

**LANAI METEOROLOGICAL TOWERS
HABITAT CONSERVATION PLAN
PERMIT NO. TE194350-0 AND LICENSE NO. ITL-09
SIXTH ANNUAL REPORT**

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TABLE OF CONTENTS

1.0	INTRODUCTION	1
2.0	STUDY AREA	2
3.0	PCMP METHODS.....	2
3.1	Carcass Searches.....	4
3.2	Searcher Efficiency Trials.....	4
3.3	Carcass Removal Trials	4
3.4	Statistical Methods.....	5
4.0	PCMP RESULTS.....	5
4.1	Standardized Carcass Searches	5
4.1.1	2013 Standardized Carcass Searches	5
4.1.2	2012 Standardized Carcass Searches	5
4.2	Carcass Removal Trials	5
4.2.1	2013 Carcass Removal Trials	5
4.2.2	2012 Carcass Removal Trials	6
5.0	PCMP DISCUSSION AND CONCLUSIONS.....	6
5.1	Mortality	6
5.2	Carcass Removal.....	7
5.3	Vegetation Management	8
5.4	Conclusions.....	8
6.0	REFERENCES	8

TABLES

Table 1.	Results of carcass removal trials conducted for the Lanai met tower project during spring and summer, 2013, with fall 2012 carcass removal trial results for comparison.....	6
Table 2.	Comparison of overall (seasons combined) carcass persistence and mortality estimation between the Lanai met tower project and similar post-construction monitoring studies.	7

FIGURES

Figure 1.	Location of Lanai Meteorological Towers	3
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1.0 INTRODUCTION

In August 2008, Castle & Cooke Properties, Inc. (Castle & Cooke) and Tetra Tech, Inc. (Tetra Tech), 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 (Tetra Tech 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 met tower HCP establishes an incidental take limit for each of the covered species during the period the met towers are in operation. Take limits established for the Newell's shearwater, Hawaiian hoary bat, and Hawaiian stilt are for two individuals each. A two-tiered take limit was established for the Hawaiian petrel, with Tier 1 authorizing the take of up to seven 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 total individuals and triggering additional mitigation. To date, take has not occurred for any of the covered species.

The initial term of the HCP was for 2 years through March 1, 2010. Since then, the ITP/ITL has been amended twice:

- On December 7, 2009, Castle & Cooke requested a minor amendment to the 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 amendment was authorized for the ITL on March 11, 2010. USFWS and DOFAW agreed to the requested changes to the monitoring protocols and reporting. In February 2010, five of the six met towers were taken down, leaving only tower 1 in operation (see the Lanai Meteorological Towers HCP 4th annual report for details). This amendment permits the re-installation of met towers 2 through 6 during the permit period if so desired by Castle & Cooke.
- On February 28, 2012, a second minor amendment was granted to extend the period of coverage under the ITL to March 1, 2016. On April 13, 2012, a minor amendment to the ITP was granted extending coverage over the same period.

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 6 years, was developed as a means to document impacts, if any, to the covered species as a result of operation of the project, and to ensure compliance with the authorized provisions and take limits 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 designed to compensate for potential, incidental take of the four covered species during the period of the ITP/ITL, and provide these species a net benefit. The Tier 1 mitigation plan has been fully implemented by DOFAW and is not addressed further here. A summary of completed mitigation is provided in the 2010 (Year 3) annual report (Tetra Tech 2010).

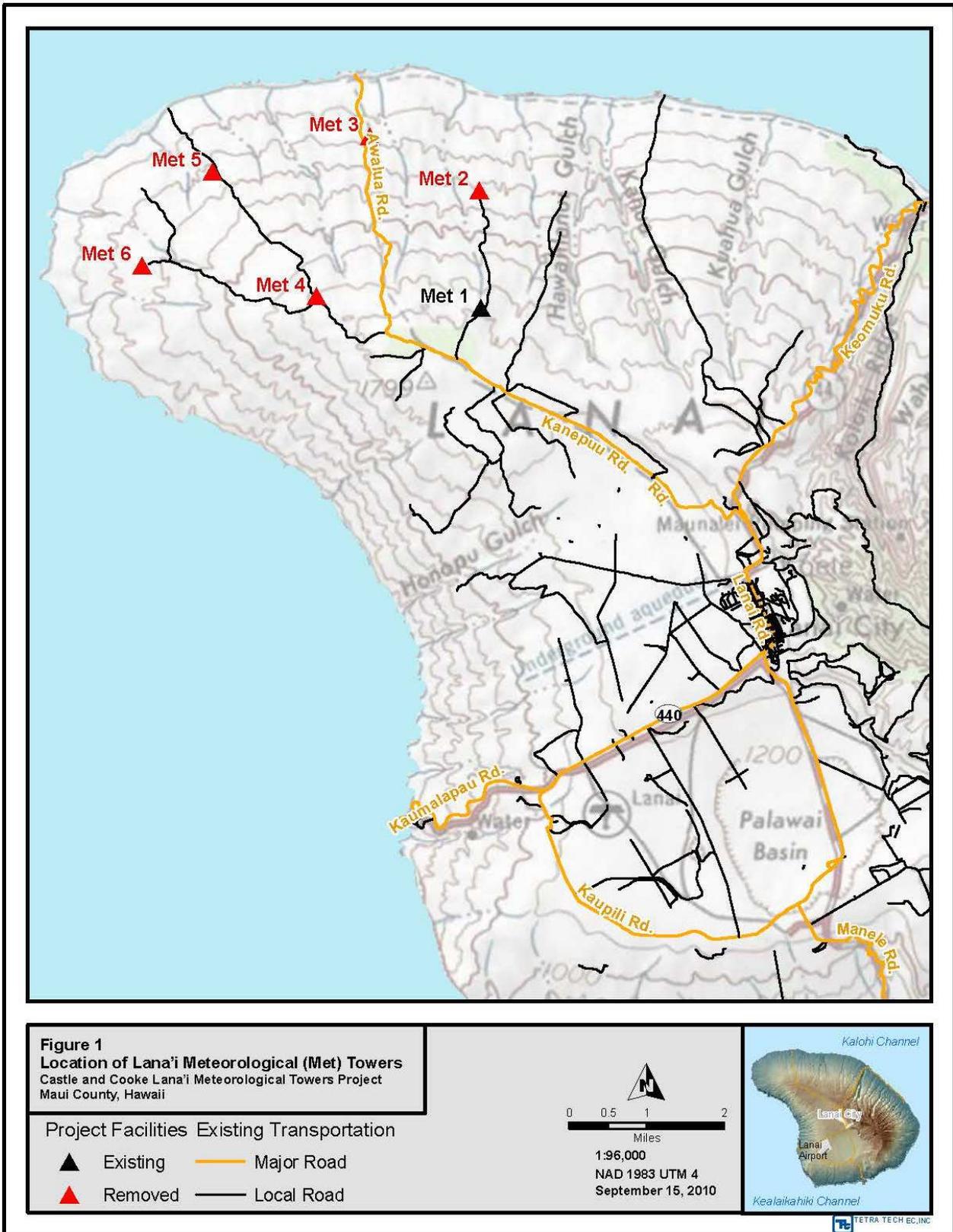
2.0 STUDY AREA

The Lanai met tower project 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 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 3 kilometers (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 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*). Habitat within the met towers' footprint and in the surrounding area ranges from barren eroded soils to shrub/scrub, interspersed with areas of open grassland.

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 1 meter (3 feet) 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. However, vegetation is maintained each year as needed in order to keep growth at a lower height for increased visibility.

3.0 PCMP METHODS

The survey protocol implemented in FY 2013 was consistent with methods implemented in 2012. A description of each survey parameter is provided below. Should met towers 2 through 6 be reinstalled, the same protocol would be implemented at these towers. The USFWS Special Purpose Permit, valid through March 31, 2013, was not renewed due to changes in internal USFWS policy. The Protected Wildlife Permit was amended by DOFAW on March 28, 2012 and is valid through March 11, 2016. Therefore, without both permits in effect any native species found during the carcass searches must be left in place, and only non-native/game birds can be used in the field trials.



FIGIS_PROJECTSCastle_and_Cooke\Lana'i\MXD\HCP\Figure1_Location_of_Lana'i_Meteorological_Towers_3511i_091310 - Last Accessed: 9/13/2010 - Map Scale correct at: ANSIA (8.3" x 11")

3.1 Carcass Searches

Standardized carcass searches were 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. For purposes of the survey effort, 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 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 occurred approximately every 30 days at met tower 1. The vegetation was managed to maintain a high level of searcher efficiency. Carcass surveys were conducted between April 18 and August 16, 2013. Due to vegetation conditions in the monitoring plot, vegetation management was conducted in 2013 to enhance ground visibility.

3.2 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 not 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 2012-2013 searches. Searcher efficiency is not discussed further.

3.3 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 current 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 (Tetra Tech 2008).

During each trial, Tetra Tech placed one carcass near met tower 1 at a random distance and direction from a search plot corner stake and checked its status every 10 days. In past years, two carcasses have been placed during trials, but this is dependent on the availability of carcasses. Given that the USFWS has not yet been renewed, carcasses of cryptically colored chickens were used in 2013. To avoid confusion with potential met tower-related fatalities, planted carcasses were placed outside of the search area boundary.

The spring carcass removal trial was initiated on April 18, 2013, and conducted through May 18, 2013. The summer carcass removal trial was initiated on July 17, 2013, and conducted through August 16, 2013. One adult chicken carcass was placed during each trial.

3.4 Statistical Methods

Mortality 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 estimation are provided in the HCP (Tetra Tech 2008).

4.0 PCMP RESULTS

This section summarizes the results of surveys and trials conducted to date in 2013. Results of monitoring conducted in fall 2012 are also provided because surveys continued through December 2012 after the completion of the 2012 annual report.

4.1 Standardized Carcass Searches

4.1.1 2013 Standardized Carcass Searches

To date, Met tower 1 has been searched five times in 2013 (April 18, May 18, June 13, July 17, and August 16); additional searches will be conducted monthly September through December. All surveys were completed within the established search intervals. No bird or bat mortalities of any threatened or endangered species or any other species were detected during 2013 spring or summer carcass surveys.

4.1.2 2012 Standardized Carcass Searches

Met tower 1 was searched eight times in 2012 (April 18, May 18, June 17, July 17, August 15, September 15, October 14, and November 13). All surveys were completed within the established search intervals. No bird or bat mortalities of any threatened or endangered species were detected during 2012 spring, summer, or fall carcass surveys.

4.2 Carcass Removal Trials

The following presents the results of 2012 and 2013 carcass removal trials. All trial carcasses were present at the end of each 30-day trial. Therefore, actual carcass persistence time is longer than the estimates presented below because carcasses were removed at the end of each trial period but would have continued to persist if left in place.

4.2.1 2013 Carcass Removal Trials

The one carcass placed during each of the spring 2013 (April 18-May 18) and summer 2013 (July 17-August 16) carcass removal trials remained intact with some scavenging by insects

through trials. Carcass persistence during spring and summer 2013 was 30 days (Table 1). This represents the mean persistence time over the two trials. Although more complex methods are now often used to estimate carcass persistence times for wind farm post-construction monitoring studies (e.g., bootstrapping) they require larger sample sizes; therefore, the currently approved methods outlined in the PCMP continue to be appropriate for use here.

4.2.2 2012 Carcass Removal Trials

The one carcass placed during each of the spring 2012 (April 18-May 18), summer 2012 (June 17-July 17), and fall 2012 (October 14-November 13) carcass removal trials remained intact with some scavenging by insects. Carcass persistence during each season was 30 days (Table 1).

Table 1. Results of carcass removal trials conducted for the Lanai met tower project during spring and summer, 2013, with fall 2012 carcass removal trial results for comparison.

Carcass Size Class	Season	No. Carcasses Placed	Mean Persistence (days)^{1/}
Birds 2013	Spring	1	30
	Summer	1	30
	Overall	2	30
Birds 2012	Spring	1	30
	Summer	1	30
	Fall	1	30
	Overall	3	30

1/ Note that actual persistence times are longer because carcasses were present at the end of the 30-day trial period and were then removed, but would have persisted longer if left in place.

5.0 PCMP DISCUSSION AND CONCLUSIONS

5.1 Mortality

In 2013, 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 operation of the met tower does not appear to be having a direct effect on Hawaiian petrels, Newell's shearwaters, Hawaiian stilts, Hawaiian hoary bats, or any other species (Table 2). The flagging and bird diverter hardware installed on the met tower may be increasing visibility of the tower and contributing to birds and bats avoiding collisions.

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 2013	30.0	-	0.0	0.0
Lanai 2012	30.0	-	0.0	0.0
Lanai 2011	30.0	-	0.0	0.0
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 (2002-2003) ⁵	26	16	1.93	1.12
Foote Creek Rim ⁶	29	20	2.04	2.38
Oklahoma ⁷	-	-	-	1.19 – 1.71
Stateline (2006) ⁸	-	-	0.81	0.63
Hopkins Ridge ⁹	23.3	26.6	2.21	1.13
Wildhorse ¹⁰	-	-	2.79	0.70
Bighorn ¹¹	34.9	20.6	3.81	2.86
Judith Gap (2006-2007) ¹²	12.3	9.1	4.52	13.4
Biglow I ¹³	14.0	10.1	2.90	3.29
Judith Gap (2009) ¹⁴	9.7	8.9	3.33	7.20
Biglow II ¹⁵	6.6	3.5	12.73	6.24
Top of Iowa ¹⁶	-	-	-	4.45 – 7.14
Kaheawa Wind Power II ¹⁷	-	-	-	0.06
Kaheawa Wind Power ¹⁸	14.0	9.4	-	-
Kaheawa Wind Power (2012) ¹⁹	11.3	5.6	0.29	-

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. Small birds often used as surrogates for bats.

3/ Johnson et al. (2002)

4/ Johnson et al. (2003)

5/ Erickson et al. (2004)

6/ Young et al. (2003)

7/ Piorkowski (2006)

8/ Erickson et al. (2007)

9/ Young et al. (2007)

10/ Erickson et al. (2008)

11/ Kronner et al. (2008)

12/ TRC Environmental (2008)

13/ Jeffery et al. (2009)

14/ Poulton and Erickson (2010)

15/ Enk et al. (2011)

16/ Jain et al. (2011)

17/ SWCA (2011)

18/ First Wind (2011)

19/ First Wind (2012); avian estimate includes only Hawaiian goose and Hawaiian petrel fatalities.

5.2 Carcass Removal

The bird carcass removal rates for the Lanai met tower project in 2012 and 2013 continue to be low in comparison with other published post-construction mortality monitoring studies (Table 2).

Although most of the carcasses were scavenged by insects relatively quickly, no carcasses were removed. These results are consistent with carcass removal rates documented from 2008 to 2011 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 necessary 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 2013 monitoring year.

5.4 Conclusions

During the 2012 and 2013 monitoring seasons to date, no carcasses of the four covered species or any other threatened or endangered species, or any other wildlife 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, which would apply to any carcasses found in 2013, was high, indicating that searchers are finding carcasses when they occur. Thus, the operation of the Lanai met tower project does not appear to be having a direct effect on Hawaiian petrels, Newell's shearwaters, Hawaiian stilts, Hawaiian hoary bats, or any other flying wildlife species during its 6 years of operation.

6.0 REFERENCES

- AECOS, Inc. 2007. Botanical surveys at seven meteorological tower sites on northern Lanai, Hawaii. Prepared by E.B. Guinther and S.A. James. AECOS No. 1162.
- Erickson, W.P., J. Jeffery, K. Kronner, and K. Bay. 2004. Stateline Wind Project wildlife monitoring final report, July 2001 – December 2003. Technical report peer-reviewed by and submitted to FPL Energy, the Oregon Energy Facility Siting Council and the Stateline Technical Advisory Committee.
- Erickson, W.P., K. Kronner, K. Bay. 2007. Stateline Wind Project wildlife monitoring annual report, January – December 2006. Technical report prepared by WEST, Inc. and NWC, Inc. and submitted to FPL Energy, the Oregon Energy Facility Siting Council, and the Stateline Technical Advisory Committee.

- Erickson, W.P., J.D. Jeffrey, and V.K. Poulton. 2008. Puget Sound Energy Wild Horse Wind Facility post-construction avian and bat monitoring first annual report: January-December 2007. Prepared for Puget Sound Energy.
- Enk, T., K. Bay, M. Sonnenberg, J. Flaig, J.R. Boehrs, and A. Palochak. 2011. Year 1 post-construction avian and bat monitoring report: Biglow Canyon Wind Farm Phase II. Prepared by WEST, Cheyenne, WY.
- First Wind. 2011. Kaheawa Pastures Wind Energy Generation Facility Habitat Conservation Plan FY 2011 Annual Report: Year 5 HCP Implementation. Kaheawa Wind Power, LLC.
- First Wind. 2012. Kaheawa Pastures Wind Energy Generation Facility Habitat Conservation Plan FY 2012 Annual Report: Year 6 HCP Implementation. Kaheawa Wind Power, LLC.
- Jain, A.A., R.R. Koford, A.W. Hancock, and G.G. Zenner. 2011. Bat mortality and activity at a Northern Iowa Wind Resource Area. *American Midland Naturalist* 165: 185-200.
- Jeffery, J.D., K. Bay, W. Erickson, M. Sonnenberg, J. Baker, M. Kesterke, J.R. Boehrs, A. Palochak. 2009. Portland General Electric Biglow Canyon Wind Farm Phase I post-construction avian and bat monitoring first annual report. Prepared by WEST, Inc., Cheyenne, WY.
- Johnson, G.D., W.P. Erickson, M.D. Strickland, M.F. Shepherd, D.A. Shepherd, and S.A. Sarappo. 2002. Collision mortality of local and migrant birds at a large-scale wind-power development on Buffalo Ridge, Minnesota. *Wildlife Society Bulletin* 30: 879-887.
- Johnson, G.D., M.K. Perlick, W.P. Erickson, and M.D. Strickland. 2003. Bat activity, composition and collision mortality at a large wind plant in Minnesota. *Wildlife Society Bulletin* 32: 1278 – 1288.
- Kronner, K., B. Gritski, and S. Downes. 2008. Big Horn Wind Power Project wildlife fatality monitoring study 2006–2007. Prepared by Northwest Wildlife Consultants, Inc., Goldendale, WA.
- Piorkowski, M.D. 2006. Breeding bird habitat use and turbine collisions of birds and bats located at a wind farm in Oklahoma mixed-grass prairie. Master's Thesis, Oklahoma State University, Stillwater, OK.
- Poulton, V. and W.P. Erickson. 2010. Post-Construction Bat and Bird Fatality Study Judith Gap Wind Farm Wheatland County, Montana, Final Report, Results from June–October 2009 Study and Comparison with 2006-2007 Study. Technical report prepared by WEST, Inc., Cheyenne, WY.

- SWCA (SWCA Environmental Consultants). 2011. Kaheawa Wind Power II Wind Energy Generation Facility habitat conservation plan. Prepared for Kaheawa Wind Power II, LLC.
- Tetra Tech (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, HI.
- Tetra Tech EC, Inc. 2010. Lanai meteorological towers habitat conservation plan second annual report (2010). Prepared for Castle & Cooke, DOFAW, and USFWS.
- Young, D.P., W. Erickson, R.E. Good, M.D. Strickland and G.D. Johnson. 2003. Avian and bat mortality associated with the initial phase of the Foote Creek Rim Windpower Project, Carbon County, WY. Final Report to Pacific Inc., Portland OR. 53 pp.
- Young, D.P., W. Erickson, J. Jeffrey, and V. Poulton. 2007. Puget Sound Energy Hopkins Ridge Wind Project phase I post-construction avian and bat monitoring first annual report: January-December 2006. Prepared for Puget Sound Energy.