

**LANAI METEOROLOGICAL TOWERS
HABITAT CONSERVATION PLAN
THIRD ANNUAL REPORT**

Prepared for:

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1.0 INTRODUCTION

In August 2008, Castle & Cooke Resorts LLC (Castle & Cooke) and Tetra Tech EC, Inc. (TtEC), in collaboration with the U.S. Fish and Wildlife Service (USFWS) and Hawaii Division of Forestry and Wildlife (DOFAW), finalized a joint Habitat Conservation Plan (HCP) for the construction and operation of six meteorological (met) towers on the island of Lanai (TtEC 2008). The HCP was developed to obtain an incidental take permit and incidental take license (ITP/ITL) issued by USFWS and DOFAW in September and October 2008, respectively, for four federally and state-listed species including the Hawaiian petrel (*Pterodroma sandwichensis*), the Hawaiian hoary bat (*Lasiurus cinereus semotu*), the Hawaiian stilt (*Himantopus mexicanus knudseni*), and the Newell's shearwater (*Puffinus newelli*).

The HCP establishes an incidental take limit for each of the covered species for the period during which the met towers are in operation. Take limits established for the Newell's shearwater, Hawaiian hoary bat, and Hawaiian stilt are two individuals each. A two-tiered take limit was established for the Hawaiian petrel authorizing the take of up to 7 individuals with an associated level of mitigation. Tier 2 provides a contingency should tier 1 take levels be exceeded, authorizing the take of up to 14 individuals total, and triggers additional mitigation. To date, there has been no take of any of the covered species.

The initial term of the HCP was through March 1, 2010, the expected two-year time period the met towers were to be in operation. On December 7, 2009, Castle & Cooke requested a minor amendment to the HCP and ITP/ITL to extend the period of coverage for an additional 2 years (through March 1, 2012) and to reduce the monitoring and reporting requirements. The changes that were approved as part of the HCP amendment include the following:

- 1) Five of the six met towers previously installed were taken down in February 2010. Met tower 1 remains in operation to continue collecting wind data. The amendment would permit the re-installation of met towers 2 through 6 during this permit period if so desired by Castle & Cooke.
- 2) Surveys are conducted monthly rather than every 10 days, carcass removal trial requirements are reduced, and searcher efficiency trials are not required. The revised protocol is discussed in section 3.0.
- 3) Reporting requirements include informal quarterly emails and the annual report.
- 4) DOFAW and Castle & Cooke will coordinate on ungulate removal in the Lanaihale through an extension of the MOA or some other mechanism.

The two primary programs implemented as part of the HCP includes a post construction monitoring plan (PCMP) at the met towers and an offsite mitigation plan. The PCMP, which has been implemented for 3 years, was developed as a means to document impacts to the covered species as a result of operation of the project, and to ensure compliance with the authorized provisions and take limitations of the HCP and the associated ITP/ITL. The mitigation plan, which consists of a combination of predator control and habitat restoration on Lanai, was

completed to compensate for potential incidental take of the four covered species during the initial 2-year project period of the HCP, providing a net benefit to the covered species.

This report presents the results of the third year of the post-construction monitoring (March 16 to August 31, 2010) at met tower 1 and provides a summary of the results of monitoring conducted in March 16 to December 15, 2009 (Year 2) at all six met towers. The report also provides a summary of mitigation completed by DOFAW since the 2009 annual report was submitted to USFWS and DOFAW.

2.0 STUDY AREA

The met tower project area is located on the northwestern portion of Lanai (Figure 1). Lanai is generally a hilly island that rises gradually to 1,027 meters (3,369 feet) above sea level at Lanaihale, or Mount Palawai. The Kalohi Channel separates the island of Lanai from the island of Molokai to the north, and Auau Channel separates Lanai from the island of Maui to the east. The project area is remote, with a few dirt roads that allow access to the shoreline and the met tower locations. There are no nearby existing structures. Lanai City is located about 5 miles southeast of met tower 1.

Much of the terrestrial habitat on Lanai has been disturbed by several factors, including the establishment of the Cook Island pine (*Araucaria columnaris*), 100 years of island-wide Dole pineapple plantations, cattle grazing, the intentional release of non-native game species, and the incidental release of non-native terrestrial species such as house cats (*Felis domesticus*), Norway rats (*Rattus norvegicus*), and black rats (*Rattus rattus*). All of these factors have negatively impacted many of the native species and have altered the ecology of the island. Habitat within the met towers footprint and surrounding area ranges from barren eroded soils to shrub/scrub, interspersed with open grassland areas. The met tower footprint includes the 0.8 square meters (9 square feet) of the tower base plate and the anchor points for the four sets of guy wires that radiate from the tower pole approximately 30.5 to 33.5 meters (100 to 110 feet).

Met tower 1 is in a badlands area and the central portion of the search plot consists of bare ground, beyond which is grassland where Angleton grass (*Dichanthium aristatum*) predominates (AECOS 2007). Grass height is approximately one meter or lower. Scattered shrub growth, located on the eastern and western margins of the search plot, consists of 'a'ali'i (*Dodonaea viscosa*), lantana (*Lantana camara*), uhaloa (*Waltheria indica*), and Brazilian pepper (*Schinus terebinthifolius*). This vegetation typically ranges from approximately 1 to 2 meters (3 to 7 feet) in height.

3.0 PCMP METHODS

The brief summary of the survey protocol used in 2009 is provided in Section 3.1. The 2010 revised protocol is described in Section 3.2.

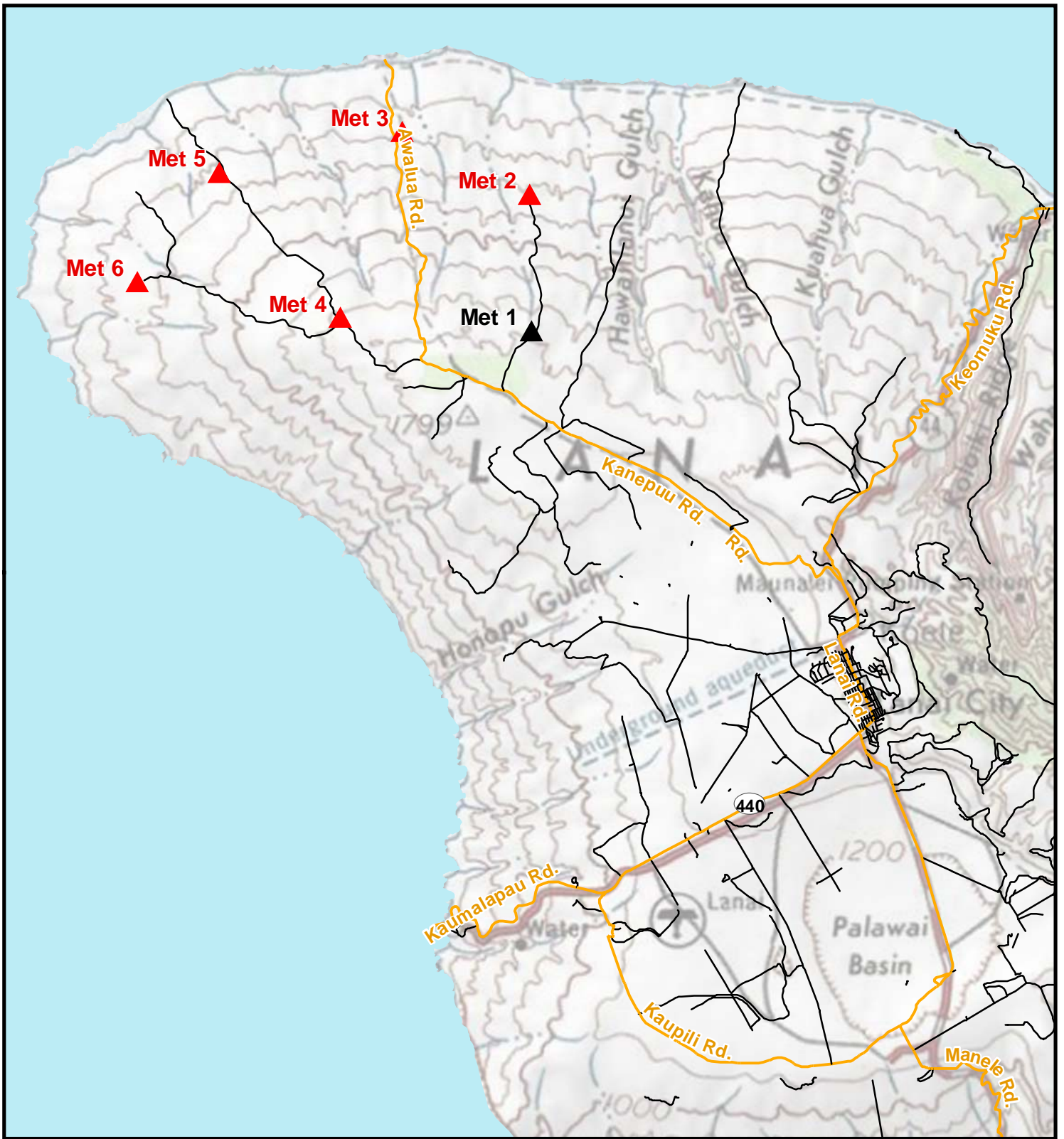



Figure 1
Location of Lana'i Meteorological (Met) Towers
 Castle and Cooke Lana'i Meteorological Towers Project
 Maui County, Hawaii

Project Facilities Existing Transportation

- Existing
- Removed
- Major Road
- Local Road


 0 0.5 1 2
 Miles
1:96,000
NAD 1983 UTM 4
September 15, 2010



3.1 2009 PCMP Methods

The PCMP protocol for the 2009 surveys, as described in Lanai *Meteorological Towers Habitat Conservation Plan Second Annual Report* (TtEC 2009) and in the Final HCP (TtEC 2008), included: 1) standardized carcass searches conducted every 10 days to monitor potential injuries or fatalities; 2) carcass removal trials conducted in spring, summer, and fall to assess seasonal, site-specific carcass removal rates by scavengers; and 3) searcher efficiency trials conducted throughout the monitoring period to assess observer efficiency in finding carcasses. Both the ability of searchers to locate carcasses (searcher efficiency) and the length of time carcasses remain onsite before being removed by scavengers (a site-specific carcass removal rate) can bias the number of carcasses found during standardized searches. Thus, fatality rate estimation is based on the number of carcasses found during standardized searches adjusted for these two sources of bias. The PCMP protocol focuses on seabirds because the Hawaiian petrel is the species with the highest potential for incidental take (TtEC 2008).

3.2 2010 PCMP Methods

The revised protocol reflects the project-specific site conditions and results demonstrated after the first 2 years of monitoring including low scavenging rates and high searcher efficiency for seabirds. The revised monitoring protocol, as summarized in the following subsections, is being implemented at met tower 1 in year 3. The survey plot and protocol for conducting the searches is the same as the previous 2 years of monitoring described in TtEC (2009). Should met towers 2 through 6 be reinstalled the same protocol would be implemented at these towers.

Permits to handle carcasses and wildlife were amended as needed. The USFWS Special Purpose Permit was amended on June 2, 2010, and the Protected Wildlife Permit was amended by DOFAW on March 11, 2010.

3.2.1 Carcass Searches

Standardized carcass searches are conducted at met tower 1 during the seasons when seabirds are expected to be present on Lanai (March through December), as requested by USFWS and DOFAW. The seasons are defined as: spring (March 15-June 15), summer (June 16-September 15), and fall (September 16-December 15). Carcass searches may end prior to December 15 if DOFAW has verified that the seabirds have left the colony. Personnel discontinue surveys if the study area is not accessible as a result of storm events or road conditions, and/or if staff safety is questionable.

Carcass surveys are conducted approximately every 30 days at met tower 1 provided the vegetation is managed to maintain a high level of searcher efficiency. Carcass surveys were conducted between March 16 and August 31, 2010. A photograph depicting the monitoring plot vegetation conditions at the active met tower(s) should be provided to the agencies at least one week prior to the beginning of the survey season to confirm vegetative management took place, if needed.

3.2.2 Searcher Efficiency Trials

The objective of searcher efficiency trials is to estimate the percentage of bird fatalities that searchers are able to find. Searcher efficiency trials, conducted during each season in years 1 and 2 of monitoring, documented a high level of searcher efficiency for birds. Searcher efficiency trials are no longer required in the revised protocol if vegetation management continues as needed within the survey plot. The high rates of searcher efficiency for birds (93.8 percent, SD = 11.5) documented in 2009 would be applied to any carcass of a listed species found during 2010 searches. Searcher efficiency is not discussed further.

3.2.3 Carcass Removal Trials

The objective of the carcass removal trials is to document the length of time carcasses remain in the search area and are thus available to be detected by searchers. Carcass removal trials were conducted once per season to account for changes in weather, climate, and scavenger densities. For carcass removal trials, the revised protocol requires that one carcass be placed near each active met tower at the beginning of each season (defined above) and its status checked at the time of the next monitoring event (30 days later). If a carcass is removed during this time, the search interval would return to once every 10 days and carcass removal trials would be implemented as previously conducted and as defined in the HCP.

TtEC modified the methods specified in the HCP amendment by placing two carcasses near met tower 1 at random distances and directions from opposite search plot corner stakes and checking their status every 10 days. To avoid confusion with potential met tower-related fatalities, planted carcasses were placed outside of the search area boundary. The number of carcasses placed exceeds the number required under the HCP amendment to provide a better estimate of variation in carcass removal. Conducting checks more frequent checks than once a month as required under the amendment enables TtEC to better document the actual date of carcass removal if it were to occur.

The spring carcass removal trial was initiated on April 12 and conducted through June 2, 2010. Two wedge-tailed shearwater carcasses were planted during the spring trial. The summer carcass removal trial was initiated on August 10 and will be conducted through September 9, 2010. Two wedge-tailed shearwater carcasses were placed during the summer trial. Carcasses were placed in relation to opposite plot corner stakes during the spring and summer trials. Trial carcasses were marked discreetly for recognition by searchers.

3.2.4 Statistical Methods

Mortality rate estimates are based on observed number of carcasses found during standardized carcass searches, searcher efficiency rates, and carcass persistence. Statistical methods for searcher efficiency, carcass removal rates, and mortality rate estimation are provided in the HCP (TtEC 2008).

4.0 PCMP RESULTS

This section summarizes the results of surveys and trials conducted to date in 2010. Results of monitoring conducted in 2009 are also provided because surveys continued through December 2009 after the completion of the 2009 annual report.

4.1 Standardized Carcass Searches

4.1.1 2010 Standardized Carcass Searches

Met tower 1 was searched approximately every 30 days resulting in a total of 5 searches conducted: three in spring and two to date in summer (April 11, May 12, June 11, July 11, and August 10, 2010). All surveys were completed within the established search intervals. No bird or bat mortalities of any threatened or endangered species were detected during 2010 spring and summer carcass surveys.

4.1.2 2009 Standardized Carcass Searches

In 2009, a total of 102 standardized carcass searches (17 searches at each of six met towers) were conducted at the Lanai project area. One gray francolin chick carcass (*Francoelinus pondicerianus*) was observed outside the plot at met tower 1, during the June 24 survey, but this was unrelated to the met tower project.

4.2 Carcass Removal Trials

4.2.1 2010 Carcass Removal Trials

During the spring 2010 carcass removal trial, one of the two carcasses was scavenged. On day 20, one wing and a group of 20 feathers were found approximately 4 feet from the original placement location but still within the search plot, where it remained throughout the length of the trial. The other carcass was intact for the length of the trial, with some scavenging by insects. Average carcass persistence during spring was 30 days (SD = 0 days; Table 1).

Table 1. Results of carcass removal trials conducted for the Lanai met tower project during spring and summer, 2010, with 2009 carcass removal trial results for comparison.

Carcass Size Class	Season	No. Carcasses Placed	Mean Persistence (days)
Birds 2010	Spring	2	30
	Summer	2	30
	Overall	2	30
Birds 2009	Spring	18	28.0
	Summer	10	28.0
	Fall	9	28.0
	Overall	37	28
Bats 2009	Summer	4.0	8.7
	Overall	4.0	8.7

The 2 adult wedge-tailed shearwaters placed during the summer carcass removal trial were not removed. Both carcasses were scavenged by insects by the first check of the trial and one carcass showed evidence of more substantial scavenging but remained in its original location throughout the trial. Average carcass persistence during summer was also 30 days (SD = 0 days; Table 1).

4.2.2 2009 Carcass Removal Trials

Overall carcass persistence (spring, summer, and fall combined) for birds in 2009 was 28 days (N = 37, SD = 0.0 days). No carcass was completely removed during the three trials. More substantial scavenging (i.e., head or wings missing and movement of a carcass from the initial location placed) of several carcasses was noted during all of the trials. For informational purposes, four mouse carcasses were set out to simulate bats. The mice were removed more quickly than the shearwaters. Three of the four mouse carcasses were removed by scavengers: one on day two near met tower 5; one on day three near met tower 3; and one on day five near met tower 4. The fourth mouse carcass was scavenged (torn in half) on day 10 near met tower 2 but was not removed. Average mouse carcass persistence time was 8.7 days (SD = 11.2 days; Table 1).

5.0 PCMP DISCUSSION AND CONCLUSIONS

5.1 Mortality

In 2010, as in the previous years, no carcasses of the four covered species or any other listed species were found during standardized carcass searches, or incidentally by searchers. The one carcass of a non-listed bird species found in the project vicinity (the gray francolin chick) indicates that searchers are finding carcasses when they occur. The operation of the met towers does not appear to be having a direct effect on Hawaiian petrels, Newell's shearwaters, Hawaiian stilts, or Hawaiian hoary bats (Table 2). The flagging and bird diverter hardware installed on all the met towers may be contributing to birds avoiding collision with the met towers.

Table 2. Comparison of overall (seasons combined) carcass persistence and mortality estimation between the Lanai met tower project and similar post-construction monitoring studies.

Study Site ^{1, 2}	Carcass Persistence (days)		Mortality Estimation (per tower or turbine)	
	Avian	Bat	Avian ⁷	Bat
Lanai 2010	30.0	-	0.0	0.0
Lanai 2009	28.0	8.7	0.0	0.0
Lanai 2008	27.6	-	0.0	0.0
Buffalo Ridge ^{3, 4}	7	11	0.98	2.16
Stateline ⁵	26	16	1.93	1.12
Foote Creek Rim ⁶	29	20	2.04	2.38
Oklahoma ⁷	-	-	-	1.19 – 1.71

¹ Sites used for comparison are operating wind farms and are most similar in habitat to Lanai among sites with published post-construction monitoring results (i.e., shrubland, short-grass prairie, and other grassland habitat types).

² Some comparison sites used a combination of small and large birds for trials and analysis.

³ Johnson et al. (2002)

⁴ Johnson et al. (2003)

⁵ Erickson et al. (2004)

⁶ Young et al. (2003)

⁷ Piorkowski (2006)

5.2 Carcass Removal

The bird carcass removal rates for the Lanai met tower project area in 2009 and 2010 were low in comparison with other published post-construction mortality monitoring studies (Table 2).

Although all of the carcasses were scavenged by insects relatively quickly, and some were more substantially scavenged, no carcasses were removed. These results are consistent with carcass removal rates documented in 2008 on Lanai. This is likely due to the few predators that live on the island. Feral cats and rats are the most likely scavengers in the project area and cat tracks and scat have been documented near the met towers in previous years.

5.3 Vegetation Management

Vegetation management was identified in 2008 as being needed to increase searcher efficiency because some of the survey plots were densely vegetated or had patches of dense vegetation. Tall grass or shrubs at the met tower site can obscure carcasses and decrease the likelihood that searchers will find carcasses. Vegetation management will continue at met tower 1, as needed, throughout the 2010 monitoring year.

5.4 Conclusions

The most substantial finding during 2009 and 2010 monitoring seasons to-date was that no carcasses of the four covered species or any other threatened or endangered species were found during standardized carcass searches, or incidentally by searchers. The carcass persistence time for birds indicates that the 30-day search interval is an adequate time frame to minimize any losses due to scavenging. Searcher efficiency documented in 2009 indicates that searchers are finding carcasses when they occur. Thus, the operation of the Lanai met towers does not appear to be having a direct effect on Hawaiian petrels, Newell's shearwaters, Hawaiian stilts, or Hawaiian hoary bats or any other flying wildlife species during its 3 years of operation.

6.0 MITIGATION

The mitigation plan funded by Castle & Cooke includes habitat restoration and predator control. DOFAW, who is implementing the mitigation program with assistance from the Maui Invasive Species Committee, Americorps, Hawaii Youth Corps, NOAA Marine Sanctuary Team and local community groups and individuals, is required to submit monthly progress reports that detail the work to date on both of these components. The annual report due in August 2009 was received on January 14, 2010 (Attachment 1) and monthly progress reports were received through the end of October 2009. No additional status reports have been received from DOFAW since October 2009. A final report to be provided is referenced in the DOFAW 2009 annual mitigation summary report.

Restoration efforts at Lanaihale to date has included the removal of invasive species utilizing mechanical and chemical techniques, native seed collection and propagation, outplanting of native seeds, caging native plant species to protect them from ungulate grazing, and erosion control. As of October 31, 2009, the 3-acre parcel to be restored in the Tier 1 mitigation plan has been cleared. At that time approximately 10 percent of this cleared area had regenerated with patches of uluhe fern (*Dicranopteris linearis*), with individual plants scattered throughout the rest of the site.

Predator control has involved efforts to reduce the feral cat population on Lanai. Approximately 56 traps at Lanaihale and 12 traps at the Lanai wastewater treatment plant have been in active

use since July 2008. Between July 2008 and October 2009, 14 cats have been removed from the Lanaihale and 12 cats have been removed from the wastewater treatment facility. In addition, during this period 35 rats have been removed from the Lanaihale and 4 rats have been removed from the wastewater treatment facility. Ungulate browsing continues to affect the success of native vegetation regeneration and Castle & Cooke and DOFAW are working cooperatively to reduce the ungulate population in the Lanaihale.

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Tetra Tech EC, Inc. 2008. Final Habitat Conservation Plan for the Construction and Operation of the Lāna‘i Meteorological Towers. Prepared for Castle & Cooke, DOFAW and USFWS, Lāna‘i, Hawai‘i. Lāna‘i, Maui County, Hawai‘i.

Tetra Tech EC, Inc. 2009. Lanai Meteorological Towers Habitat Conservation Plan Second Annual Report (2009). Prepared for Castle & Cooke, DOFAW, and USFWS.

Attachment 1

Year 2 Lanai Met Towers Annual Mitigation Report

Lānaʻi Met Towers Annual Mitigation Report Reflective of July 2008 to October 2009

Note: This Annual Mitigation Report is a summary of monthly mitigation reports submitted to the Applicant by DOFAW from July 2008 to October 2009

ACTIVITIES COMPLETED

The habitat restoration and predator control activities completed at Lānaʻihale and the Waste Water Treatment Plant are reflective of the Scope of Work outlined in the Habitat Conservation Plan; an excerpt can be found at the end of this document.

Staff

- Jay Penniman, Christine Costales, Mos Masicampo, Ed Morimoto, Kelsey Tsuchiyama
Roland Gella, Travis Fernandez

Invasive Plant Control Activities

- Total acres cleared at Lānaʻihale as of October 2009: 3
- Strawberry guava (*Psidium cattleianum*) clearing, herbicide treatment (20% Garlon 4 in bio-diesel) and chipping
- Strawberry guava (*Psidium cattleianum*) herbicide foliar treatment of re-growth, (2% Garlon 4 in bio-diesel)
- Hand pulling of small strawberry guava (*Psidium cattleianum*) and *Tibouchina herbacia*
- Distribution of invasive species chips

Native Plant Regeneration Activities

- 10% of the 3 acres cleared is covered with uluhe (*Dicranopteris linearis*) fern patches, individual native plants are scattered over the entire site. The final report for the (mitigation-funded) clearing portion of the restoration project will include mapped native regeneration and out planted individuals.
- List of native species out-planted (number if available):
Wikstroemia bicornuta – 4, Wikstroemia oahuensis – 4, Bobea sandwicensis – 2, Scaevola chamissoniana - 8, Psychotria mariniana – 3, Dicranopteris linearis
- List of native species resurfaced:
Ungulate browsing has suppressed “re-surfacing” dramatically. In the final report for the two year clearing phase of the restoration there will be documentation of

species, number, and location on the site. Additional “hardening” efforts will be employed around regeneration where feasible.

- Wire caging put around native plants to protect from ungulate browsing
- Seed collection at and propagation at project office in Lāna‘i City
- Out planting of native plants from seed collection
- Water catchment shelter, 400 gallon water buffalo
- Log borders around native plant patches
- Transfer of uluhe clumps
- Staff training on: plant identification and propagation; safety in powered tool operations; and fire suppression.
- For seabird nesting habitat purposes, native plant activities focus on restoring ‘Ōhi‘a (Metrosideros) Lowland Mesic Forest with subtype 4 – uluhe (*Dicranopteris linearis* and *Diplopterygium pinnatum*) fern ground cover. (Wagner et al 1990, pp 80-81)

Erosion Control Activities

- Distribution of cut logs from invasive plant control placed across slope at mitigation site to control erosion by diverting water from channeling slopes, dispersing flow to maximize retention.

Invasive Cat Control Activities

- **Wastewater Treatment Plant**
12 active traps were in use, trap bait included sardines, hotdogs, fresh fish offal, cat food and beef.
Number of cats caught:
July 2008 – 2
September 2008 – 2
October 2008 – 2
November 2008 – 2
December 2008 – 1
February 2009 – 1
August 2009 – 1
September 2009 – 1
Total: 12
- **Lāna‘ihale**
An average of 56 active traps were in use, trap bait as above.
Number of cats caught:

July 2008 - 2

August 2008 – 1

September 2008 – 4

January 2009 - 1

February 2009 – 1

April 2009 – 2

July 2009 - 2

August 2009 – 1

Total: 14

Invasive Rat Control

- **Lāna‘ihale, number of rats caught:**

- **July 2008 - October 2009 - 35**

Total: 35

- **Wastewater Treatment Plant, number of rats caught:**

July 2008 – October 2009 – 4

Total: 4

Issues reported that affect mitigation success

- Ungulate browsing of native vegetation within the fence effectively suppressed regeneration
- Machinery; lack of or dysfunction
- Vehicles; lack of or dysfunction

Assistance – Physical on-site clearing, feeding chipper and pulling

- Maui Invasive Species Committee
- AmeriCorps
- Hawaii Youth Conservation Corps
- NOAA Marine Sanctuary Team
- Local community groups
- Local individuals
- DOFAW Administration staff

Total Expenses:

- As of October 2009: \$127,870.19

SCOPE OF WORK OUTLINED IN THE HABTIAT CONSERVATION PLAN MITIGATION PLAN

2.2 Phase II – Site Clearing

DOFAW staff recognized strawberry guava (*Psidium cattleianum*) as a serious threat to the Lāna‘ihale watershed and the petrel in early 2006. Strawberry guava is widely distributed in the Lāna‘i forest. In areas, it forms mono-typic stands, eliminating, among other species, uluhe fern (*Dicranopteris linearis* and *Diplopterygium pinnatum*) habitat. Uluhe fern is the dominant component of Hawaiian petrel habitat on Lāna‘i. DOFAW has consulted with the MISC, Haleakala National Park, National Tropical Botanical Gardens and others with experience in guava control. DOFAW has contracted MISC to conduct the initial phase of vegetation removal within the restoration parcel(s). MISC will conduct much of the vegetation removal during the winter and early spring prior to the petrels return to the colony. However, clearing activities will continue throughout the summer and fall according to specific guidelines. Restoration activities will be conducted so as to minimize any disturbance to the petrel colony during the breeding season and potentially to Hawaiian hoary bats if indeed bats breed on Lāna‘i. Clearing activities will not occur in the vicinity of active petrel burrows during the breeding season. The sensitive period for bats is July 1 through September 30. During that time period, five consecutive days of negative bat detections must occur for DOFAW to be able to cut trees greater than 3 meters in height. Vegetation removal will focus on stems greater than 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. DOFAW will implement erosion control measures during this initial phase of vegetation removal and on-going 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. The one non-native tree species which will not be removed is the Cook pine (*Araucaria columnaris*). Cook pine has been identified as a significant collector of moisture from clouds and fog. Therefore, it is being utilized to attempt to increase the recharge of the Lāna‘ihale aquifer. One of the reasons that Cook pine is a desirable species for this use is the assumption that it will not form a closed canopy forest, pushing the wind blown cloud and fog above ground level. If this assumption holds it should mean that Cook pine can be a component in an otherwise native Lāna‘i forest. The native forest is and was a low stature forest with dense understory (uluhe, etc.). Cook pines would be scattered throughout, at distances which still allow the aerial mating behavior of the petrel to occur without presenting collision hazard.

2.3 Phase III – Site Management

DOFAW staff will monitor and maintain the restoration parcel(s) for the 2-year duration of the meteorological towers project. All stems remaining after the initial clearing will be cut and treated with herbicide. Site specific techniques i.e.: percent triclopyr, triclopyr amine or triclopyr ester, for control will be finalized before control work commences. Staff understands that control techniques will be adaptable, dependent upon conditions and situations found on site. The majority of stems will be less than 1 cm diameter. Cutting will involve chain saws and hand cutters. Attention and care will be paid to all native plants on the site. Rats (*Rattus* sp.) eat seeds of many native plant species. Project staff will collect ripe seed from native plants, both on the site and across Lānaʻihale as they carry out their other duties. These seeds will be given to the Castle & Cooke plant nursery for propagation. When plants have reached planting age, they will be planted within the restoration parcel(s). If, during the course of the two-year period, seed or appropriate plants become available from other sources, they will be utilized to aid in the revegetation of the restoration parcel(s) if needed. Re-vegetation will utilize Lānaʻi seed and plant stock. Work will be carried out and recorded by management unit. Cutting and treating all the small diameter stems will be an extremely long and demanding task. However, it is a crucial element of the attempt to eradicate strawberry guava in particular. Seed collection needs to happen from the start of the work and continue throughout. This and attention to enhancing the area for existing plants will be accelerated when the small diameter stems are removed. Project staff will have to be constantly vigilant to control re-sprouting of remaining root stock. The seed bank in the area is unknown but certainly exists and new growth must also be identified and controlled. There has been little success in propagating uluhe fern in Hawaiʻi (Romanchak et al. 2005). However, there have been some techniques learned and with these and input from botanists familiar with the plant, staff will attempt to increase the rate of uluhe re-colonization within the site.

2.4 Phase IV – Monitoring

DOFAW will conduct regular (semi-annual) monitoring surveys within the restoration area throughout the 2-year period and for a period of up to 8 years thereafter or until nesting and/or fledging success of petrels has been documented, whichever comes first (if take of petrels occurs as a result of collision with one or more of the met towers). Plots established during the site assessment will be surveyed throughout the monitoring period. Data collected at each plot will include at a minimum percent cover and dominance of plant species within each plot and wildlife species observations including sign of petrels or burrows. Each plant or animal species will be identified as native, federally or state-protected, or invasive. Management recommendations will be identified after each monitoring event and described in the annual summary reports provided to Castle & Cooke.

3.0 PREDATOR CONTROL

Predation of young and adults is considered one of the primary threats to all four species. Feral cats, barn owls, and rats represent the predators known to occur on Lānaʻi that may kill adult or young Hawaiian petrels, Newell's shearwaters, and Hawaiian stilts. An active

feral cat population has been documented in the vicinity of the petrel colony and the wastewater treatment plant. DOFAW has established traps in some locations around the colony and does not currently have the staff to conduct regular trapping at the treatment plant. Twenty percent of cats trapped at the petrel colony to date contained seabird remains in their stomachs which suggests cats are a source of mortality. Increasing the trapping efforts for cats at the Lānaʻihale, as well as establishing a regular program at the wastewater treatment plant, would logically have the potential to decrease the number of adult and juvenile birds killed and have a net positive effect on these populations.

3.1 Lānaʻihale Predator Control

As part of the Tier 1 mitigation plan for the met towers, DOFAW will augment their existing predator-control within the petrel colony by adding 20 additional cat traps throughout the Lānaʻihale for a two-year period beginning March 1, 2008; locations will be determined by DOFAW. Traps will be placed in previously disturbed areas; creating new trails through the colony would only provide increased access for the cats to the birds and burrows. The stomach content of cats trapped will be examined to verify the presence of remains of the covered species. Cat tissue will also be analyzed for stable isotopes of carbon and nitrogen to identify prey consumed. If Tier 2 mitigation is required, an additional 15 traps will be set within the Lānaʻihale for the duration of the meteorological towers project, or March 1, 2010.

3.2 Wastewater Treatment Plan Predator Control

DOFAW will conduct cat trapping within the vicinity of the wastewater treatment facility to mitigate for potential take of Hawaiian stilts. Twelve cat traps will be placed at locations surrounding the wastewater treatment plant; locations will be determined by DOFAW. Cat trapping at the wastewater treatment facility will begin sometime after March 1, 2008 and continue through March 1, 2010.

4.0 MONITORING

DOFAW will provide Castle & Cooke with status reports after each semi-annual monitoring event that will be expanded upon for annual reports to be completed throughout the 2-year project period. DOFAW's annual report for the mitigation program must be submitted to Castle & Cooke by August 15 of each year. Castle & Cooke will then provide DLNR with annual reports for the HCP and mitigation program on August 31, 2008 and August 31, 2009 and will provide a final report 30 days after completion of the project (March 1, 2010). DOFAW will continue monitoring and maintaining the restoration area after the 2-year project period pursuant to the conditions outlined in the Memorandum of Agreement between DOFAW and Castle & Cooke.