Annual Report for the Kenai Industrial Park: Round-Leaved Chaff Flower (*Achyranthes splendens* var. *rotundata*) Habitat Conservation Plan July 1, 2020 – June 30, 2021

SEPTEMBER 2021

PREPARED FOR

CIRI Land Development Company and AKC Leasing Corporation

SUBMITTED TO

State of Hawai‘i

Division of Forestry and Wildlife

PREPARED BY

SWCA Environmental Consultants

ANNUAL REPORT FOR THE KENAI INDUSTRIAL PARK ROUND-LEAVED CHAFF FLOWER (*ACHYRANTHES SPLENDENS* VAR. *ROTUNDATA*) HABITAT CONSERVATION PLAN JULY 1, 2020 – JUNE 30, 2021

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1 INTRODUCTION

In February 2014, CIRI Land Development Company (CIRI) received an incidental take license, pursuant to Chapter 195D of the Hawai‘i Revised Statutes, to allow for the incidental take of round-leaved chaff flower (*Achyranthes splendens* var. *rotundata*), a federally and state-listed endangered species, at the proposed Kenai Industrial Park (KIP) site. To obtain the incidental take license, CIRI developed a habitat conservation plan (HCP) to offset project impacts to round-leaved chaff flower individuals by implementing measures that would protect and perpetuate the species as a whole (SWCA Environmental Consultants [SWCA] 2013). The proposed compensatory mitigation measures implemented as a result of the HCP would create new populations of round-leaved chaff flower on the Kalaeloa Unit of the Pearl Harbor National Wildlife Refuge (NWR) from the genetic stock (seeds and cuttings) of the individuals at the KIP project, as well as from an additional nearby seed source.

Subsequent to ITL approval, 2 existing round-leaf chaff flower plants were removed from the Kenai site (in shaded depression in coral). It should be noted that the original HCP indicated that there were 3 plants found at the original plot; however, at the time of the implementation of the HCP only 2 plants remained alive at the site. The HCP indicated that the success criteria would be met at a 30:1 ratio which should have adjusted the total number of plants to satisfy the success criteria at 60 rather than the 120 in the HCP’s success criteria.

This annual report describes the activities, observations, and results that took place during the annual reporting year of the HCP implementation at the Kalaeloa Unit (the mitigation site) from July 1, 2020, to June 30, 2021. The HCP implementation was to take place for five years, ending in April 7, 2020. However, as the success criteria were not met at the end of the implementation period, SWCA is doing additional work (maintenance, monitoring, and planting) in order to meet the HCP success criteria requirements. During this reporting period, maintenance and monitoring occurred at the mitigation site as required in the HCP, with four horticultural (qualitative) monitoring events. Photographic documentation occurred during each horticultural event. The monitoring program is designed to document mitigation success and inform the need for remedial and adaptive management measures. Monitoring was led by SWCA Project Manager Jaap Eijzenga, SWCA Botanist Danielle Frohlich, and SWCA Botanist Alex Lau. All maintenance was conducted by staff from AKC Leasing Co. while additional cuttings for outplanting were maintained by local plant nursery Native Ecosystem Services LLC and supervised by their Project Horticulturalist Taylor Marsh.

2 DESCRIPTION OF THE MITIGATION SITE

The KIP mitigation site is on preserved lands at the Kalaeloa Unit of the Pearl Harbor NWR. The mitigation site is approximately 3.2 kilometers (2 miles) from the KIP project. The Kalaeloa Unit was established during the Barber Point Naval Air Station base-closure proceedings in 2001 to protect and enhance the habitat for the endangered coastal dryland plants round-leaved chaff flower and ‘Ewa Plains ‘akoko (*Euphorbia skottsbergii* var. *skottsbergii*).

The mitigation site is on a dry coastal plain. The Natural Resources Conservation Service classifies soils at the site as coral outcrop (Foote et al. 1972). Coral outcrop includes coral or cemented calcareous sand, with small areas that contain a thin layer of soil material. Kiawe (*Prosopis pallida*), koa haole (*Leucaena leucocephala*), and buffelgrass (*Cenchrus ciliaris*) are the dominant non-native plants within the Kalaeloa Unit. Approximately 10.1 hectares (ha) (25 acres) of the 15.1-ha (37.4-acre) Kalaeloa Unit was under active management within designated work units before this mitigation was implemented.

On April 18, 2014, Hui Kū Maoli Ola, SWCA, and the U.S. Fish and Wildlife Service (USFWS) identified four round-leaved chaff flower planting plots at the mitigation site. These plots were identified using work units that the USFWS designated for restoration through natural regeneration and outplanting of native plants within the Kalaeloa Unit (Figure 1). Two of the planting plots are in Work Unit 1 and two of the planting plots are in Work Unit 5. These plots did not support round-leaved chaff flower individuals before HCP mitigation activities were implemented. Each planting plot is approximately 12 × 12 meters (m) (39.5 × 39.5 feet) or 144 square m (1,600 square feet).

On November 25, 2014, Hui Kū Maoli Ola outplanted round-leaved chaff flower plants in Plots 1 and 2, and Plots 3 and 4 were each planted on December 9, 2014.

Four round-leaved chaff flower individuals were also planted outside of Plots 1–4 on November 25, 2014. These plants were not previously included in the total count; however, based on discussion with the state in December 2015, these four plants were included in the total plant count as of the sixteenth horticultural monitoring that took place on January 14, 2016, and are referred to as planting Plot 5. Plot 5 is in Work Unit 5 between Plots 1 and 2 and is approximately 4 × 4 m (13.1 × 13.1 feet) or 16 square meters (172 square feet).

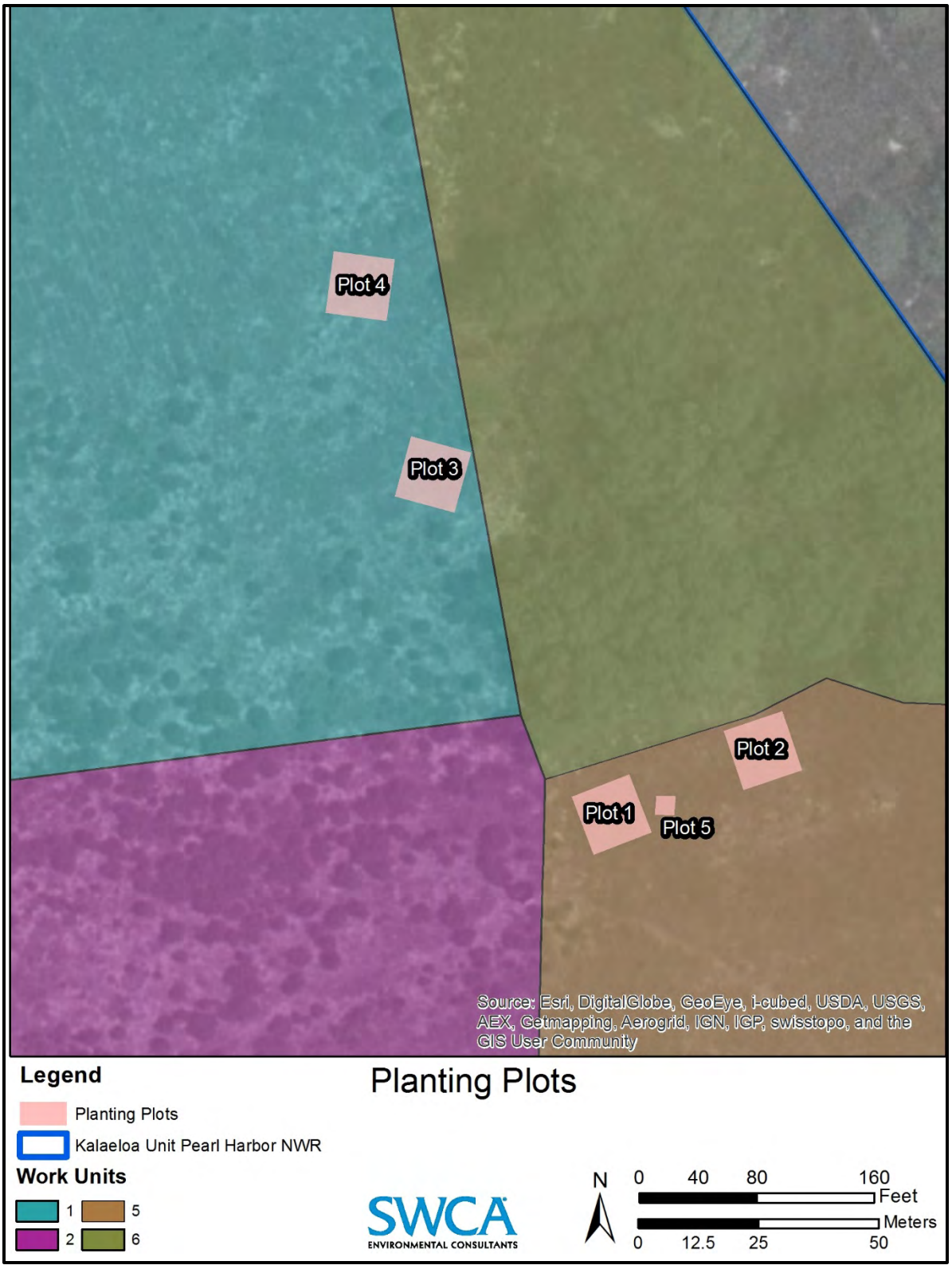

Figure 1. Planting plots in the mitigation site.

3 METHODS

Table 1 presents a timeline for activities associated with implementation of the HCP between January 2021 and June 2021.

Table 1. Timeline of Monitoring Activities

Year	Activity	Date
6	Horticultural monitoring no. 44	01/14/2021
7	Horticultural monitoring no. 45	04/15/2021
	Horticultural monitoring no. 46	06/02/2021
	Horticultural monitoring no. 47	06/29/2021

3.1 Maintenance

Maintenance activities included weed control, pest control, and outplant replacement. All maintenance activities were conducted by AKC Leasing Co. and Native Ecosystem Services LLC under the direction of the project horticulturalist.

During this reporting period, no maintenance took place from July 1, 2020 through May 2021. Maintenance resumed in June 2021 and took place each week through the end of June 2021, in order to control encroaching weeds throughout the project site. Maintenance activities for this reporting period are summarized in Appendix A. The project horticulturist provided observations and recommendations following each maintenance visit and implemented recommendations as necessary in consideration of the success criteria. Maintenance activities will occur as necessary for 5 years, or until mitigation goals have been met.

3.2 Monitoring

3.2.1 Horticultural Monitoring

Horticultural monitoring (qualitative assessment) took place four times during this reporting period. The following information was collected during horticultural monitoring:

- *Direct counts of healthy round-leaved chaff flower individuals*: Survival is measured by assessing the presence or absence of living aboveground plant material. Plants are considered living if at least one green leaf or stem is present.
- *Mortality counts of round-leaved chaff flower individuals*: Dead individuals are counted based on the presence or absence of living aboveground plant material. Plants are considered dead if no green leaves or living stems are present.
- *Plant vigor categories*: Vigor of each individual is assigned to one of the following four categories:
    - Dead = No green leaves, stems, or flowers are present.
    - Marginal = Branches have few leaves or mostly brown or yellow leaves. Plant is severely drought stressed.

  - Moderate = Branches have at least 50% green leaves, plant is drought stressed, and plant may have pests or some discoloration on leaves.
  - Healthy = Leaves are all green, branches are mostly leaved, very few to no pests are seen, and plant is not drought stressed.
- *Phenological stage*: Phenological stage is classified as vegetative or reproductive.
- *General description of the status of the plantings*
- *Plant damage from rodents, insects, and other pests:* Invertebrate pest damage is classified as none, minimal, moderate, or fully infested.
- *Threats:* Threats include encroaching weeds and water stress.
- *List of maintenance requirements*
- *Visual assessment and photographic documentation of native and non-native percentage cover*: Percentage cover estimates and photographs are taken in four quadrats in each plot.

Following each horticultural monitoring event, a written memorandum was prepared listing problems (if observed) and recommending remedial measures. These memoranda were sent to AKC Leasing Co., and remedial measures were performed promptly. A letter report identifying maintenance issues and corrective measures was provided to AKC Leasing Co. and to the State of Hawai‘i, Division of Forestry and Wildlife (DOFAW).

3.2.2 Photographic Documentation

Permanent photo points were established before plant installation to document baseline conditions of the mitigation site. Photographs were subsequently taken from the same location during each monitoring event (Appendix B). Photographs were also taken of installation activities and maintenance. Representative photographs were taken of healthy, dead, reproducing, and naturally recruited individuals.

4 RESULTS

4.1 Maintenance

To date, maintenance activities have included weed control, irrigation, and pest control. Some level of weed control (by hand pulling) has occurred during each maintenance visit. A 0.6-m (2-foot) buffer is also maintained around each outplant to reduce competition, promote growth, and encourage regeneration.

Maintenance activities took place consistently throughout the month of June, with the newly outplanted 57 individuals being watered every day for the first 7 days after outplanting, followed by watering every other day for the next two weeks though the end of the reporting period in June.

No chemical treatment has taken place during this reporting period.

A summary of the observations and recommendations from the project horticulturalist’s site visits is provided in Appendix A.

4.2 Monitoring

Four horticultural monitoring events took place from early January 2021 through the end of June 2021 (see Table 1). The results are summarized below.

4.2.1 Survival

In all, 159 individual plants were initially planted by December 2014 in Plots 1–4. Four individual plants were planted outside of Plots 1–4 on November 2014, in Plot 5. These four individuals were added to the total count on January 14, 2016 (sixteenth horticultural monitoring event). In order to allow for better data tracking, monitoring data were being reported separately for original plantings and progeny starting from the first reporting period in Year 4 on July 18, 2017. An additional 60 individuals were outplanted at the mitigation site in April 2020, but none of those individuals survived until the horticultural monitoring that followed in May 2020, which is why they are not included in any of the data results.

An additional 57 individuals were outplanted on June 10, 2021, but they were not tagged as of the latest Horticultural monitoring that followed on June 29, 2021, which is why they are not included in any of the data results.

An additional 100 cuttings are being cultivated at the Native Ecosystem Services nursery and are ready for outplanting should it be determined they are needed to meet success criteria.

Figure 2. Achyranthes cuttings being cultivated at the Native Ecosystem Services nursery.

None of the originally outplanted individuals (0%) survived during this reporting period. Mortality for these individuals is likely due to the short lifespan of the plant species.

The overall total number of individuals continued to increase (Table 2) with new progeny individuals growing in the plots. Eight new progeny were recorded in this reporting period, from a total of 127

progeny in January, 2021 to 135 in June, 2021 (see Figure 3). However, the number of mortality increased, with 22 individuals recorded as dead between January and June 2021. As of the last monitoring, Plots 5 and 2 have the highest survival numbers (100% and 66% respectively), while Plot 1 has the highest mortality with 82%.

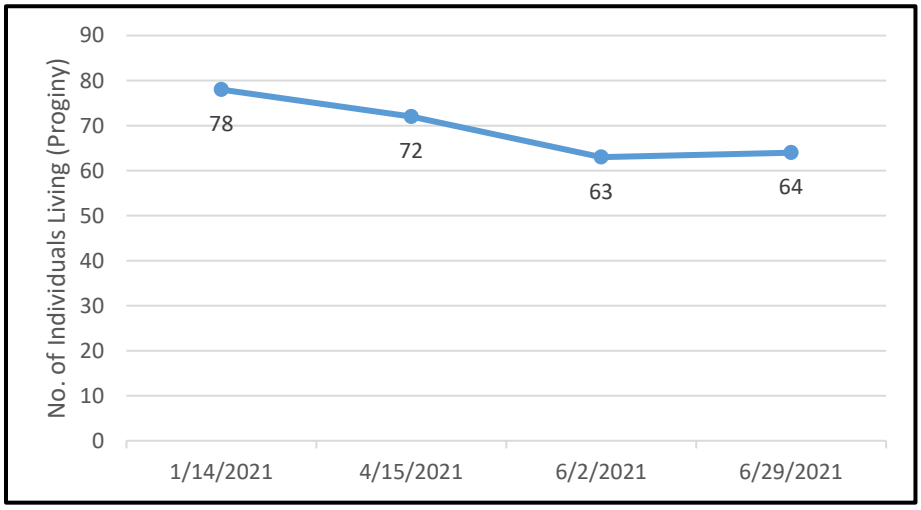

Figure 3. Survival of progeny during the horticultural monitoring events (January 14, 2021, to June 29, 2021).

Table 2. Number of Progeny between the First and Last Monitoring of the Annual Reporting Period

Plot	Number of Progeny Living (01/14/2021)	Number of Progeny Individuals Living (06/29/2021)
1	19 (40%)	9 (19%)
2	27 (73%)	27 (66%)
3	30 (73%)	26 (60%)
4	–	–
5	2 (100%)	2 (100%)
Total	**78 (61%)**	**64 (47%)**

4.2.2 Plant Vigor

The fluctuations in vigor seen during this reporting period in the progeny continued to reflect those seen in previous years (Figure 4). These fluctuations can be attributed primarily to drought stress and hot temperatures during the dry season as well as infestations of mealybug and bostrichid beetle that arise when plants are stressed and weak.

Vigor in the progeny was recorded to be consistently low during this reporting period. The highest percentage of healthy progeny was recorded in April 2021 at 32%, and the lowest in January and early June at 5%. The percentage of plants showing moderate vigor stayed relatively the same, ranging between 13% in January and 20% in April and June.

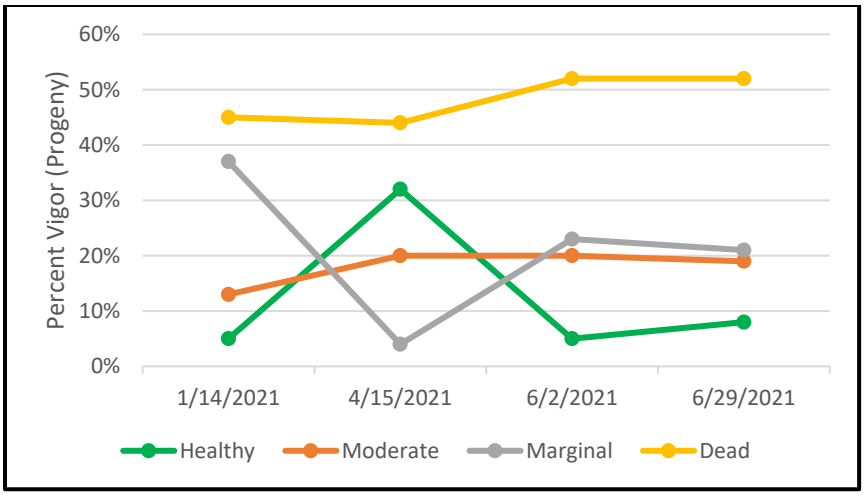

Figure 4. Percentage of progeny in the various vigor categories during the horticultural monitoring events (January 14, 2021, to June 29, 2021).

4.2.3 Pests

Consistent with the previous monitoring reports, pests (mainly mealybug, bostrichid beetle, and ants) continue to be a significant issue for all plots as the seasons change from wet to dry. Pests were the highest in January 2021 with 61 individuals (78%) having pests present, decreased in April 2021 to 30% (39 individuals), increased to 53% (34 individuals) in the beginning of June 2021, and continued to increase again to 72% (48 individuals) at the end of June 2021 (Figure 5).

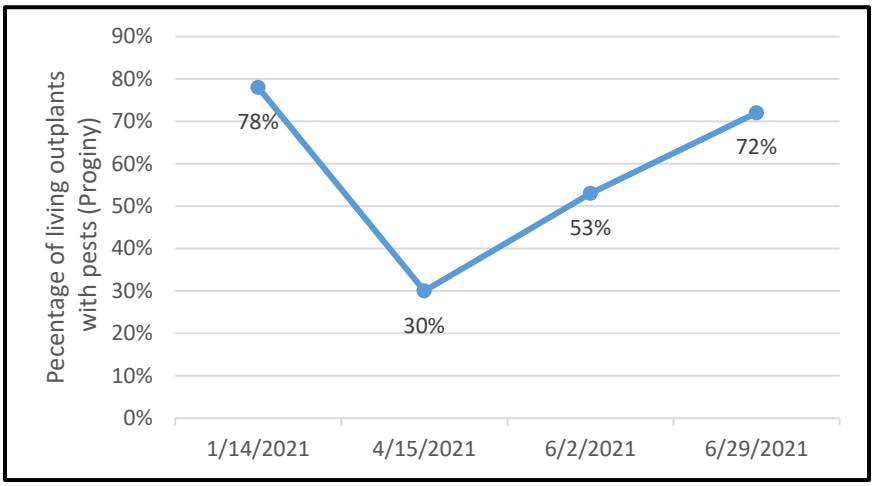

Figure 5. Percentage of all live progeny with pests during the horticultural monitoring events (January 14, 2021, to June 29, 2021).

Presence of the bostrichid beetle continues to be noted throughout the plots, and it continues to contribute to mortality in outplants. The beetle is likely attacking dead or dying branches and introducing a fungus that weakens the plant further (personal communication, K. Magnacca, Bishop Museum, February 14, 2017). Some plants have been noted deteriorating from moderate or healthy vigor to dead within a matter of months after being colonized by this beetle. Mortality-related beetle presence continued to be significant during this reporting period, and pesticide continues to be applied

as a control measure wherever beetles are found. No rodent or other vertebrate damage has been seen in any of the plots.

4.2.4 Natural Regeneration and Reproduction

The outplants are showing a seasonality with their reproduction, which is consistent with what is known about round-leaved chaff flower phenology (USFWS 1994).

The highest reproduction recorded was in April 2021, and the lowest level in April 2021 (Figure 6). Plots 5 and 3 have the highest percentage of reproductive individuals. No progeny have been recorded in Plot 4. New seedlings were monitored, individuals reaching a height of 6 inches were tagged and numbered, and their growth, pest presence, and vigor were tracked. In all, there were an additional 8 new progeny tagged and tracked during this reporting year, and 22 progeny mortalities. At the end of the reporting period in June 2021, there were a total of 64 progeny alive and 71 mortalities.

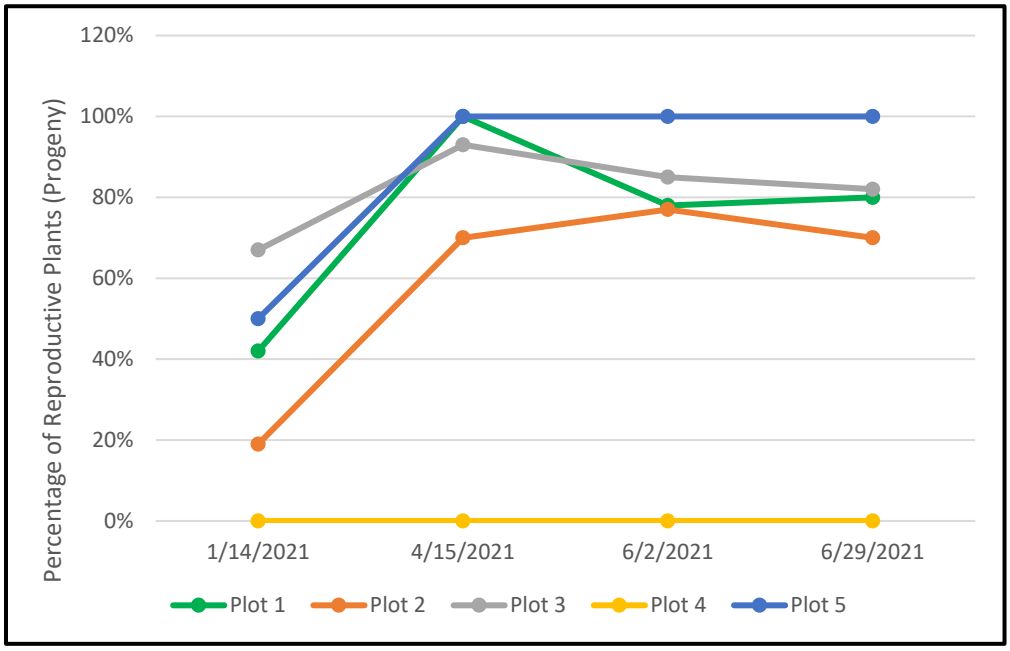

Figure 6. Percentage of reproductive living progeny in Plots 1–5 during the horticultural monitoring events (January 14, 2021, to June 29, 2021).

5 EVALUATION OF SUCCESS CRITERIA

The goal of the measures of success is to ensure that the outplanted populations of round-leaved chaff flower become established and are stable and viable self-producing populations. The seven criteria presented below were developed based on consultation with the Pearl Harbor NWR and in accordance with the goals and objectives presented in the Pearl Harbor NWR comprehensive conservation plan for the Kalaeloa Unit (USFWS 2010). The original measures for mitigation success were to be determined by the following criteria:

1. Outplanted individual survivorship:

   a. 100% of 120 outplanted individuals will survive by Year 1.

   b. 95% of 120 outplanted individuals will survive by Year 2.

c. 85% of 120 outplanted individuals will survive by Year 3.

d. 75% of 120 outplanted individuals will survive by Years 4 and 5.

2. There must be a) recruitment of seedlings that survive through the dry season, in absence of any supplemental watering; and b) seed production by at least 25% of the outplanted lineages by Year 5.

3. The number of seedlings recruited into the mature age class must be greater than the mortality rate of existing adult plants over a 5-year period, with a minimum recruitment of 25% of the number of outplanted individuals over a 5-year period.

4. No fewer than 120 mature plants, which will include plants recruited from the planted lineages, will be established by Year 5.

5. The cover of herbaceous non-native plants (e.g., buffelgrass, khaki weed [*Alternanthera pungens*], and golden crownbeard) will be less than 25% within the planting plots by Year 5.

6. No mature kiawe will be within the planting plots over the 5-year period.

7. Native plant species cover within the planting plots will be greater than 25% by Year 5.

Success criteria were met again this reporting year (July 1, 2020 – June 30, 2021) with the exception of Criterion 1, which requires that 75% of the original outplants remain at the end of the reporting year. During the last horticultural monitoring on June 29, 2021, none of the originally outplanted individuals (0%) were alive, thus, this criterion is not being met. Reports on the life expectancy of round-leaved chaff flower vary, ranging from 2 to 10 years (A Native Hawaiian Garden 2017); however, restoration managers generally agree that this species has a relatively short lifespan, relying on its high reproductive output to perpetuate its populations in the harsh, dry environments in which it is found (personal communication, Matt Schirman, Hui Kū Maoli Ola, July 25, 2017). After survivorship of the original outplants dipped below the level specified in Criterion 1, SWCA and DOFAW agreed to discuss adjusting the survivorship criterion in the HCP to reflect the realities of this species' life history with the Endangered Species Recovery Committee (ESRC) (personal communication, Glenn Metzler, DOFAW, August 17, 2017). In response to this discussion, in a meeting with ESRC and DOFAW on April 26, 2018, SWCA suggested eliminating Criterion 1 because it is not realistic to expect a high percentage of the original outplants to survive 5 years, seeing as the lifespan of this species often falls below this time period. Criterion 4 (no fewer than 120 mature plants, which will include plants recruited from the planted lineages, will be established by Year 5) adequately captures the ultimate goal of the HCP, which is to ensure that round-leaved chaff flower becomes established at the mitigation site and has a stable and viable self-producing population. However, because the HCP specified the mitigation ratio as 30:1, and the actual take was 2 plants, this success criterion should be met at 60 plants. ESRC has agreed with the proposed changes to the success criteria and is working with DOFAW on processing an administrative approval of the revised success criteria. The status of Criterion 4 from reporting data during the last reporting period on June 29. 2021 show that this criterion has not been met, with the most recent numbers, showing a total of 78 alive individuals (0 original plants and 78 progeny). However, based on a 30:1 mitigation ratio with a take of 2 plants, this success criteria should be considered met.

An additional 57 individuals were outplanted on June 10, 2021, but they were not tagged as of the latest Horticultural monitoring that followed on June 29, 2021, which is why they are not included in any of the data results. Including these plants in the total count brings the total number of plants to 121.

6 LITERATURE CITED

A Native Hawaiian Garden. 2017. *Achyranthes splendens* var. *rotundata* (*'Ewa hinahina*) – The power of volunteers. Available at: http://www.nativehawaiiangarden.org/flowering-plants/achyranthes. Accessed August 28, 2017.

Foote, D.E., E.L. Hill, S. Nakamura, and F. Stephens. 1972. *Soil Survey of the Islands of Kaua'i, O'ahu, Maui, Moloka'i, and Lana'i, State of Hawai'i.* U.S. Department of Agriculture, Soil Conservation Service.

SWCA Environmental Consultants (SWCA). 2013. *Round-Leaved Chaff Flower (Achyranthes splendens var. rotundata) Habitat Conservation Plan, Kenai Industrial Park Project*. Honolulu, Hawai'i.

———. 2014. *Planting Plan for Kenai Industrial Park Project Round-Leaved Chaff Flower (Achyranthes splendens var. rotundata) Habitat Conservation Plan.* Prepared for CIRI Land Development. Honolulu, Hawai'i.

U.S. Fish and Wildlife Service (USFWS). 1994. *Draft Recovery Plan for Chamaesyce skottsbergii* var. *kalaeloana* and *Achyranthes splendens* var. *rotundata.* Portland, Oregon.

———. 2010. *Pearl Harbor National Wildlife Refuge Comprehensive Conservation Plan*. Prepared by O'ahu National Wildlife Refuge Complex and the U.S. Fish and Wildlife Service. Available at: http://www.fws.gov/pacific/planning/main/docs/HI-PI/James%20Campbell%20Pearl%20Harbor%20CCP/Pearl%20Harbor%20NWR%20Final%20CCP.pdf. Accessed August 28, 2015.

Appendix A

Summary of Maintenance Activities

Table A-1. Summary of Maintenance Activities

Maintenance and Monitoring Period	Date of Visit	Comments
June	06/03/2021	Prepared are for planting next week.
	06/08/2021	Set irrigation lines.
	06/10/2021	Outplanted 57 plants.
	06/11/2021	Watered.
	06/12/2021	Watered.
	06/13/2021	Watered.
	06/14/2021	Watered.
	06/15/2021	Watered.
	06/16/2021	Watered.
	06/17/2021	Watered.
	06/19/2021	Watered.
	06/21/2021	Watered.
	06/23/2021	Watered.
	06/24/2021	Hand weeded around plants.
	06/25/2021	Watered.
	06/27/2021	Watered.
	06/29/2021	Watered.

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Appendix B

Select Permanent Photo Points

Figure B-2. Plot 1 conditions during horticultural monitoring no. 45, 04/15/2021.

Figure B-3. Plot 1 conditions during horticultural monitoring no. 46, 06/02/2021.

Figure B-4. Plot 1 conditions during horticultural monitoring no. 47, 06/29/2021.

Figure B-6. Plot 2 conditions during horticultural monitoring no. 45, 04/15/2021.

Figure B-7. Plot 2 conditions during horticultural monitoring no. 46, 06/02/2021.

Figure B-8. Plot 2 conditions during horticultural monitoring no. 47, 06/29/2021.

Figure B-10. Plot 3 conditions during horticultural monitoring no. 45, 04/15/2021.

Figure B-11. Plot 3 conditions during horticultural monitoring no. 46, 06/02/2021.

Figure B-12. Plot 3 conditions during horticultural monitoring no. 47, 06/29/2021.

Figure B-18. Plot 5 conditions during horticultural monitoring no. 45, 04/15/2021.

Figure B-19. Plot 5 conditions during horticultural monitoring no. 46, 06/02/2021.

Figure B-20. Plot 5 conditions during horticultural monitoring no. 47, 06/29/2021.

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