

# Kahuku Habitat Conservation Plan Annual Report FY 2015



Kahuku Wind Power, LLC

56-1050 Kamehameha Hwy

Kahuku, Hawaii 96731

August, 2015

ITL 10/ BO# 2010-F-0190

I certify that to the best of my knowledge, after appropriate inquiries of all relevant persons involved in the preparation of this report, the information submitted is true, accurate and complete.

A handwritten signature in cursive script that reads "Mitchell Craig".

Hawaii HCP Manager  
SunEdison Energy, LLC

## Table of Contents

Executive Summary.....	5
Introduction.....	6
Fatality Monitoring.....	6
Vegetation Management.....	8
Carcass Retention Trials.....	8
Searcher Efficiency Trials.....	8
Downed Wildlife.....	8
Hawaiian Hoary Bat Take Estimation.....	8
Hawaiian Hoary Bat Monitoring.....	9
Wildlife Education and Observation Program.....	9
Mitigation.....	9
Adaptive Management.....	10
Agency Meetings Site Visits.....	10
Expenditures.....	10
Citations.....	10
Appendices.....	11

## List of Figures

**Figure 1.** KAH roads, WTG's, MET tower, fatality monitoring plots and bat detector locations.....7

## List of Appendices

- Appendix 1.** .....Fatality Monitoring Plot Search Dates at KAH in FY 2015 Q3 and Q4.
- Appendix 2.** .....CARE trials U, V and X at KAH in FY 2015.
- Appendix 3.** .....SEEF trials at KAH in FY 2015 Q4.
- Appendix 4.** .....Fatality estimation at KAH in FY 2015.
- Appendix 5.** .....Nights with bat detections at KAH in FY 2014-2015.
- Appendix 6.**.....Waterbird nesting activity at Hamakua Marsh-July 2015.
- Appendix 7.**.....Hawaiian hoary bat mitigation for Kahuku Wind Power-FY2015.
- Appendix 8.** .....KAH expenditures for FY 2015.

## ***Executive Summary***

Kahuku Wind Power, LLC (KAH) has been implementing a Habitat Conservation Plan (HCP) since approval May 27, 2010. A federal Biological Opinion (BO 2010-F-0190) and a Hawaii State Incidental Take License (ITL-10) were approved in May and June 2010, respectively. The project was constructed in 2010 and early 2011, and began commercial operations on March 23, 2011. This report summarizes work performed by KAH at the conclusion of the State of Hawaii 2015 fiscal year (FY 2015: July 1 - June 30, 2015). Species covered under the HCP include seven threatened and endangered birds and one endangered bat.

SunEdison, LLC acquired First Wind Energy, LLC officially on January 29, 2015. As a result of this transaction the U. S. Department of Energy no longer regulates activities under the BO; however USFWS has determined that the Incidental Take Statement remains in effect. The HCP, ITL and ITP remain unchanged and in the project owner's name, Kahuku Wind Power, LLC. First Wind's HCP program employees have not changed and are now SunEdison employees.

Fatality monitoring plots were reduced from full intensive monitoring (twice weekly to 64m and every two weeks to 96m) on September 1 to only 64 m radius circular plots searched twice weekly centered on the wind turbine generators (WTGs). Plots were reduced again to 35 m radius plots searched monthly from December 2014 through March 2015 and then once weekly beginning in April 2015. Intensive monitoring was discontinued on November 18, 2014.

Fifty-one searcher efficiency (SEEF) trials with six medium size birds and 45 rats and three carcass persistence (CARE) trials with seven medium size birds and 11 rats were conducted in FY 2015. Considering only the first 14 days as the trial length in order to compare current trials to past trials that lasted only 14 days, the mean rat carcass persistence in days for FY 2015 is 7.8 (N = 11, SD = 4.7) and for medium birds is 11.7 (N = 7, SD = 4.0). The mean searcher efficiency for rats in FY 2015 is 71 % (N = 45) and for medium birds is 100 % (N = 6).

One bat and no birds listed in the state ITL and federal BO were found in FY 2015. Two wedge-tailed shearwaters and one great frigatebird were found dead and one great frigatebird was found injured but alive in FY 2015. The great frigatebird now resides at Sea Life Park on Oahu. Non-native introduced species found dead in FY 2015 include three zebra doves, one spotted dove, one red vented bulbul, one nutmeg mannikin, and one ring necked pheasant.

The fatality estimate using the Huso et al (2015) estimator for four observed bats at 80% credibility levels is 10 and the indirect take (IDT) considering the credibility range is four juveniles.

Twelve Wildlife Acoustics SM2BAT+™ ultrasonic detectors (SM2s) with one SM3BAT™ microphone (mic) each located 50m from the project's 12 WTG's at 6.5m above the ground detected Hawaiian hoary bats on 13 of 3461 detector nights (0.4 % of detector nights) in FY 2015.

SunEdison continued monthly progress calls with the USFWS and DOFAW in FY 2015. The ESRC reviewed the FY 2014 annual HCP report on October 24<sup>th</sup>. SunEdison implemented low level monitoring in April after receiving support from the ESRC on March 31<sup>st</sup>. Barn owl eradication as mitigation for Newell's shearwater and Hawaiian petrel on Kauai began in FY 2015 Q4. Baseline mitigation for waterbirds at Hamakua Marsh is complete. Baseline pueo and bat mitigation are complete.

## ***Introduction***

This report summarizes work performed by KAH under the terms of the approved Habitat Conservation Plan (HCP) dated May 27, 2010 and pursuant to the project's Incidental Take License (ITL-10) and Biological Opinion (BO 2010-F-0190) at the conclusion of the State of Hawaii FY 2015 (July 1, 2014 – June 30, 2015). The BO and ITL were issued for the project in May and June, 2010, respectively. The ITL and BO cover seven federally-listed threatened and endangered species and one state-listed endangered species: the Hawaiian stilt or ae'o (*Himantopus mexicanus knudseni*), Hawaiian coot or 'alae ke'oke'o (*Fulica alai*), Hawaiian duck or koloa maoli (*Anas wyvilliana*), Hawaiian moorhen or 'alae 'ula (*Gallinula chloropus sandvicensis*), Newell's shearwater or 'a'o (*Puffinus auricularis newelli*), Hawaiian petrel or 'ua'u (*Pterodroma sandwichensis*), Hawaiian hoary bat or 'ope'ape'a (*Lasiurus cinereus semotus*) and the Hawaiian short-eared owl or pueo (*Asio flammeus sandwichensis*), respectively. KAH began construction shortly after issuance of the ITL and BO, including initiation of monitoring and mitigation measures as prescribed by the HCP.

SunEdison, LLC acquired First Wind Energy, LLC officially on January 29, 2015. As a result of this transaction the U. S. Department of Energy no longer regulates activities under the BO, however USFWS has determined in a letter dated November 19, 2014 that the Incidental Take Statement remains in effect. The HCP and ITL remain unchanged and in the project owner's name, Kahuku Wind Power, LLC. A federal HCP is being drafted that will mirror the state HCP and the state HCP is being amended to permit Nēnē take. First Wind's HCP program employees have not changed and are now SunEdison employees.

## ***Fatality Monitoring***

Fatality monitoring protocol was changed on September 1, 2014 from the full intensive searching protocol, i.e., searching to 96m radius circles centered on the WTGs (75 % of the rotor swept zone (RSZ) height) twice monthly and to 64m radius circles centered on the WTGs (50 % of the RSZ height) twice weekly to only the 50 % plots twice weekly. Intensive monitoring that had begun in January 2011 as WTGs became operational and fully implemented by March 2011, ended November 18, 2014. WTGs were not operational from August 2013 through August 2014 (13 months). According to the HCP the full intensive monitoring protocol was required for two years. By September 2014 the full protocol was implemented for two years and five months.

As an interim measure until state and federal regulatory agency and ESRC members concluded what low level monitoring protocols would be recommended, SunEdison conducted monthly searches to 35m radius from the WTGs (equivalent to 27 % of the maximum RSZ height) from December 2014 through March 2015. The ESRC met December 16, 2014 and requested additional information about intensive monitoring in order to make a recommendation what future monitoring protocols would be appropriate. SunEdison provided additional information to the ESRC on February 25, 2015 and proposed to discontinue intensive monitoring.

On March 31, 2015 the ESRC met again and after additional review of intensive monitoring data agreed to low-level monitoring each year, the details to be determined in consultation with the DOFAW, USFWS and USGS statistical experts. With the agreement of DOFAW and USFWS beginning in April 2015 searches have been conducted weekly within 35m radius circular plots centered on the WTGs (Appendix 1, Figure 1). As part of the reduced monitoring protocol one CARE trial will be conducted in each quarter using at least two medium size birds and 5 rats in each trial. SEEF trials will include at least 10 rat and 1 medium bird in each quarter.

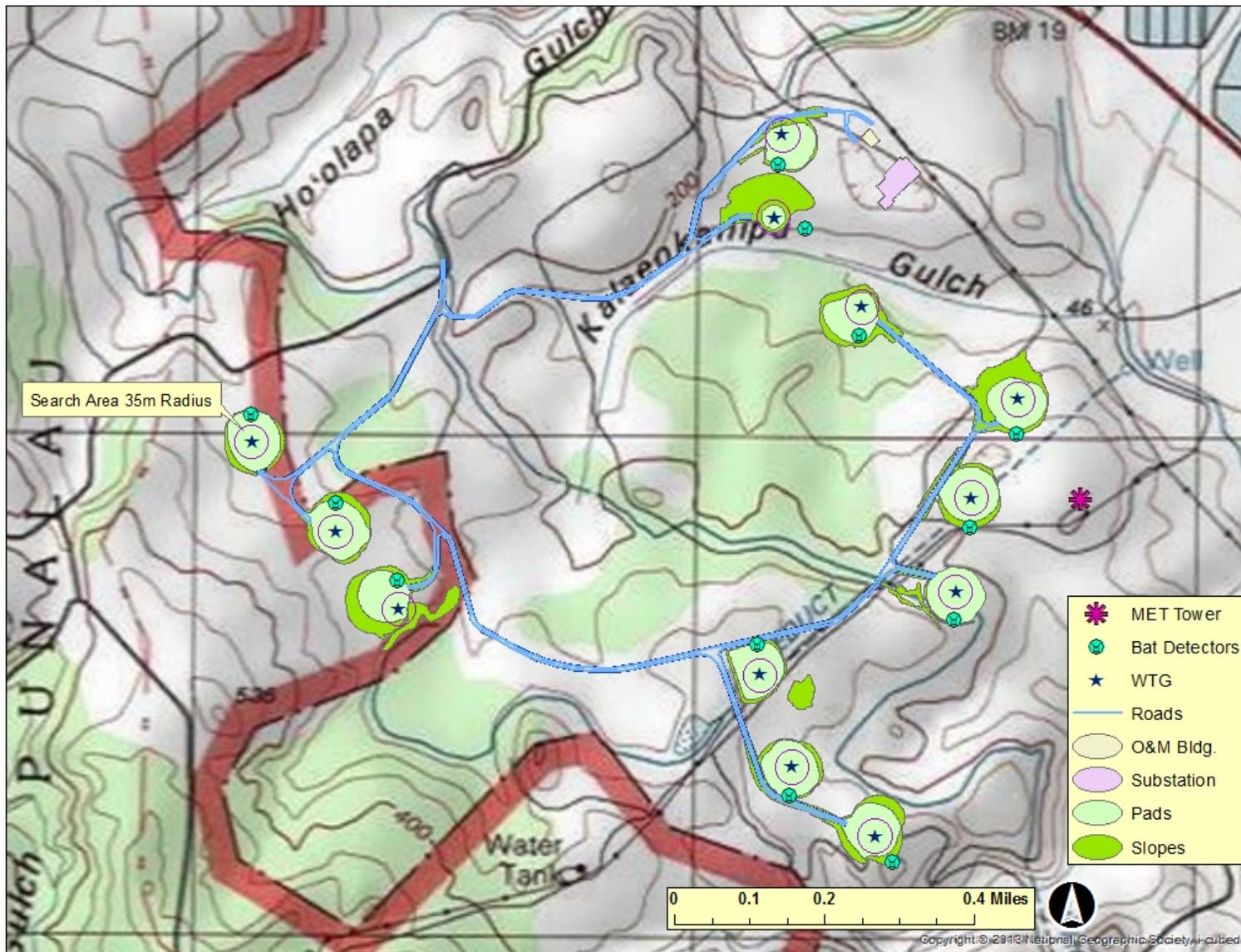


Figure 1. KAH roads, WTG's, MET tower, fatality monitoring plots and Bat detector locations.

## ***Vegetation Management***

Fatality monitoring plots around the WTG's and MET tower are mowed every month to facilitate downed wildlife detection. After November 18, 2014 plots were mowed monthly only within the 35m low-intensity search radius.

## ***Carcass Persistence Trials***

Three CARE trials with seven medium size birds and 11 rats were conducted in FY 2015 (Appendix 2). The mean rat carcass persistence in days for FY 2015 is 7.8 (N = 11, SD = 4.7) and for all rat trials conducted at KAH is 8.6 (N = 67, SD = 5.1). The mean bird carcass persistence in days for FY 2015 is 11.7 (N = 7, SD = 4.0) and for all bird trials conducted at KAH is 12.0 (N = 35, SD = 4.1).

## ***Searcher Efficiency Trials***

Fifty-one SEEF trials (including 9 canine trials) with six medium size birds and 45 rats were conducted in FY 2015 (Appendix 3). The mean searcher efficiency for rats in FY 2015 is 71 % (N = 45) and for all rat trials at KAH is 69 % (N = 198). The mean searcher efficiency for the medium birds in FY 2015 is 100 % (N = 6) and for all medium size bird trials at KAH is 87 % (N = 70).

## ***Downed Wildlife***

One bat and no birds listed in the ITL and federal BO were found in FY 2015. The total observed bat take at KAH is four. Two wedge-tailed shearwaters and one great frigatebird were found dead and one great frigatebird was found alive in FY 2015. The great frigatebird now resides at Sea Life Park on Oahu. Non-native introduced species found dead in FY 2015 include three zebra doves, one spotted dove, one red vented bulbul, one nutmeg mannikin, and one ring necked pheasant.

As prescribed in the HCP, KAH had initiated adaptive management (see Adaptive Management below) measures to reduce bat fatalities at the site on April 27, 2012.

## ***Hawaiian Hoary Bat Take Estimation***

The fatality estimate using the Huso et al (2015) estimator for four observed bats found between January 2011 and July 2015 at the more conservative 80% credibility level is 10 (Appendix 4). The estimators used in this report were developed by USGS and have been recommended by DOFAW and USFWS. The estimator's output is a value that represents the number of fatalities that has not likely been exceeded during the survey period. Values can be generated for varying levels of "credibility" (confidence), expressed as a percentage (e.g., 50%, 80%, etc.) - the higher the desired level of credibility, the more conservative (higher) the estimated value. At the request of USFWS the more conservative 80% credibility level is reported.

Observed direct take (ODT) is the only take that has been documented and confirmed at the site. However, for the purposes of estimating potential take for permitting and mitigation, various statistical methods have been developed for estimating additional take that may have occurred but that was not observed. This unobserved direct take (UDT) attempts to account for fatalities that may have fallen outside of search plots, were missed by searchers, or were removed by scavengers or environmental factors such as high winds.

In addition to ODT and UDT, indirect take (IDT) is estimated separately to account for the loss of dependent young that may occur indirectly as the result of the loss of an adult female during the breeding season. Any adult female bat fatalities found during the breeding season are assumed to have dependent young, and a loss of 1.8 juveniles is calculated (2 pups X 0.9 survival rate per pup). The sex ratio of adult bats found from April through September during FY 2013, 2014 and 2015 at Kahuku and nearby Kawaihoa is nine males to four female. If we assume the same sex ratio for the three adults of unknown sex found during the breeding season at Kahuku then there is a 0.31 ( $4/13=0.31$ ) chance each adult is female.

Thus, the IDT from the three observed adults of unknown sex found during the breeding season would be  $3 \times 0.31 \times 1.8 = 1.7$  juveniles. The indirect take (IDT) for the unobserved direct take considering the 80% credibility level is 1.8 juveniles ( $10 - 4 = 6 \times 0.3 = 1.8$ ). The total take at 80% credibility are not more than 10 adults plus four juveniles (3.5 rounded up). The Baseline 5-year permitted take of 10 adult and eight juvenile bats has not been exceeded.

### ***Hawaiian Hoary Bat Monitoring***

Twelve Wildlife Acoustics SM2BAT+™ ultrasonic detectors (SM2) with one SM3BAT™ microphone (mic) each located 50m from the project's 12 WTG's at 6.5m above the ground detected Hawaiian hoary bats on 13 of 3461 detector nights (0.4 % of detector nights) in FY 2015 (Appendix 5).

### ***Wildlife Education and Observation Program***

Seven new personnel or longer term contractors required WEOP training orientation to be administered in FY 2015.

### ***Mitigation***

#### ***Newell's Shearwater and Hawaiian Petrel***

As part of KAH's seabird mitigation obligation SunEdison funded the Kaua'i Endangered Seabird Recovery Project (KESRP) to deploy and then analyze data from Wildlife Acoustics SM2™ Songmeters at multiple locations in Kauai's remote mountains to survey for Newell's shearwater and Hawaiian petrel nesting colonies. These were deployed in August 2013 and April 2014 via helicopter and were retrieved in October 2013 and August 2014, respectively. Songmeters were deployed again in April 2015 on Kauai and will be retrieved in August 2015. Songs were analyzed and results summarized by Conservation Metrics, Inc.

Additional mitigation for Newell's shearwater and Hawaiian petrel on Kauai began in FY 2015 Q4. SunEdison has funded DOFAW to conduct a barn owl predator control project on Kauai at the chosen seabird colonies for one year.

#### ***Waterbirds***

SunEdison has completed its obligation for Hawaiian stilts, moorhens, and coot with funding already provided to DOFAW for four years of waterbird mitigation at Hamakua. Quarterly reports of progress and results were submitted by DOFAW in July and October 2014 and January, April and July 2015 (Appendix 6).

Waterbird mitigation included four years of predator and vegetation control and productivity assessment. Total Coot, Moorhen and Stilt fledgling production from FY2012 through FY2015 was 13, 141 and 24, respectively.

### ***Pueo***

The final \$25,000 obligation to fund DOFAW to initiate pueo research was paid in July 2014.

### ***Hawaiian Hoary Bat***

KAH has paid the full obligation of \$150,000 for Tier 1 bat mitigation being conducted by DOFAW at Kahikinui, Maui. The annual report for FY2015 is Appendix 7.

### ***Adaptive Management***

The third of the four total Hawaiian hoary bat fatalities occurred April 23, 2012. According to fatality estimate calculations the Baseline annual take of four was exceeded then, triggering Adaptive Management. In accordance with the HCP, curtailment of all turbines up to a wind speed of five m/s began April 27, 2012 and continues to be implemented between sunset and sunrise from April through November.

### ***Agency Site Visits and Reporting***

SunEdison continued monthly progress calls with the USFWS and DOFAW throughout FY 2015. SunEdison biologists met with the ESRC on October 24 to review the FY 2014 HCP annual report and on December 16, 2014 to review interim monitoring protocols and a Resource Equivalency Analysis for determining the amount of mitigation required to offset anticipated take of bats. SunEdison biologists met with the ESRC on March 31, 2015 to receive their determination on post-intensive downed wildlife monitoring protocols. A bat workshop organized by the state DOFAW was held on April 14 and 15, 2015. Experts, ESRC members, consultants, and HCP permittees and applicants attended the workshop.

### ***Expenditures***

KAH total HCP related expenditures were \$231,011 (Appendix 8).

### ***Citations***

Manuela M. P. Huso, Daniel H. Dalthorp, David A. Dail, and Lisa J. Madsen. 2015. Estimating wind-turbine caused bird and bat fatality when zero carcasses are observed. *Ecological Applications*.  
<http://dx.doi.org/10.1890/14-0764.1>

**Appendix 1. Fatality Monitoring Plot Search Dates at KAH in FY 2015 Q3 and Q4.**

<b>WTG</b>											
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>
12/19	12/19	12/19	12/19	12/19	12/19	12/19	12/19	12/19	12/19	12/19	12/19
1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16
2/12	2/12	2/12	2/12	2/12	2/12	2/12	2/12	2/12	2/12	2/12	2/12
3/13	3/13	3/13	3/13	3/13	3/13	3/13	3/13	3/13	3/13	3/13	3/13
4/10	4/10	4/10	4/10	4/10	4/10	4/10	4/10	4/10	4/10	4/10	4/10
4/17	4/17	4/17	4/17	4/17	4/17	4/17	4/17	4/17	4/17	4/17	4/17
4/24	4/24	4/24	4/24	4/24	4/24	4/24	4/24	4/24	4/24	4/24	4/24
5/1	5/1	5/1	5/1	5/1	5/1	5/1	5/1	5/1	5/1	5/1	5/1
5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8
5/15	5/15	5/15	5/15	5/15	5/15	5/15	5/15	5/15	5/15	5/15	5/15
5/21	5/21	5/21	5/21	5/21	5/21	5/21	5/21	5/21	5/21	5/21	5/21
5/29	5/29	5/29	5/29	5/29	5/29	5/29	5/29	5/29	5/29	5/29	5/29
6/5	6/5	6/5	6/5	6/5	6/5	6/5	6/5	6/5	6/5	6/5	6/5
6/11	6/11	6/11	6/11	6/11	6/11	6/11	6/11	6/11	6/11	6/11	6/11
6/18	6/18	6/18	6/18	6/18	6/18	6/18	6/18	6/18	6/18	6/18	6/18
6/25	6/25	6/25	6/25	6/25	6/25	6/25	6/25	6/25	6/25	6/25	6/25

**Appendix 2.** CARE trial U at KAH in FY 2015.

CARE U FY2015		Trial 1		Trial 2		Trial 3		Trial 5		Trial 4		Trial 6	
Carcass Type		Rat		Bird		Rat		Bird		Rat		Bird	
WTG		5		6		6		7		7		8	
Vegetation		Bare (on slope)		Bare (on slope)		Tall grass		Short grass		Bare		Bare (top of slope)	
Distance (m)		52m		55m (changed from 88m)*		58m		26m		36m		60m (changed from 86m)*	
Day	Date	P/A	Notes	P/A	Notes	P/A	Notes	P/A	Notes	P/A	Notes	P/A	Notes
day 0	2-Sep	P		P		P		P		P		P	
day 1	3-Sep	P	M,H	P		P	A	P	A,L	P		P	
day 2	4-Sep	P	A,C,D	P	A	P	D,H	P		P	H,A	P	L
day 3	5-Sep	P		P		P		P	F,C	P	D	P	
day 4	6-Sep	P	S	P		P	S,L	P	Scav,M,B	A	Scav	P	
day 5	7-Sep	P		P		P		P				P	S,M,B,W
day 6	8-Sep	P		P		P		P				P	
day 7	9-Sep	P		P		P		P				P	
day 8	10-Sep	P		A	S	A	S,L	P				P	
day 9	11-Sep	P						P				P	
day 10	12-Sep	P						P				P	
day 11	13-Sep	P						P				P	
day 12	14-Sep	P						P				P	
day 13	15-Sep	P						P				P	
day 14	16-Sep	P						P				P	
day 21	23-Sep	P						P				P	
day 28	30-Sep	P						P				P	
<b>Retention (days)</b>		<b>28</b>		<b>7</b>		<b>7</b>		<b>28</b>		<b>3</b>		<b>28</b>	

\* Directive to eliminate searching in 75%. CARE trial moved from 75% areas and into 50% areas

A	ants	H	hair loss
B	body feathers	L	fly larvae
C	dirt covered	M	moved
D	desiccated	S	skeleton
F	feathers	W	wing feathers
Scav	Scavenged		

**Appendix 2 (cont.).** CARE trial V at KAH in FY 2015.

<b>CARE V FY2015</b>		<b>Trial 1</b>		<b>Trial 2</b>		<b>Trial 3</b>		<b>Trial 4</b>		<b>Trial 5</b>		<b>Trial 6</b>	
Carcass Type		Bird		Rat		Bird		Rat		Rat		Bird	
WTG		1		1		5		6		7		12	
Vegetation		Bare (on Slope)		Bare		Bare		Bare		Short grass		Short grass	
day 0	27-Oct	P		P		P		P		P		P	
day 1	28-Oct	P		<b>P</b>	A	P		P		P	A	P	
day 2	29-Oct	P		A		P		P	A,H	P		P	
day 3	30-Oct	P				P		P		P	H	P	
day 4	31-Oct	P	A			P	M	<b>P</b>		P		P	
day 5	1-Nov	P				<b>P</b>		A		P	D	P	
day 6	2-Nov	P				A				P		P	
day 7	3-Nov	<b>P</b>								<b>P</b>	S	<b>P</b>	
day 8	4-Nov	End of Trial											
<b>Retention (days)</b>		<b>7</b>		<b>1</b>		<b>5</b>		<b>4</b>		<b>7</b>		<b>7</b>	

**Appendix 2 (cont.).** CARE trial X at KAH in FY 2015.

CARE X FY2015		Trial 1		Trial 2		Trial 3		Trial 4		Trial 5		Trial 6	
Carcass Type		Rat		Rat		bird		Rat		Rat		Rat	
WTG		12		10		8		6		4		2	
Vegetation		Short grass on pad											
Distance (m)		30m											
Day	Date	P/A	Notes	P/A	Notes	P/A	Notes	P/A	Notes	P/A	Notes	P/A	Notes
day 0	9-Jul	P		P		P		P		P		P	
day 1	10-Jul	P		P	A	P	A	P	A,M	P	A	P	A
day 2	11-Jul	P		P	S,D	P		P		P		P	
day 3	12-Jul	P		A	C	P		P		P		P	
day 4	13-Jul	P		A		P		<b>P</b>		<b>P</b>		P	
day 5	14-Jul	P	H	A		P		A		A		P	S,D
day 6	15-Jul	<b>P</b>		A		P						P	
day 7	16-Jul	A		A		P						P	
day 8	17-Jul			A		P						P	
day 9	18-Jul			A		P					-	P	
day 10	19-Jul			A		P						P	
day 11	20-Jul			A		P						P	
day 12	21-Jul			A		P						P	
day 13	22-Jul			A	C	P						P	
day 14	23-Jul			P	S	P						P	
day 21	30-Jul			P		P						P	
day 28	6-Aug			<b>P</b>		<b>P</b>						<b>P</b>	
<b>Retention (days)</b>		<b>6</b>		<b>28</b>		<b>28</b>		<b>4</b>		<b>4</b>		<b>28</b>	

**Appendix 3.** SEEF trials at KAH in FY 2015 Q4.

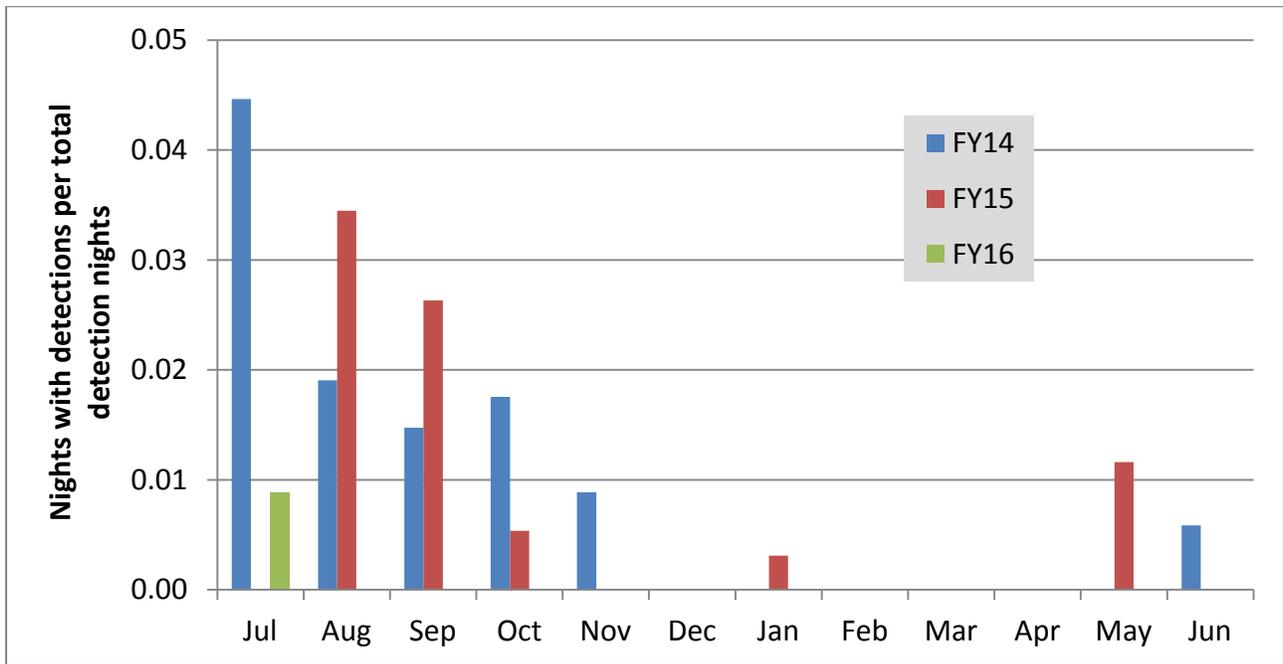
Date	WTG	Carcass Size	Carcass Type	Found	Point ID	Human/ K9
7/7/2014	1	Short	Rat	1	224	Human
7/7/2014	2	Short	Rat	1	223	Human
7/7/2014	3	Medium	Rat	1	227	Human
7/24/2014	7	Short	Rat	1	225	Human
7/24/2014	1	Short	Rat	1	220	K9
7/24/2014	1	Short	Rat	1	222	K9
7/25/2014	12	Short	Bird	1	378	Human
7/25/2014	12	Short	Rat	0	221	Human
7/25/2014	6	Short	Rat	1	217	K9
8/15/2014	3	Short	Rat	0	216	Human
8/15/2014	7	Short	Rat	1	219	Human
8/21/2014	7	Short	Rat	1	207	Human
8/21/2014	1	Short	Rat	1	214	K9
8/21/2014	5	Medium	Rat	0	212	K9
8/29/2014	4	Short	Bird	1	210	Human
8/29/2014	10	Short	Rat	1	208	Human
8/29/2014	10	Short	Rat	0	211	Human
9/3/2014	12	Short	Bird	1	305	Human
9/3/2014	10	Short	Rat	0	206	Human
9/3/2014	7	Short	Rat	1	329	K9
9/25/2014	4	Short	Rat	1	203	Human
9/25/2014	6	Short	Rat	1	204	Human
9/25/2014	2	Short	Rat	1	205	K9
10/10/2014	1	Short	Rat	0	401	K9
10/10/2014	6	Short	Rat	0	410	Human
10/14/2014	1	Short	Rat	1	412	Human
10/14/2014	2	Short	Rat	1	415	Human
10/14/2014	3	Short	Bird	1	414	Human
10/28/2014	7	Short	Rat	1	403	Human
10/28/2014	7	Short	Rat	0	404	Human
10/28/2014	11	Medium	Rat	0	405	K9
11/6/2014	3	Short	Rat	1	406	Human
11/6/2014	6	Short	Rat	1	419	Human
11/6/2014	6	Short	Rat	0	421	Human
11/14/2014	7	Short	Rat	1	404	Human
11/14/2014	8	Short	Rat	1	402	Human
11/14/2014	11	Short	Bird	1	407	Human

11/20/2014	4	Short	Rat	1	422	Human
11/20/2014	6	Short	Rat	1	423	Human
5/15/2015	3	Short	Rat	1		Human
5/15/2015	5	Short	Rat	1		Human
5/15/2015	5	Short	Rat	0		Human
5/15/2015	5	Short	Rat	0		Human
7/2/2015	3	Short	Rat	1		Human
7/2/2015	6	Short	Rat	1		Human
7/2/2015	6	Short	Bird	1		Human
7/9/2015	7	Short	Rat	0		Human
7/16/2015	1	Short	Rat	1		Human
7/16/2015	8	Short	Rat	1		Human
7/16/2015	9	Short	Rat	1		Human
7/16/2015	10	Short	Rat	1		Human

**Appendix 4.** Fatality estimation at KAH in FY 2015.

Credibility level (1 - ?)					Posterior distribution for total fatality for 3.5 years.						
0.8							g = P(observe   arrive):	0.593	95% CI:	0.410	0.763
Yr	X	g	min(g)	max(g)	rel_wt	80% credible maximum:	<b>10</b>				
						m	P(total = m)	P(total > m)			
1	1	0.495	0.302	0.679	0.75						
2	0	0.765	0.599	0.87	0.5	0	0	1			
3	2	0.603	0.496	0.71	0.33	1	0	1			
4	0	0.777	0.637	0.871	0.9	6	0.164	0.609			
5	1	0.672	0.382	0.868	0.25	7	0.151	0.458			
6	0	0.149	0.06	0.351	0.42	9	0.096	0.239			
7	0	0.504	0.187	0.766	0.17	<b>10</b>	<b>0.071</b>	<b>0.168</b>			

**Appendix 5.** Nights with bat detections at KAH in FY 2014-2015.



## Appendix 6.



### JULY 2015 WATERBIRD NESTING ACTIVITY HAMAKUA MARSH ISLAND OF OAHU

Prepared by: Katherine Doyle, Wildlife Biologist

Oahu Division of Forestry and Wildlife

## INTRODUCTION

Since July 2011, the Division of Forestry and Wildlife (DOFAW), funded by the Kahuku SunEdison's Habitat Conservation Plan (HCP), has been actively managing Hamakua Marsh. Predator control and vegetation maintenance have been identified as key needs for maintaining and increasing waterbird productivity. Waterbird productivity is: nesting success, fledgling success, overall habitat utilization, and predator control success. Predator control has been contracted through the United States Department of Agriculture, Wildlife Services (USDA-WS). Predator control is conducted year-round to ensure enhanced waterbird nesting success. Vegetation maintenance is done by DOFAW personnel using herbicide, machinery, and hand tools. The Hawaiian Stilt (*Himantopus mexicanus knudseni*), Hawaiian Gallinule (*Gallinula chloropus sandvicensis*), and Hawaiian Coot (*Fulica alai*) are endemic and endangered Hawaiian waterbirds that utilize Hamakua Marsh for nesting, feeding, and loafing. There are also Black-crested night herons (*Nycticorax nycticorax*), Mallard ducks (*Anas platyrhynchos*) and Mallard/Hawaiian Duck (*Anas platyrhynchos/Anas wyvilliana*) hybrids at Hamakua. A number of shorebirds also utilize this wetland as a loafing area. The Pacific golden plover (*Pluvialis fulva*), Ruddy turnstone (*Arenaria interpres*), Wandering tattler (*Tringa incana*), and Cattle Egret (*Bubulcus ibis*) are commonly seen and recorded. The main water source at Hamakua is the rainfall. There is a stream that runs adjacent to the marsh, but it plays a minor role for water in the interior mudflats, except when large amounts of water enter the system. Because the wetland's water supply is from the rain, flooding usually only occurs in the winter. This means the wetland dries out in the late summer, and after the nesting season is over, machinery and herbicides can be used for management. This quarter, there was 189% of the average precipitation for Hamakua Marsh (appendix 1).

## OVERVIEW

This quarter was productive for moorhens and coots. Coot and moorhen nests were seen along the stream bank and interior of B and C basins. Then the city removed the sand plug in April, May and June which resulted in a water exchange and slight loss. Stilts started nesting in May, and after the chicks were born the families moved into the middle of the basins. The batis was so thick I was unable to observe them, only seeing them as they became adults. I observed 3 stilts fledge, 3 successful coot nests this quarter, with 3 chicks fledging. The following is a breakdown of the annual fledging results. Every quarterly report, I will update these numbers.

	Coot	Moorhen	Stilt	Vegetation Maintenance	Predator Control
2005	1	13	1	Grass, limited tilling	During nesting season
2006	0	51	15	Tilling post breed 2005	During nesting season
2007	1	36	13	No tilling	Year round
2008	5	33	10	No tilling	Year round
2009	5	52	16	Tilling post breed	Year round
2011	8	30	2	No tilling, grass	Year round
<b>2012</b>	<b>1</b>	<b>10</b>	<b>4</b>	<b>Tilling post breed 2011, grass</b>	<b>Year round</b>
<b>2013</b>	<b>2</b>	<b>24</b>	<b>13</b>	<b>No tilling, grass</b>	<b>Year round</b>
<b>2014</b>	<b>6</b>	<b>81</b>	<b>7</b>	<b>Tilled along roadway, grass</b>	<b>Year round</b>
<b>2015</b>	<b>5</b>	<b>26</b>	<b>3</b>	<b>Tilled along roadway, grass</b>	<b>Year round</b>

\*bold denotes HCP activity years

## METHODS

Survey Start Date: April 7, 2015

Survey End Date: June 29, 2015

Surveys are conducted following DOFAW protocol and have been repeated the same for every survey. Observers walked along the bank of the stream, on the shop side, away from the nesting areas, to avoid contact with birds, and survey the entire 22.7-acre wetland. This distance allows for observation of natural activity; most of the waterbirds in Hamakua are tame and expect to be fed when approached, so distance is needed to observe natural habits. The survey starts at the northwest corner of Kailua Road and Hamakua Drive, then continued southeast along the canal and marsh fence line. On each visit, the number of waterbirds and shorebirds in each of the four Basins were counted, native or non-native. Gallinule, coot and stilt numbers, habitat usage, nesting activity, banding information, predator control success, and overall wetland condition were the main focus in each of the surveys. Individuals were counted and mapped. Habitat usage was identified as: stream, stream bank, mudflat, mudflat/vegetated, 0"-3" water, 3"-6" water and >6" water (appendix 2a.-c.). Nesting activities of each species were also observed. Pairings, establishment of territory, and nesting activity was observed and recorded on maps. Survival rates of chicks and brood sized were also recorded.

## NEST ACTIVITY AND REPRODUCTIVE SUCCESS

From April 2015 until June 2015, Hamakua Marsh had 24 bird surveys completed with observations recorded. During this time, a total of 48 hours was spent on monitoring the stilts, moorhens, coots, migratory birds, and their interactions. Also during this time, a total of 358 hours was spent on vegetation maintenance. The following table shows the monthly time allocation.

		April	May	June	Total
Survey	days	7	9	8	24
	hours	14	18	16	48
Vegetation Maintenance	days	8	10	8	26
	hours	115	128	115	358

## **WATERBIRD SUCCESS**

The surveys found a range of numbers for all native and non- native birds. Generally, ducks seen were Mallards with the possibility of a few Koloa hybrids. The ducks were seen on the banks and in the parking lots behind the shops on Hamakua Drive, where they are feed by the public. There was an average of 6 Mallard/Koloa hybrids seen during surveys. Also seen along the shop banks were the Black Crested Night Heron, or Auku'u. There were an average of 12 adult 'Auku'u seen. Inside the marsh along the grasslands, Cattle Egrets were seen. On average there were 10 egrets within the wetland.

### **'Alae Ke'oke'o**

In the fall of 2011, a University of Hawaii graduate student, Randi Rhodes, has been catching coots to study them. She takes vital information, collars them, and releases where she catches them. There are two resident collard coots in Hamakua: AAF, and AAA.



\*Coot in the stream

Generally in this quarter, coot numbers were constantly at 10 paired. The coots were mating and nesting on the interior ponds, which are at a low salinity, this quarter. In April, three more coot nests were seen in the B basin. There were two nests in the interior ponds and the third was on the stream bank. These nests were all last quarters nests being reused. All three nests had a coot fledge successfully.

During this quarter, coots were primarily seen in the interior of the A, B and C Basins (appendix 3). Coots prefer to nest in locations that have robust emergent plants interspersed with open, fresh water which is usually less than 3 feet deep. They look for an area with room for takeoff and landing, but still protected from the wind. Salinity levels were taken periodically throughout the quarter.

	Basin A	Basin B	Basin C	Basin D	Total
Stream	0	2	0	2	4
Stream Bank	0	0	0	0	0
Mudflat	0	0	0	0	0
Mudflat/Veg	0	0	0	0	0
0" - 3"	0	0	0	0	0
3" - 6"	0	4	2	0	6
> 6"	0	0	0	0	0

## ‘Alae ‘Ula

Gallinule had the largest population among the endemic waterbirds within the marsh. Surveys found population counts ranged from 60 - 72. Most often, birds were seen inside the mudflat vegetation, popping their heads out of the *Batis*, or on the grassy knoll abutting parking lot or within parking lot. Gallinules generally prefer to nest in locations above open water less than 3 feet, but may choose to nest in dry areas, which leave chicks more easily accessible to predation. Survivorship of gallinule chicks is difficult to ascertain because of their secretive nature.



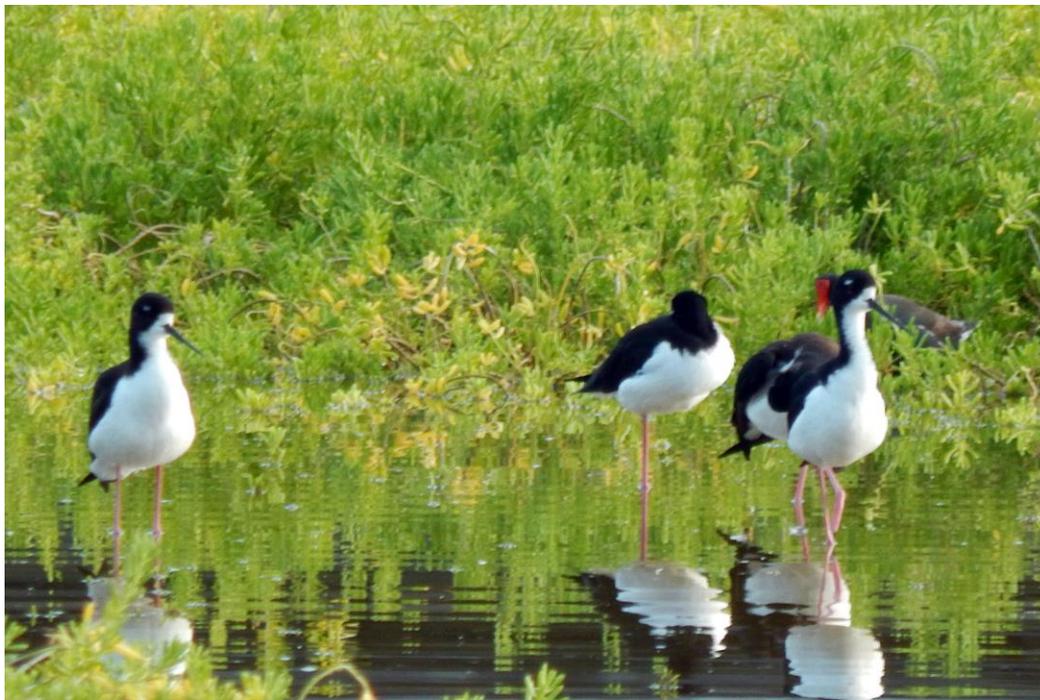
\*Gallinule family in stream

Because of the large amount of *batis* and water levels, there was nesting occurring throughout the marsh this entire quarter. I was unable to see any nest this quarter, only observing the chicks as they were born. Again, this marsh produces a large amount of moorhen year round.

	Basin A	Basin B	Basin C	Basin D	Total
Stream	0	0	0	0	0
Stream Bank	0	6	8	0	14
Mudflat	0	0	0	0	0
Mudflat/Veg	10	25	16	4	55
0" - 3"	0	0	0	0	0
3" - 6"	0	0	0	0	0
> 6"	0	0	0	0	0

## 'Ae'o

Stilt numbers were between 12 and 16 this quarter. Stilts started nesting in April along the edges of the marsh. After the chicks were born, the water levels decreased and the families moved into the interior to forage. I was unable to follow the families, only being able to observe the chicks as they were fledging. The majority of stilts are found in the B basin, with two in the D basin (appendix 3). The A basin is filled with moorhen and coots, pushing the stilts to the mudflats and grassy areas.



\*Stilts in A basin with gallinule

	Basin A	Basin B	Basin C	Basin D	Total
Stream	0	0	0	0	0
Stream Bank	0	0	0	0	0
Mudflat	0	0	0	0	0
Mudflat/Veg	4	5	5	0	14
0" - 3"	0	0	0	0	0
3" - 6"	0	0	0	0	0
> 6"	0	0	0	0	0

## TRACKING TUNNELS RESULTS

Tracking tunnels are used by conservationists to check for the presence of pest species in a target area. Because predators are often nocturnal, and are not readily seen during daylight, tracking tunnels give an indication of the presence of predators in the area. Tracking tunnels were deployed once per month, from July to present, to monitor trapping success. The construction was compliant with commonly used tunnels, 4" x 5" x 21". This rectangular box had peanut butter bait in the middle, ink pads surrounding the bait, and tracking cards placed on the inside of the tunnel. The tunnels were placed in a variety of areas to get a better understanding of rat activity. At each different spot, the tunnels were deployed overnight to monitor animal activity. The following table shows the results for the quarter with the yearly data as appendix 4.

## TRAPPING RESULTS

Live trapping, hunting and firearms were used throughout the quarter by the USDA-WS, to control predators in the Sanctuary. 20 traps are placed along the inner fenceline about 180 feet apart (appendix 5). The traps are baited and checked every 48 hours, except over holidays.

	Killed Euthanized	Transfer Custody
<u>Cats</u>	4	
<u>Mongoosees</u>	44	
<u>Mallards</u>	2	
<u>Rats</u>	23	

No snap-traps were set in this quarter.

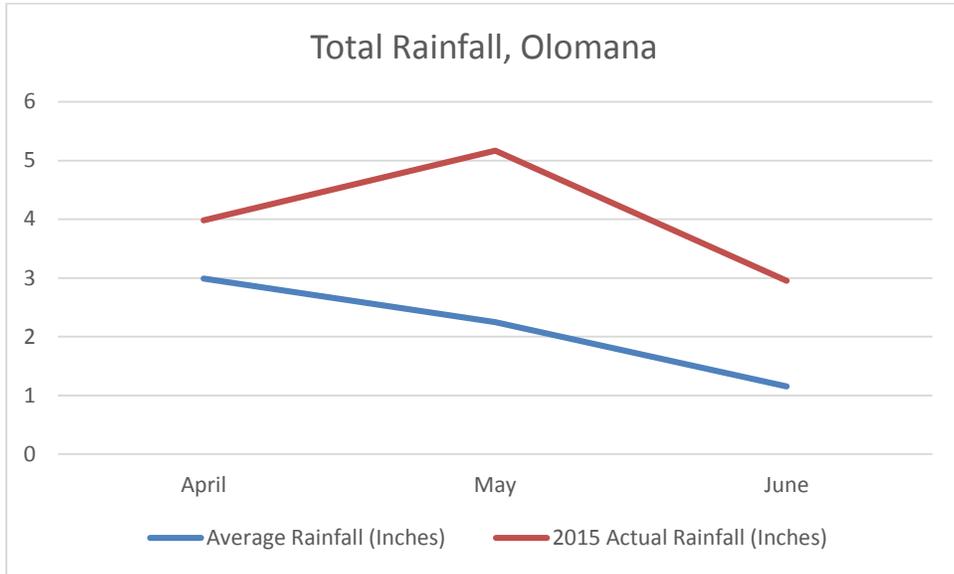
## VEGETATION

Since the October 2012, invasive species Indian fleabane (*Pluchea indica*) and koa haole (*Leucaena leucocephala*) have been targeted and are being removed. Non-native Guinea grass (*Urochloa maxima*) and California grass (*Urochloa mutica*) are also targeted for removal, so as to reduce biomass and encourage growth of native plants and non-native Bermuda grass (*Cynodon* spp.). Bermuda grass populations are encouraged on access roads, outplanting sites, and slopes, to reduce erosion and as foraging ground for native birds.

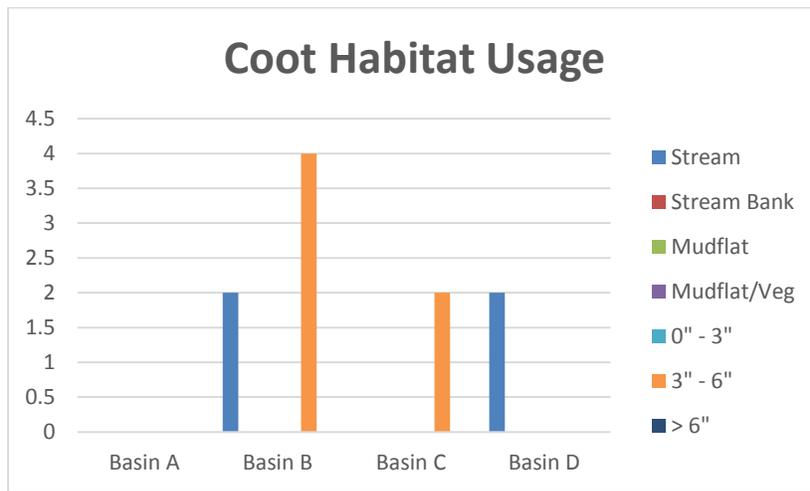
Mowing along grassy roads and surrounding marsh land has continued. This provides extra foraging grounds for stilts, moorhens, kolea and other birds. Keeping the grass cut low, 2.5", keeps California grass from growing and spreading. The inside of the marsh where the California grass was able to establish and grow during the nesting season, was sprayed, and cut. Weed-whacking the surrounding burms and roadways, has continued. With the extra rain we have been getting this year, I have been spending more time with vegetation maintenance than in the past.

We had high winds this spring, and 8 kiawe trees fell down. I spent many hours chopping and dragging the limbs out of the marsh. Also during this time, I cut and removed haole koa, pluchea, and mangrove from the stream bank. There is still one mangrove on the stream bank within the marsh. This is where a coot nest was and I was waiting to remove it until the coots stopped using it. Hopefully with some of the trees removed, there will be better water retention.

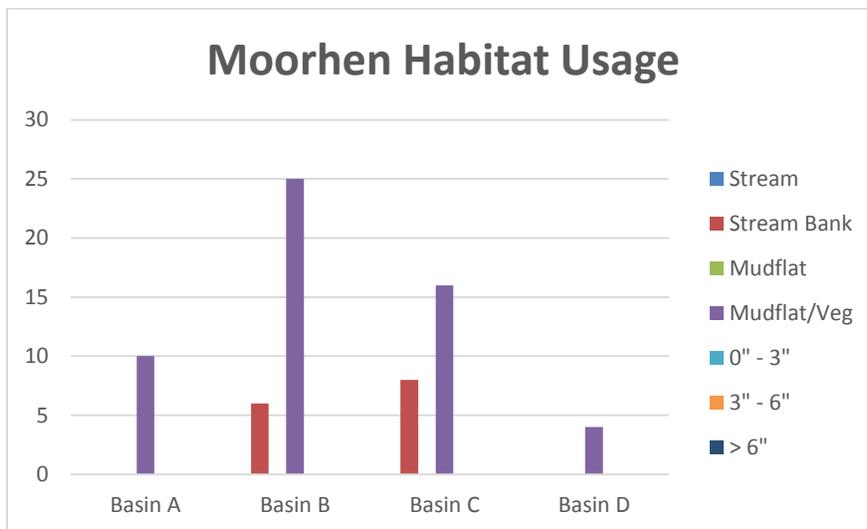
Appendix 1.



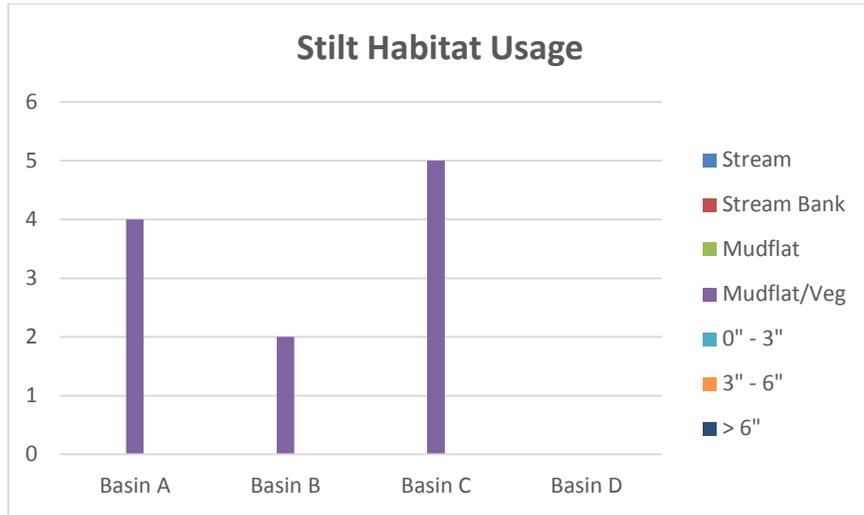
Appendix 2.a.

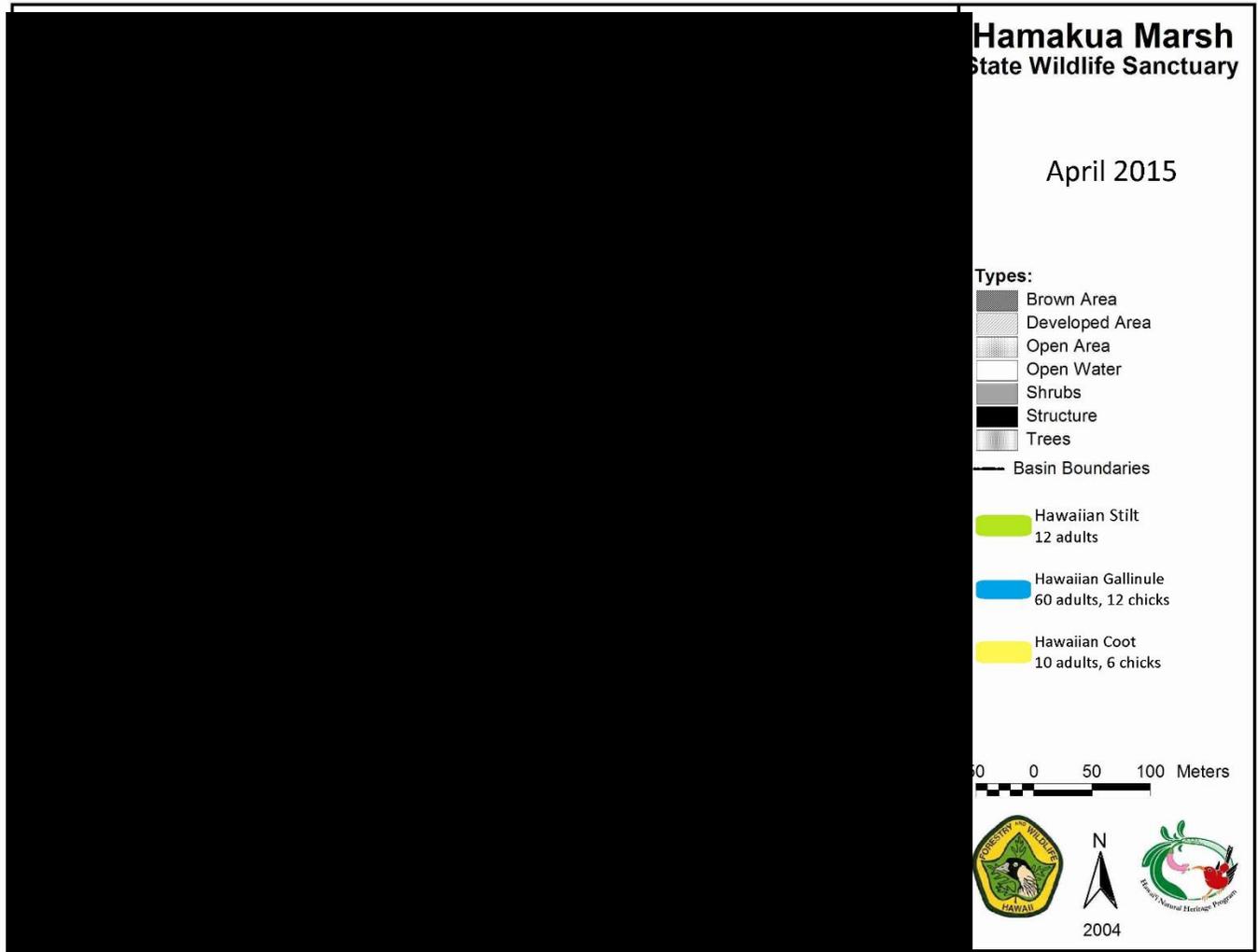


Appendix 2.b.



Appendix 2.c.





# Hamakua Marsh State Wildlife Sanctuary

May 2015

### Types:

-  Brown Area
-  Developed Area
-  Open Area
-  Open Water
-  Shrubs
-  Structure
-  Trees
-  Basin Boundaries

 Hawaiian Stilt  
12 adults, 8 chicks

 Hawaiian Gallinule  
64 adults, 13 chicks

 Hawaiian Coot  
12 adults, 1 chick

50 0 50 100 Meters



2004

# Hamakua Marsh State Wildlife Sanctuary

June 2015

### Types:

-  Brown Area
-  Developed Area
-  Open Area
-  Open Water
-  Shrubs
-  Structure
-  Trees
-  Basin Boundaries

 Hawaiian Stilt  
15 adults

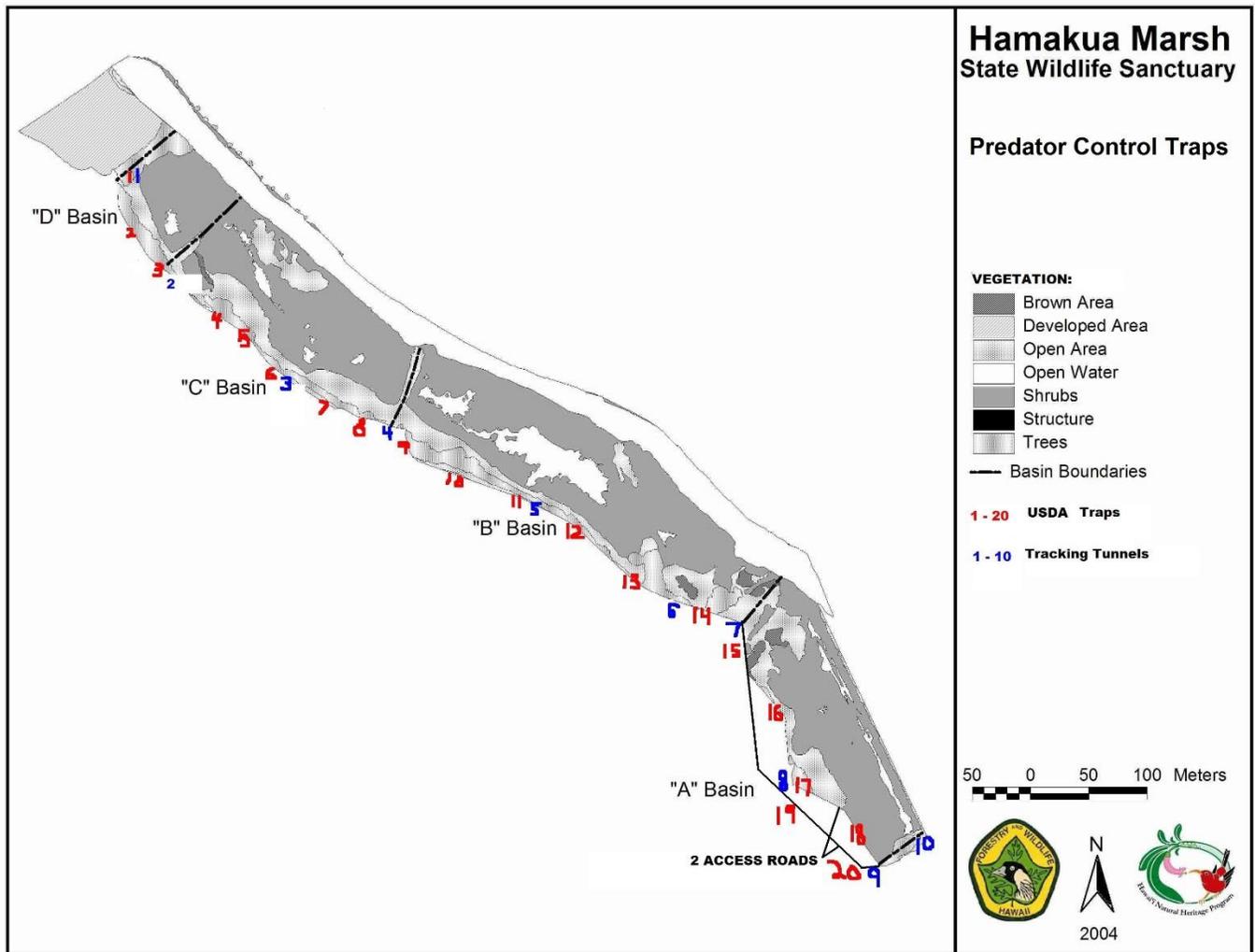
 Hawaiian Gallinule  
70 adults, 6 chicks

 Hawaiian Coot  
13 adults

50 0 50 100 Meters



2004



Appendix 5.

**2015 Tracking Tunnel Station**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
1/15/2015	0	R	0	R	R	0	0	R	0	0
2/19/2015	0	R	R	0	0	0	R	0	0	0
3/20/2015	0	0	R	0	0	0	R	0	0	0
4/20/2015	0	R	R	0	0	R	R	0	0	0
5/19/2015	0	0	R	0	0	R	R	0	0	0
6/23/2015	0	0	R	0	0	R	0	R	0	0

R = mammal tracks present

0 = no tracks present

## Appendix 7.



### FY 15 – HAWAIIAN HOARY BAT MITIGATION FOR KAHUKU WIND POWER, ISLAND OF MAUI

Prepared by: Peter Landon NARS Specialist IV  
Division of Forestry and Wildlife, Maui Branch

## INTRODUCTION

Since May 2014, the Division of Forestry and Wildlife (DOFAW), funded as per the requirements described in the Kahuku Wind Power Habitat Conservation Plan (HCP) has been actively managing 280 acres within the Kahikinui Forest Reserve/Nakula Natural Area Reserve. Activities including fence construction, ungulate removal, and reforestation have been identified as key needs for maintaining and increasing hoary bat productivity.

Large Scale forest restoration has started within the Kahikinui Forest Reserve and Nakula Natural Area reserve and has been ongoing since 2013. Funds for Hawaiian Hoary Bat Mitigation were allocated by Kahuku Wind in the amount of \$150,000 dollars to DOFAW for fencing in this area as part of a larger effort to create ungulate free units for outplanting of native tree species.

## OVERVIEW

Prior to receiving mitigation funds, DOFAW developed a regional watershed management strategy that included several units on the south slope of Haleakala spanning Department of Hawaiian Home Lands Kahikinui, Nakula Natural Area Reserve, and Kahikinui Forest Reserve. Using fencing materials stockpiled by DOFAW, the mitigation funds were used to secure a labor contract to construct a 280 acre unit within the Natural Area Reserve and a portion of the Forest Reserve. Ungulates were then removed, a planting area prepped, and several thousand trees planted in the Western portion of the new unit.

## ACTIVITIES & RESULTS

### **Fence installation and maintenance**

Approximately 2,500 meters of fence were installed to enclose a 280 acre unit. The unit was originally planned to enclose 254 acres, based on the GPS coordinates of the planned fenceline. During construction, the contractor was permitted to deviate up to 50 feet from the proposed fenceline as need to accommodate fewer/smooth corners or avoid obstacles. The final fenceline was measured and was slightly larger than originally planned, enclosing an additional 26 acres. The fence was built under contract with Rock'n H Fencing, LLC using materials supplied by DOFAW. The fence is inspected quarterly by DOFAW staff.

## **Invasive animal removal and control**

Eight pigs and 20 goats were removed from the area, and it is now considered ungulate-free. Monitoring for ingress is accomplished via helicopter and ground surveys during planting trips. The remaining portions of the Forest Reserve and Natural Area Reserve are currently being surveyed and ungulates removed on a monthly basis using ACETA (aerial capture, eradication, and tagging of animals) missions conducted by DOFAW staff. During these missions the new unit is surveyed and remains ungulate free.

## **Vegetation management**

Approximately 30 acres of non-native grasslands were prepped with herbicide using a helicopter boom spray technique prior to planting.

## **Outplanting**

The 28,354 plants have been planted into that unit since the first planting trip took place in October. Plantings include: 11,873 koa, 11,123 aalii, 2,485 mamane, 2,293 ohia, 480 iliahi, and 100 pilo.

## **Bat Monitoring**

DOFAW is not currently conducting bat monitoring as part of this project. Bat monitoring will be conducted during Year 5 as part of a wider effort to capture activity with Nakula Natural Area Reserve and Kahikinui Forest Reserve.

**Table 1. Schedule of Mitigation Activities.**

<b>Implementation Activities</b>	<b>Fiscal Year 2015</b>				<b>Entity Responsible</b>	<b>Total Cost</b>
	<b>1st Qtr</b>	<b>2nd Qtr</b>	<b>3rd Qtr</b>	<b>4th Qtr</b>		
Fence Construction	XX				DOFAW Maui Nui Branch	\$150,000, Funded by Kahuku Wind
ACETA Activities		XX	XX		DOFAW Maui Nui Branch	\$5,000
Boom Spray			XX		DOFAW Maui Nui Branch	\$6,000

Implementation Activities	Fiscal Year 2015				Entity Responsible	Total Cost
	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr		
Plant Procurement	XX			XX	Obtained from Native Nursery, LLC by DOFAW, Funded by S&PF Grant	\$85,000
Initial Planting of Overstory Species		XX	XX	XX	DOFAW Maui Nui Branch	\$35,000
<b>Total</b>						<b>\$281,000</b>

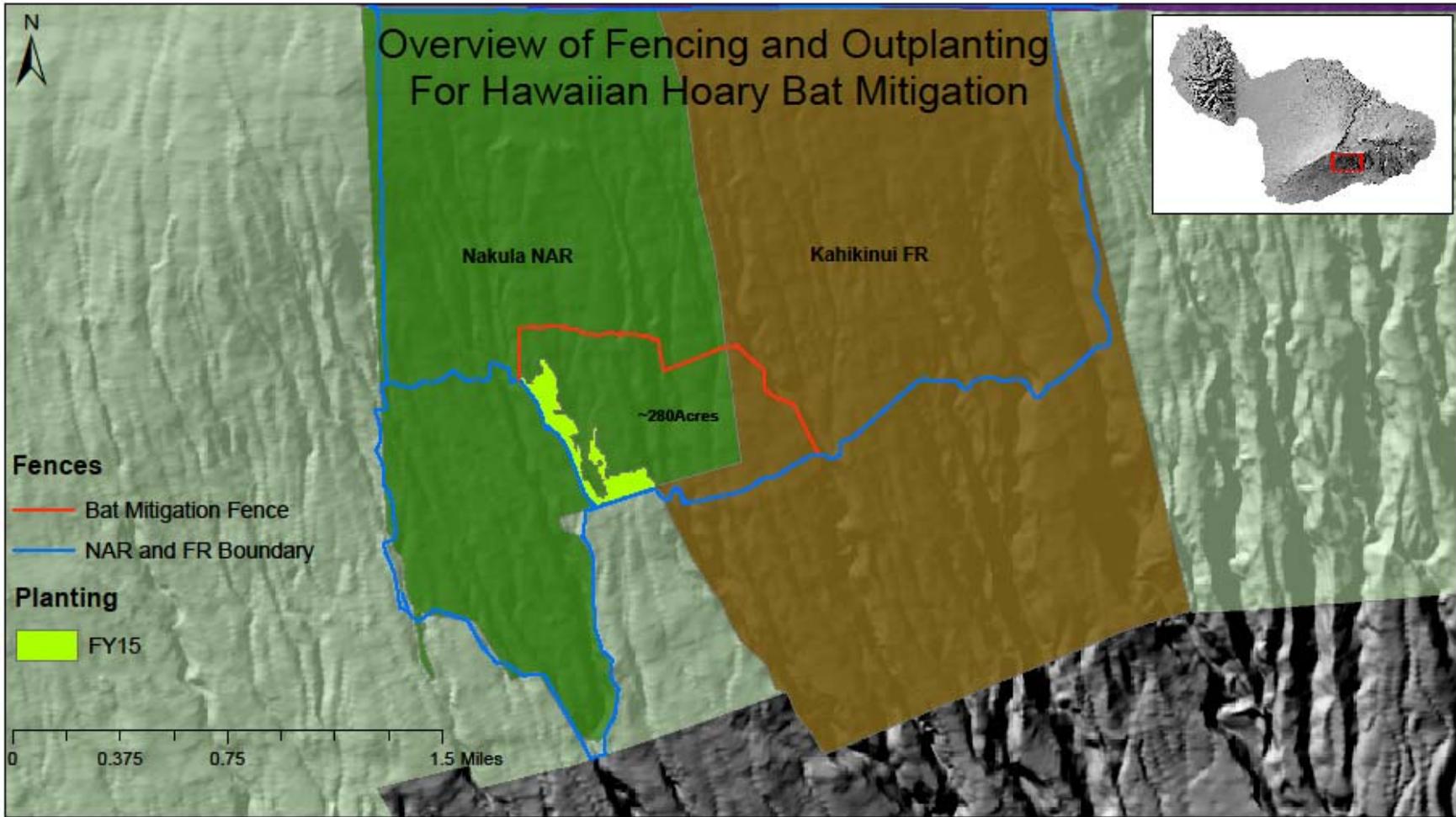
**APENDIX 1 – MAPS & PHOTOS**











**Appendix 8.** KAH expenditures for FY 2015.

<b>KWPI</b>	<b>Cost</b>
Permit Compliance	\$14,301
Seabird Management	\$62,566
Vegetative Management	\$961
Fatality Monitoring	\$44,501
Equipment and Supplies	\$3,046
Staff Labor	\$105,636
<b>Total Cost for FY 2015</b>	<b>\$231,011</b>