flats on other parts of Lanai or other islands (Englis and Pratt 1993; Reed et al. 1998). Reports of waterbird fatalities associated with

met towers are limited, but some wind turbine facility studies have documented waterbird fatalities, such as grebes and coots (Johnson et al. 2002, Anderson et al. 2005).

One Hawaiian stilt was observed near Met tower 1 (at 200 meters above ground level) during 485 radar sampling sessions, and no observations were made during spring and fall point count surveys. Thus, the potential for incidental take of Hawaiian stilts as a result of collision with met towers is very low, if any. However, in the slight chance that a Hawaiian stilt would collide with one of the met towers, the stilt has been included as a covered species in the HCP. In consultation with USFWS and DOFAW, Castle & Cooke established a take limit of two Hawaiian stilts, as a result of collision with one or more of the met towers prior to March 1, 2010.

In cooperation with USFWS and DOFAW, the HCP and ITP would be finalized to establish a maximum take limit for each of these species through the period up to March 1, 2010. Mitigation measures would be implemented to compensate for the authorized level of incidental take for Hawaiian petrel, Newell's shearwater, Hawaiian stilt, and Hawaiian hoary bat. These mitigation measures are briefly described in Section 3.4.3 and are more fully discussed in the HCP. The mitigation program would negate impacts to these four species and would provide a net benefit to their populations on Lanai.

3.4.3 Mitigation for Potential Wildlife Impacts

Mitigation measures may include a wide variety of options. In considering mitigation for this project, several criteria were considered in developing the proposed mitigation plan. These criteria include:

- Mitigation programs should be based on sound biological principles, be practical, and be commensurate with the impacts to be addressed.
- Mitigation should be species-specific.
- Mitigation measures can contribute to recovery or have a net benefit to the species.
- Mitigation can include habitat enhancement or restoration of degraded or former habitats.
- Mitigation alternatives may include studies and strategies that provide new information for a poorly documented species, which could in turn have merit when this information helps identify efforts to improve survival and productivity.

The proposed mitigation plan is expected to have a net benefit for the four covered species through predator control, restoring native nesting habitat for seabirds, and providing roosting and foraging habitat for the bat. The predator control will benefit both juvenile and adult stilts. Furthermore, the ongoing studies being implemented by Castle & Cooke as part of this project will serve to increase the knowledge of these species on Lanai.

As discussed in meetings with DOFAW and USFWS, the basic population biology (distribution, abundance, population, and threats) has not been fully established for the Hawaiian petrel, Newell's shearwater, Hawaiian stilt, and Hawaiian hoary bat on Lanai. The petrel colony at Lanaihale was only recently rediscovered in 2006. Although the size of the petrel population has not been estimated with statistical confidence, it is estimated that at least a thousand birds are using the habitat within the Lānaʻihale (Penniman, pers. comm. 2007). The presence of Newell's shearwaters was verified on the island during surveys of the petrel colony. The Hawaiian stilt occurs primarily on the island as a result of man-made habitat at the city WWTP, but larger

numbers are documented on the other islands. Research is ongoing to more fully document the extent of the Hawaiian hoary bat population, although it is expected to occur in higher numbers on Hawaii and Kauai.

3.4.3.1 Tiered Mitigation Approach

Castle & Cooke consulted with biologists from DOFAW and USFWS to identify appropriate mitigation measures to compensate for potential incidental take of the four listed wildlife species and determined that the recommended mitigation measures would address potential impacts to all four species. Therefore, a comprehensive mitigation plan is provided below, rather than four separate mitigation plans for each species.

The first tier of mitigation (Tier 1) would compensate for a take limit of seven Hawaiian petrels, two Newell's shearwaters, two Hawaiian stilts, and two Hawaiian hoary bats. The mitigation has been structured to compensate for observed direct take and indirect take. Should the Tier 1 take limit be reached for the petrel, additional mitigation would be implemented (Tier 2). Thus, Tier 2 mitigation would compensate for the take of 14 Hawaiian petrels.

Castle & Cooke proposes to fund a project-specific mitigation plan that would be integrated into the ongoing interagency seabird conservation project and the watershed enhancement program on Lanai. This collaboration ensures that a coordinated and cost-effective program will be implemented by DOFAW. The mitigation plan includes two primary components: predator control and habitat restoration. The combination of these mitigation measures would provide immediate- and long-term benefits for each species by increasing adult and juvenile survival, nest success, and suitable nesting habitat required for the long-term productivity of these species.

Castle & Cooke will also implement a wildlife education and observation program for all staff members who will be at the project area on a regular basis. This will enable staff to identify the listed native species that may occur in the area and understand the appropriate steps to be taken when a downed bird or bat is discovered. This program includes a handout that shows a photograph of each of the listed species and the protocol to follow when a downed bird or bat is found.

Subsequent measures implemented by DOFAW will allow the agencies to assess the effectiveness of the mitigation methods. The monitoring results can be used to enhance the effectiveness of the management activities here and at other seabird colonies throughout Hawaii. This could result in a greater net benefit to bird and bat populations beyond the initial net benefit to the birds and bats on Lanai.

<u>Predator Control</u>

Predation of young and adults is considered one of the primary threats to all four species. Feral cats, barn owls, and rats are the predators known to occur on Lanai that may kill adult or young Hawaiian petrels, Newell's shearwaters, or Hawaiian stilts. An active feral cat population has been documented in the vicinity of the petrel colony and the WWTP, and DOFAW has established traps around both locations. Increasing the trapping efforts for predators would logically have the potential to decrease the number of adult and juvenile petrels, Newell's shearwaters, and Hawaiian stilts that are killed and would have a net benefit on their populations. Increases in survival and productivity at seabird colonies through predator control are well-documented in Hawaii and elsewhere (Winter and Wallace 2006).

As part of the Tier 1 mitigation plan for the met towers, Castle & Cooke will provide funding to augment DOFAW's current predator-control program at the petrel colony. Tier 1 funding

provides for materials and for the hire of two DOFAW staff members to set and monitor 20 additional traps throughout the Lanaihale for the 2-year period; locations will be determined by DOFAW. Care will be taken to locate traps in previously disturbed areas; creating new trails through the colony would only provide increased access for the predators to the birds and burrows. In addition to funding for personnel to set and monitor traps, Castle & Cooke will provide DOFAW with the use of a vehicle on Lanai during the 2-year period to implement the predator control program.

DOFAW confirmed that cats are present and have been trapped in the vicinity of the WWTP. Therefore, it can be assumed that predation of stilts by cats occurs and could have an adverse effect on the resident stilt population (DOFAW, pers. comm. 2007 and 2008). DOFAW does not currently have the staff or resources to implement a regular predator control program at the WWTP to protect the Hawaiian stilt. Castle & Cooke will provide DOFAW 12 additional traps to be placed around the perimeter of the WWTP. DOFAW staff implementing the petrel colony predator control and habitat restoration program will maintain these traps at the WWTP. This program will be implemented with the Tier 1 funds and would provide a net benefit to the stilts.

If Tier 2 mitigation is required for the petrel, the efforts of the predator control program will be increased at the colony. An additional 15 traps will be set in the vicinity of the colony. More traps would increase the potential to remove more predators preying on the colony and provide a net benefit to the seabirds.

Habitat Restoration

At Lanaihale, much of the potential nesting habitat for Hawaiian petrels and Newell's shearwaters has been degraded by the introduction of ungulates and subsequent establishment of invasive species such as strawberry guava (*Psidium cattleianum*). Restoration of degraded habitat through the removal of invasive species and reintroduction of uluhe fern and other native species should ultimately increase the size of the breeding population. DOFAW identified an appropriate area of degraded habitat for restoration that has existing access as described in the HCP. This habitat restoration program would also benefit the Hawaiian hoary bat by increasing foraging and roosting habitat. Surveys for listed plant and animal species were conducted in the proposed restoration area prior to initiating work. Vegetation clearing will not take place in areas in close proximity to known locations of birds and/or active nesting areas thereby eliminating disturbance to the birds or breeding activities. Additionally, the sensitive annual period for Hawaiian bats is July 1 through September 30 when dependent young are with the mothers. Protocol has been established during this period so that no trees will be cut unless bats have not been detected for five consecutive days. The restoration area will require maintenance for the 2-year period to control weeds and other invasive species and protect the native plant species. Tier 1 funding also will support DOFAW staff to maintain and monitor habitat restoration activities.

Should the Tier 1 take level for petrels be reached, Tier 2 mitigation would be implemented. Tier 2 mitigation would double the acreage of Tier 1 habitat restoration. Additional funds would be provided to DOFAW/MISC to clear the additional acreage of invasive vegetation. DOFAW has the option to reallocate Tier 1 funds to restore the entire six acres (2.4 ha) in 2008 and 2009. Tier 2 funds would be provided to DOFAW only if the petrel Tier 1 take limit is reached. The three- or six-acre restoration area(s) will be maintained by the two DOFAW employees hired under the Tier 1 mitigation plan.

3.4.3.2 Funding

Castle & Cooke will provide DOFAW with funding to implement the proposed mitigation measures as well as a vehicle and chipper for its use on Lanai as outlined above and in the HCP. DOFAW, in turn, would coordinate the mitigation activities with the MISC and the Pacific Cooperative Studies Unit, University of Hawaii. The design and scope of each year's effort would be determined in consultation with USFWS and DOFAW biologists and would be formalized in writing as a Memorandum of Understanding.

Castle & Cooke will enter into an agreement with and provide monies to DOFAW to fund the predator control and habitat management program. A minimum non-refundable endowment of $252,203 for the Tier 1 mitigation will be disbursed by Castle & Cooke in two payments according to the MOA. The first payment ($143,138) was provided to DOFAW in February 2008 for Year 1 of Tier 1 and the remainder of Tier 1 costs ($109,065) will be paid within 10 working days of the permittee's receipt of the approved ITP/ITL. DOFAW will provide a letter to Castle & Cooke and the USFWS acknowledging the receipt of the funding and committing its use for seabird and bat habitat restoration and predator control. After receipt of these funds, DOFAW will provide follow-up letter reports to Castle & Cooke and the USFWS stating the progress made through the use of these funds and accounting for their expenditure.

If Tier 2 mitigation is deemed necessary, an additional $53,214 will be provided. Castle & Cooke will provide financial assurances for the Tier 2 funds through a financial instrument such as a bond, letter of credit or other similar mechanism as approved by DLNR and USFWS. This financial assurance will be in place prior to the effective date of the ITL/ITP. Tier 2 mitigation funds will be released 20 days after reaching the Tier 1 take limit for the Hawaiian petrel. If DOFAW elects not to restore the entire six-acre parcel with Tier 1 funds, there may be an inherent delay until the clearing work would begin in the second 3-acre parcel. However, additional predator control mitigation could be implemented soon after reaching Tier 1 take limits.

3.4.3.3 Monitoring and Adaptive Management

Monitoring is an important tool in an adaptive management approach and should be designed in a way that ensures data would be properly collected, analyzed, and used to adjust management strategies, as appropriate. Monitoring is required at each of the met tower locations to ensure that the authorized levels of take are not exceeded and that any effects are minimized and mitigated to the extent possible.

Castle & Cooke will conduct post-construction mortality monitoring (downed wildlife surveys) to document injuries or fatalities of listed and non-listed species. Post-construction monitoring will be conducted at each of the met tower locations according to the protocol developed in consultation with USFWS and DOFAW (as provided in the HCP). In the event an injured or dead petrel, shearwater, or bat is documented as a result of collision with one of the met towers, Castle & Cooke would immediately assess the impact and adapt the program accordingly. Searcher efficiency will be applied to the observed direct take (carcasses found, if any, during searches) to quantify adjusted take (direct and unobserved direct take combined). Adjusted take will be compared to the take limits authorized in the HCP. Should monitoring reveal that authorized take of petrels is higher at one of the tower locations, Castle & Cooke would closely evaluate the data and consider removing the tower in question.

Brief, quarterly reports will be submitted to DOFAW and USFWS. These reports will summarize the results of the post-construction monitoring surveys, document take, if any, of

each species, and identify any recommended changes to the monitoring protocols. Any incidental take of one of these covered species will be reported within 24 hours and the cumulative adjusted take reported within two weeks.

Castle & Cooke will also conduct semi-annual meetings with DOFAW and USFWS to discuss the monitoring program, compare the monitoring results to estimated take levels, discuss the progress of the mitigation measures, and develop any recommendations for revising ongoing activities. As Castle & Cooke will be funding efforts for DOFAW to implement mitigation activities, DOFAW will be responsible for monitoring these efforts.

DOFAW will use an adaptive management approach to implementing the mitigation activities. Staff will adapt management activities in both the habitat restoration and predator control programs as new data or technology becomes available so as to maximize the benefit for the covered species.

3.5 Cumulative Impacts

NEPA and its implementing regulations require that Castle & Cooke consider the cumulative environmental impacts that result from the incremental impact of the Proposed Action when added to other past, present, and reasonably foreseeable future actions (40 CFR § 1508.7 and §1508.25[c]). A cumulative impact analysis, as follows, is limited to those past, present, and reasonably foreseeable future actions that involve effects on a resource value that overlaps with the Proposed Action's effects on that same resource value.

The northern end of Lanai is relatively undeveloped and consists of land primarily owned by Castle & Cooke. An unpaved road system traverses the project area that is used by hunters and people accessing recreation areas such as the Garden of the Gods and the island's northern beaches. Other past development includes the construction of the six met towers installed in the project area. This action resulted in minor ground and vegetation disturbance. All other impacts associated with the met towers (e.g., construction noise, impacts to air quality) were temporary in nature and limited to the three- to five-day construction period for each tower. Habitat restoration was initiated at the Lanaihale site as part of the project's mitigation program. Approximately one acre of the restoration parcel has been cleared of invasive plant species. The clearing has been conducted with hand tools and a chain saw. Vegetation is mulched with a chipper located on-site.

Present actions within the project area separate from the Proposed Action include ongoing use of the road system. These past and present actions are described and evaluated throughout this EA. The effects analysis described in the previous sections for each resource assesses the potential impacts of the Proposed Action in conjunction with the existing towers.

Reasonably foreseeable future actions are defined for the purposes of this analysis as future actions that are planned within or in the immediate vicinity of the project area. Typically for private lands, projects are considered reasonably foreseeable in time if a plan or permit application has been filed with the county or other appropriate jurisdiction. Thus, there are no reasonably foreseeable actions planned for this site to date. Castle & Cooke owns most of the land on Lanai and have interest in developing a wind energy facility on the northern portion of island only if the met tower data shows that it is feasible. However, no detailed designs have been developed associated with such a project.

Should data from the met towers indicate that a wind farm is feasible for Lanai and Castle & Cooke moves forward with its development, the impacts of the wind farm would be assessed through a separate and complete review under NEPA and the ESA.

4.0 Personal Communications

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