A Habitat Conservation Plan for Hawaiian Stilt at Cyanotech Corporation. Keahole Point, Hawaii. March 2006 through March 2016

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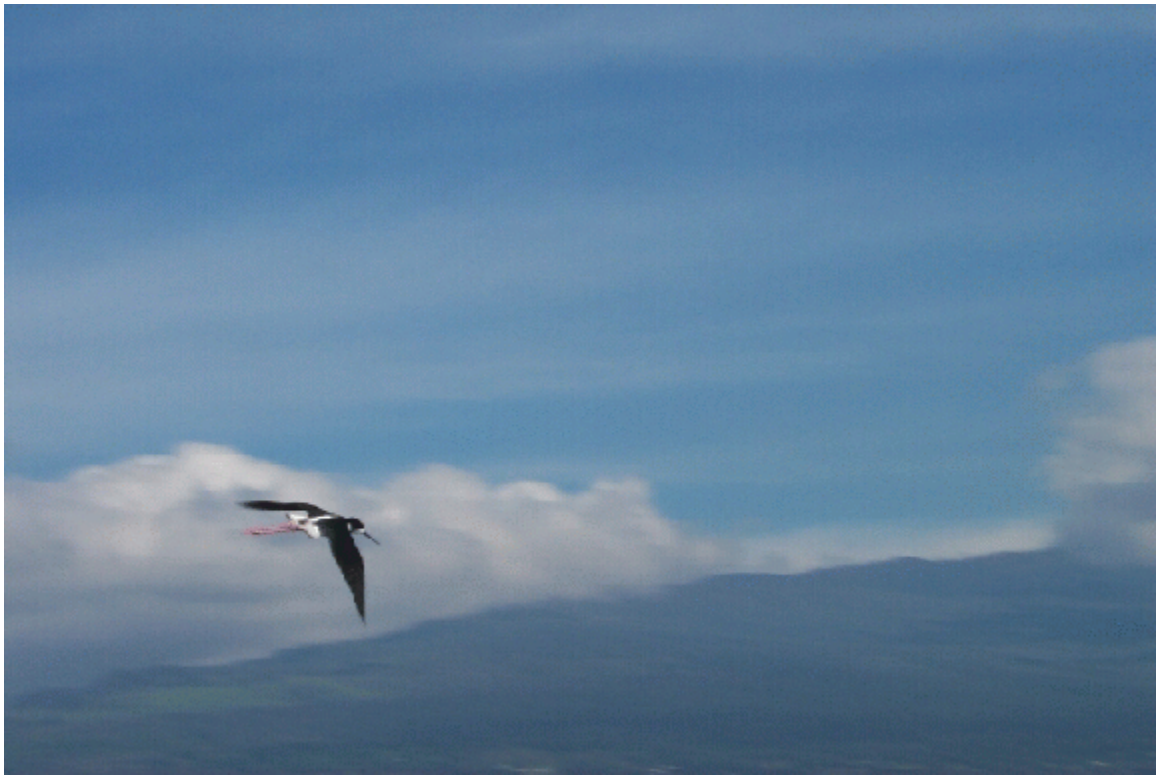

EXECUTIVE SUMMARY

Cyanotech Corporation (Cyanotech) has applied for a permit from the U.S. Fish and Wildlife Service (USFWS) pursuant to section 10(a)(l)(B) of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531-1544), as amended, and has applied for a license from the Hawaii Department of Land and Natural Resources (HDLNR) in accordance with the HRS (Hawaii Revised Statutes) section 195D-4(g) to incidentally take endangered Hawaiian Stilt (*Himantopus mexicanus knudseni*). The incidental take is anticipated to occur as a result of ongoing operations and maintenance activities at Cyanotech's aquaculture facility within the Natural Energy Laboratory of Hawaii (NELHA) along the Kona Coast of the island of Hawaii (Big Island). No other listed, proposed, or candidate species are found in the project area. In support of the permit application, Cyanotech proposes to implement a Conservation Plan as required by section 10(a)(2)(A) of the ESA and the HRS section 195D-21. The proposed permit period is ten years.

The primary goal of the Conservation Plan for Hawaiian Stilt at Cyanotech is to eliminate the incidental take of Hawaiian Stilt by eliminating the "attractive nuisance" problem created by the expanse of open-water ponds, invertebrate food resources, and remote nesting areas, which inadvertently attract Hawaiian Stilt to the Cyanotech facility. The purpose of the Conservation Plan is to actively pursue non-lethal bird deterrent measures to reduce and eliminate stilt foraging and nesting at the facility.

Cyanotech lies within NELHA, a marine research and development area, approximately eight miles north of the town of Kailua-Kona on the island of Hawaii. The initial Conservation Plan suggested that until the invertebrate base and other attractants at the Cyanotech raceways are reduced and other natural habitats are restored or enhanced and managed to provide the extent of foraging and breeding resources found at Cyanotech, significant numbers of Hawaiian Stilts will continue to be attracted to the aquaculture facility. This has proven not to be the case. Since the hazing began in 2003, the weekly mean number of stilts at Cyanotech has been reduced from 104 $\pm$ 9 (Standard Error; SE) in 2002 to 0.4 $\pm$ 0.2 (SE) for the first 8 months of 2005. The Conservation Plan was also

developed with the idea that the current lack of foraging and breeding sites for stilts on the Big Island makes it difficult to successfully haze Hawaiian Stilts from Cyanotech without adversely impacting the breeding success of the Kona Coast population of Hawaiian Stilts. However, it failed to consider the alternative that Hawaiian stilt would find new sites to forage at or leave the Big Island and relocate on other islands. The Kona Coast population of Hawaiian stilt has been reduced from a mean of 145 $\pm$ 44 (SE) from 1998-2002 to a low of 118 $\pm$ 9 (SE) through August 2005.

In the case of Cyanotech, the impacts to Hawaiian Stilts have not resulted from any alteration or loss of natural wetland habitat known to support Hawaiian Stilt, but from an attractive nuisance to the increased amount of artificial open-water habitat created by the construction and operation and management of the aquaculture facility. Thus, the biological goals of the Conservation Plan are appropriately species-based rather than habitat-based. The strategy includes measures to minimize and mitigate the incidental take of Hawaiian Stilt chicks eggs, subadults, adults at Cyanotech.

Specific biological goals of the plan are to:

- Eliminate foraging by adult/subadult Hawaiian Stilts and mortality of Hawaiian Stilts at Cyanotech;
- Maintain the absence of potential nesting habitat, and encourage dispersal to other wetlands and islands where successful reproduction is possible;
- Provide net benefit through development of effective bird deterrents and hazing measures
- Provide a net conservation benefit that contributes to the recovery of Hawaiian Stilt by providing off-site improvements to known stilt nesting habitat during the permit term.

The Conservation Plan strategy will include:

- exploring options and pursuing solutions to further reduce the invertebrate food source from microalgae ponds to limit the number of stilts attracted to the site;

- discouraging stilts from nesting in unsuitable areas by implementing design changes and management practices in the raceway ponds to reduce the attractiveness of the raceways to stilts;

- working with the USFWS and the HDLNR to identify additional non-lethal methods to detract stilts from using the raceways at Cyanotech;

- educating Cyanotech employees on the biology and protected status of the Hawaiian Stilt; and

- supporting off-site habitat management efforts by providing important biological monitoring data on Hawaiian Stilt on the Big Island.

Implementation of the Conservation Plan represents a viable way to meet the goal of significantly reducing the bird attractant problem at Cyanotech over the long-term by focusing on the root of the problem. Because Cyanotech would be able to concentrate efforts on-site, resources would be dedicated to finding effective bird deterrents that could be of greater value in resolving the attractive nuisance and reproductive sink problems attributed to many artificial wetland sites throughout the main Hawaiian Islands.

The Conservation Plan defines measures to ensure that the elements of the plan are implemented in a timely manner and discusses the possibility of unforeseen events occurring. Funding for the Conservation Plan, alternatives to the proposed plan, and other measures required by the USFWS and the HDLNR are described.

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1.0 INTRODUCTION

1.1 Purpose of the Conservation Plan

Cyanotech Corporation cultivates and harvests microalgae for commercial sale. This microalgae farming operation occurs within man-made, open water ponds along the Kona Coast on the Big Island of Hawaii, Hawaii. The nutrient rich ponds support high-density invertebrate populations, a primary food source for the endangered Hawaiian Stilt (*Himantopus mexicanus knudseni*). Prior to 2003, Hawaiian Stilts were attracted to an artificial nesting habitat at Cyanotech, and nested within and adjacent to the aquaculture facility. Hawaiian Stilt chicks that hatched at the facility were led by parent stilts to the ponds to feed, where they were often found dead, suspected either of drowning in the rapidly flowing waters or dying from adverse physiological reactions (e.g., acute dehydration) associated with ingestion of the hypersaline, high-alkaline conditions of the alga medium required for production. Cyanotech's aquaculture operation thus inadvertently attracted stilts to a man-made habitat that was unsuitable for successful stilt reproduction.

The Federal ESA provides for the protection and conservation of fish, wildlife and plants that have been federally listed as threatened or endangered. Activities otherwise prohibited by section 9 of the ESA and subject to the civil and criminal enforcement provisions of section 11 of the ESA may be authorized for Federal entities pursuant to the requirements of section 7 of the ESA and for other persons pursuant to section 10 of the ESA.

Pursuant to section 10(a)(l)(B), the USFWS may issue permits, under such terms and conditions as the Secretary of the Interior may prescribe, for the taking of any listed species that is incidental to an otherwise lawful activity. Section 10(a)(2)(A) of the ESA requires an applicant for an incidental take permit to submit a "conservation plan" that specifies:

- The impact that will likely result from the specified take;
- The steps the applicant will take to minimize, mitigate and monitor such impacts;

- The level and source of funding that will be available to implement such steps;
- Alternative actions to the take and the reasons those alternatives were not chosen;
- The names of the party or parties involved; and
- Procedures that the applicant will take to deal with unforeseen circumstances.

Chapter 195D, HRS is the State law that complements the Federal ESA and promotes the conservation and recovery of Hawaii's threatened and endangered species and habitats. HRS section 195D-21 provides for the preparation and implementation of Habitat Conservation Plans (HCP) under the Federal ESA and the State Endangered Species Law. HRS section 195D-4 gives the Hawaii Board of the Land and Natural Resources the authority to issue a temporary license as part of a HCP to take an endangered species.

The USFWS defines a low-effect HCP as one involving: (1) minor or negligible effects on federally listed, proposed or candidate species and their habitats … and (2) minor or negligible effects on other environmental values or resources. Incidental take permits issued for low-effect HCPs are those permits that, despite their authorization of some small level of incidental take, individually or cumulatively have a minor or negligible effect on species covered …" (U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration 1996).

This Conservation Plan has been prepared in accordance with section 10 of the ESA and HRS section 195D-4 in support of the issuance of an incidental take permit and license. The plan is a statutory component of the permit application under Federal and State law to incidentally take Hawaiian Stilt in connection with the ongoing microalgae farming operation at the Cyanotech aquaculture facility.

1.2 Permit Applicant

Cyanotech Corporation is the applicant for the incidental take permit. The Cyanotech facility is located within the NELHA, and Cyanotech has a 30-year lease (expiring in 2026) on the portion of NELHA lands that support the aquaculture facility.

1.3 Project and Site Description

The project site lies within NELHA, a marine research and development area set aside by the State of Hawaii on the Kona Coast, approximately eight miles north of the town of Kailua-Kona on the island of Hawaii. The Cyanotech aquaculture plant is located at Keahole Point below Makako Bay, west of the Kona Airport adjacent to other NELHA aquaculture facilities. The Cyanotech facility currently occupies approximately 90 acres of land and includes a series of man-made ponds or "raceway ponds" where the microalgae is grown; office and maintenance buildings; and laboratory, research, and processing buildings. All buildings and raceway ponds were constructed on or out of barren lava; thus, vegetation is sparse to almost non-existent at the aquaculture facility (Exhibit 1).

Individual raceways were formed from crushed lava and are oblong in shape. They vary in length from about 500 to 800 feet and are about 60 feet wide. They are shallow in depth with steep side slopes (1.5:1) and are lined with plastic sheeting. Each raceway includes a narrow, plastic-covered berm down its middle that helps regulate water flow. Similar narrow berms separate individual raceways from one another. Narrow, flat areas of crushed lava or, in a few cases, wider areas of crushed lava separate groups of raceways and serve as roads and passageways for equipment and vehicles.

Microalgae is grown and harvested within the raceway ponds, which comprise about 48 acres of open-water habitat within an otherwise barren lava field. To optimize growth of the microalgae, the water depth is kept at approximately 12 inches. The water is hypersaline (30-40 parts per thousand) and alkaline with an average pH between 10.3 and 10.6. Paddle wheels are installed at one end of each raceway to maintain a constant flow of water. Due to the intense, year-round sunlight, the microalgae crop cycle within each raceway pond is only seven days. There are 68 raceway ponds at the Cyanotech facility. Within any given day, 5-6 of these ponds are off production for cleaning or harvesting, with 62-63 ponds in full microalgae production.

1.4 Background

Cyanotech completed construction of a 5-acre aquaculture facility and became operational in 1985. The company continued to expand its operation and reached its present 90-acre size in 1996. By 1996, Hawaiian Stilts had discovered the invertebrate-rich raceway ponds. In 1996 and 1997, Cyanotech staff noticed Hawaiian Stilt nests and hatched chicks at the facility. A few stilt chicks were found dead in the raceway ponds. No formal records were kept of the number of dead stilt chicks retrieved from the raceway ponds or the number of adult stilts using the facility. Nevertheless, it was assumed that the few chicks observed at Cyanotech died 1) by drowning in the rapidly flowing raceways, 2) from adverse physiological reactions related to ingesting the hypersaline, high-alkaline alga medium or product (e.g., acute dehydration), or 3) a combination of the above factors. Cyanotech staff did not observe predators, and unhatched (non-fertile) eggs were not scavenged.

By 1997, Cyanotech recognized an increasing problem when a record seven Hawaiian Stilt nests were documented at and adjacent to the facility and up to 50 adult stilts were observed to frequent the raceway ponds to forage. The USFWS was contacted and apprised that the stilts had established a nesting pattern and that a few chicks had hatched and presumably drowned in the ponds.

During a May 27, 1997, USFWS visit to Cyanotech, a dead stilt chick was retrieved from one of the raceway ponds, and a stilt nest with four eggs was observed on the lava field adjacent to the facility. In a letter dated June 18, 1997, the USFWS recommended that Cyanotech strive to accommodate the breeding, feeding, and sheltering needs of the birds coincident with the ongoing algae farming operation rather than haze the birds from the project site.

In August 1997, under the recommendation of the USFWS, Cyanotech entered into an agreement with Ducks Unlimited, Incorporated (DUI) to provide a short-term plan to assess and manage the Cyanotech stilt population and, following this assessment, to provide a long-term plan for managing stilts at the aquaculture facility. This Conservation Plan

summarizes the results of monitoring and management actions undertaken at Cyanotech during the stilt breeding seasons from 1998-2005 and includes an assessment of the incidental take of Hawaiian Stilt that occurred during this period. Breeding years and calendar years are synonymous; for example a 2003 breeding season would occur from March through August 2003. A non-breeding season does overlap 2 calendar years (September though February) but is identified by its starting time; for example the 2003 non-breeding season runs from September 2003 through February 2004. For an in-depth analysis of the data from 1998-2000, refer to "A Conservation Plan for Hawaiian Stilt at Cyanotech Aquaculture Facility. Keahole Point, Hawaii" (DUI 2002).

Since 1999, numerous meetings have taken place between the USFWS, Hawaii Division of Forestry and Wildlife (DOFAW), USDA Wildlife Services, FAA (Federal Aviation Administration, State of Hawaii Department of Transportation (DOT), NELHA, DUI, and Cyanotech to discuss the Conservation Plan, and determine how to address the concerns of the DOT. Profound differences lie in the conflicting interpretations of the FAA/DOT mandates and the ESA, and the best method to eliminate Hawaiian Stilt usage of the facility (DUI 2002). The stakeholders were able to agree on only one concept: The common goal of all parties was to eliminate the attractive nuisance problem at Cyanotech; Cyanotech needed an incidental take permit to legally implement bird deterrent measures for Hawaiian Stilt; and without the permit Cyanotech could not effectively work toward the common goal.

In 2002, the first Conservation Plan for Hawaiian Stilt at the Cyanotech Aquaculture Facility was approved. Incidental Take Permits were issued by the USFWS on 18 March 2002 (Number TE051040-0) and by the State of Hawaii Department of Land and Natural Resources (HDLNR) on 3 April 2002 (Number T&E ES-01). Permits issued by USFWS and HDLNR, hereafter referred to as Wildlife Agencies, authorized anticipated incidental take of endangered Hawaiian Stilts as a result of ongoing operations and maintenance activities of the Cyanotech Aquaculture Facility. The duration of the permits were for three years (USFWS) and one year (HDLNR) and allowed for incidental take of up to 30

stilt eggs, chicks, or fledglings per year given that the number of stilts fledged was greater than the amount of incidental take.

In the spring of 2002, as in the previous four years, Cyanotech prepared the 1.7 acres stilt nesting habitat for the upcoming nesting season. In 2002, three chicks, originating from the nesting habitat (the Lake), were incidentally taken in production raceways while 48 stilts fledged from the same area. Based on Section 3.4(5)(a)(i) of the previous Conservation Plan (DUI 2002) "if the total number of fledglings produced in Year 1 is greater than the sum of incidental take in Year 1 plus the incidental take anticipated in Years 2 (2003) and 3 (2004), then management of the Lake as a stilt breeding area may be discontinued upon approval of the Wildlife Agencies," The option to discontinue management of the Lake for Year 2 was discussed and agreed upon by Wildlife Agencies and Cyanotech in December 2002. One hundred eighty-nine chicks fledged from the managed Lake habitat during the 1998-2001 stilt breeding seasons for a grand total of 237 fledglings from 1998 through 2002.

In February 2003, the Lake was netted with 0.75-inch polypropylene mesh to provide physical exclusion to the nesting habitat. The netting was monitored daily to check for entangled stilts. Passive hazing methods such as driving the roads of the facility and deployment of Mylar tape were used to discourage foraging, roosting and nesting of stilts in the production area of the facility. The use of more aggressive non-lethal hazing methods, per the 2002 Conservation Plan (Section 3.7 c) were approved by the Wildlife Agencies. Laser and pyrotechnic devices were purchased and employed to further discourage stilts from frequenting and utilizing the facility. There were no nesting attempts on the Cyanotech facility in 2003. The incidental take of all life stages of Hawaiian stilt at Cyanotech in 2003 was two. On 3 April 2003 a six-month extension of the State Endangered Species permit (Number T&E ES-01) was secured.

Beginning 2 December 2003, the first two of 10 adult stilts were recovered from production raceways over the next 12 weeks. The last incidental take occurred 24

February 2004. Over the past 25 months there has been only 1 incidental take at the Cyanotech facility; an adult stilt. While the nesting habitat was being managed, intraspecific aggression was commonly observed especially during the months leading up to and through the nesting season. It is suspected that intraspecific aggression of adult pairs towards first year sub adults was the primary cause of the increase in mortalities. This behavior was also observed prior to 2002. The total amount of incidental take at Cyanotech in 2004 was 10.

On 24 December 2003, a new Protected Wildlife Permit (Number WLIT-04) for the purpose of Incidental Take was issued and is valid until 17 March 2005.

On 25 June 2004 Cyanotech formally requested in writing to the Wildlife Agencies an extension to the existing incidental take permits. This one-year extension would allow for additional data collection and analysis, continued work on minimization efforts and the opportunity to identify possibilities for mitigation for the next conservation plan. As part of the request, Cyanotech proposed to fund the Kona coast waterbird surveys through DUI and to work with the state DOFAW and fund the labor to provide predator control at the Kealakehe Wastewater Treatment Plant (WTP) and at the Waikoloa Resort Treatment Plant (WTP) in an effort to increase survivorship of stilt hatchlings at those facilities. The state permit was extended on 11 March 2005 and the USFWS permit was extended on 9 May 2005. Both permits are valid until 17 March 2006. In addition, the number of birds frequenting the Cyanotech facility was substantially lower than in previous years; 104 $\pm$ 9 (SE) in 2002 versus 0.4 $\pm$ 0.2 (SE) in 2005. This corresponded with an increase in stilts in other areas along the Kona Coast, but the overall Big Island numbers were less than those prior to 2003 (Table 1) suggesting that some of the stilts may have dispersed to the other islands.

2.0 HAWAIIAN STILT - BIOLOGICAL CONSIDERATIONS[1]

2.1 Species Account

The Hawaiian Stilt is in the family Recurvirostridae and part of a cosmopolitan superspecies complex comprised of the Black-necked Stilt (*Himantopus mexicanus*) of North and South America, the Black-winged Stilt (*H. himantopus*) of Eurasia and Africa, and the Pied Stilt (*H. leucocephalus*) and the Black Stilt (*H. novaezelandiae*) from Australasia. The Hawaiian Stilt is allied with the Black-necked Stilt and is considered a distinct subspecies by the American Ornithologists' Union (AOU 1998).

The stilt is a slender wading bird, black above (except from for the forehead), white below, and with distinctive long, pink legs (Exhibit 2). Sexes are distinguished by the color of the back feathers (brownish female, black male) as well as by their voice (females having a lower voice). Downy chicks are well camouflaged, tan with black speckling. Immature stilts have a brownish back and white patches on their cheeks (Pratt et al. 1987) and produce a sharp peeping call.

The total length of an adult Hawaiian Stilt is about 16 inches. The average weight of an adult is 202.6 g (7.1 oz). The Hawaiian Stilt differs from the Black-necked Stilt by having black extending lower on the forehead as well as around to the sides of the neck and by having a longer bill, tarsus, wing chord, and tail (Coleman 1981).

Stilts use fresh, brackish, and saltwater habitats. Preferred habitats include early successional marshlands interspersed with areas of mudflat or shallow open water; shallowly flooded (< 6 inches), low-growing *Paspalum* or *Batis* flats; and exposed tidal mudflats. Stilts may nest and forage in different wetland sites, and the birds will move between these areas daily.

[1]The information in sections 2.1 and 2.2 was taken primarily from the *Recovery Plan for the Hawaiian Waterbirds* (USFWS 1985) and the *Draft Revised Recovery Plan for Hawaiian Waterbirds, Second Revision* (USFWS 1999).

Feeding habitat consists of shallow water that is fresh, brackish, or saline. Stilts eat a wide variety of aquatic organisms including polychaete worms, crustaceans, aquatic insects, and small fish (Shallenberger 1977). Loafing sites include open mudflats, *Batis* flats, and fresh- or brackish-water ponds.

Stilts nest on mudflats or adjacent to or on low-relief islands within bodies of fresh, brackish, or salt water. Nesting season in Hawaii is March through September with a peak in May and June. Clutch size is 3-4 eggs, and the incubation period is approximately 25 days. The downy, precocial chicks are led by parents to feed in the shallows within 24 hours of hatching. Parental care involves brooding, protection from predators, and selection and aggressive defense of foraging territories. Chicks fledge from four to six weeks of hatching (Coleman 1981, Chang 1990).

2.2 Population Status

Many factors, including indiscriminate hunting, predation by introduced species, and most importantly, the loss of wetland habitat, contributed to the decline of the Hawaiian Stilt. Stilts were historically found on all of the major Hawaiian Islands except Lanai, Kahoolawe, and possibly the Big Island where no sightings of stilts were documented until 1961 (Paton and Scott 1985). Prior to 1961, records of Hawaiian Stilt on the Big Island were limited to three birds collected by S.B. Wilson in the late 1800's and possibly one collected by Collett prior to 1893 (Banko 1979).

Historic population numbers of Hawaiian Stilts are unknown. Munro (1960) suggested that the population had declined to about 200 birds by the early 1940's; however, this may have been an underestimation, since Schwartz and Schwartz (1949) estimated about 1,000 birds in the late 1940s. Population counts from 1960 to 1979 fluctuated from a low of 253 in 1960 to a high of 1,476 in 1977.

Long-term population trends of the Hawaiian Stilt indicate that statewide populations have been relatively stable, or slightly increasing, for the last 30 years (Reed and Oring 1993 and

USFWS 2005). Since 1983, statewide surveys have documented 1,000 or more stilts in the islands. Stilts now occur on all of the main Hawaiian Islands except Kahoolawe, but the majority of Hawaiian Stilts are still found on the islands of Oahu, Maui, and Kauai. The current estimate of the statewide stilt population, based on biannual waterbird surveys from 1998 through 2003, averaged 1,350 birds, but fluctuated between 1,200 and 1,500 birds (HDLNR 1976-2003, USFWS 2005).

Along the Kona Coast of the Big Island, stilt habitat was historically limited to two natural wetlands (Opaeula and Aimakapa ponds) and scattered anchialine pools. The population of Hawaiian Stilts along the Kona Coast remained relatively stable (mean = 24; SD $\pm$ 11 birds) up to about 1996.

By 1996, a steady increase in the stilt population along the Kona Coast was observed (DUI 2002), and by 1997, counts as high as 128 stilts had been documented. Because Hawaiian Stilts are capable of inter-island movements (Reed et al. 1998) and are known to quickly colonize newly created wetlands (Pyle 1978, Engilis and Pratt 1993), the 1996-1997 increase may have been correlated to the movement of birds from other islands within the Hawaiian Islands chain to the Big Island in order to take advantage of the new foraging sites following opening of the Kealakehe Wastewater Treatment Plant (WTP) in 1994 and the expansion of operations at Cyanotech from 14 to 67 raceway ponds between 1990 and 1996. Loss of approximately 200 acres of settling basins on Waipio Peninsula (closure of Oahu Sugar Company, April 1995) and other declines in agricultural and natural wetlands during that period were believed to have contributed to the influx of Hawaiian Stilts to the Kona Coast.

Observations on the Big Island of banded birds from Maui and Oahu (Reed et al. 1998) and similar observations of stilts dispersing to the dry island of Lanai to occupy artificial habitat at the Lanai WTP (Engilis and Pratt 1993) support this theory. It is not suspected that the significant increase in stilt numbers along the Kona Coast could have simply resulted from

an increase in stilt reproduction on the Big Island, as no increase in managed (predator-free) or restored habitat coincided with the increase in stilt observations.

For five breeding seasons (1998-2002), almost-predator-free nesting habitat was managed at Cyanotech in an attempt to prevent Hawaiian Stilts from nesting near raceway ponds where incidental take of stilt chicks was inevitable. During this time, 237 stilts were fledged. An increased number of birds reflected in the survey data indicates that the number of Hawaiian Stilts along the Kona Coast continued to rise, with the highest monthly mean of 145 $\pm$ 44 (SE) adult and subadult stilts observed during the 1998-2002 survey period. However, following the closure of the Cyanotech nesting area (2003-2005) the number of stilts documented on the Big Island Kona Coast, and especially at Cyanotech, has declined dramatically (Table 1).

2.3 Results of Biological Monitoring and Measures to Reduce Take

Prior to the 1998-breeding season, a short-term plan (1998-2002) to monitor breeding activity and test measures to reduce incidental take was developed by DUI (2002). Following the closure of the "Lake" in 2002, birds were hazed from Cyanotech property by a variety of methods: reflective Mylar tape, an Avian Disuader Laser gun, and pyrotechnics. An understanding of stilt population levels and movement patterns in relation to Cyanotech was measured through a monthly census of the primary stilt habitats on the Kona Coast. In addition to the Cyanotech facility, monthly counts were taken at the Kealakehe WTP and when possible at Aimakapa and Opaeula Ponds. These surveys were continued through August 2005. At Cyanotech, monthly means of observed adult Hawaiian stilts ranged from a high of 104 $\pm$ 9 (SE) in 2002 to a low of 0.3 $\pm$ 0.2 (SE) in the 2005 breeding season. In the non-breeding season the highest mean was 109 $\pm$ 9 (SE) in (2002). The lowest value was during the 2005 non-breeding season was 0.4 $\pm$ 0.4 (SE). Results of Hawaiian stilt nesting activity, surveys and incidental take, are summarized in Tables 1 and 2.

In addition to the above data collection, a census of Hawaiian stilt population at Cyanotech is conducted semi-weekly, gravel berms along edge of raceways are maintained in a reduced

state or eliminated to make these nesting sites less desirable, an increase in the level of human activity in raceway areas (driving coverage of facility roads) discourages nesting, and the year round netting of the dry Bird Lake reduces its attractiveness to stilts in search of nesting sites.

2.4 Incidental Take

Incidental take of Hawaiian stilt ranged from 0 to 29 individuals per year, during the 1998-2005 breeding seasons. The highest incidental take (29) occurred in 1999 and the lowest (0) in 2005 (Table 2).

2.5 Summary Assessment of Breeding Activity, Pond Management, and Incidental Take

The previous HCP purported that Hawaiian stilts hazed from Cyanotech would continue to nest on adjacent lava flats where no successful reproduction can occur, and concluded that 1) incidental take of stilt nests and chicks cannot be totally eliminated at Cyanotech without causing the indirect loss of reproduction at other sites (*e.g.*, adjacent lava flats) along the Kona Coast and 2) stilts will continue to be attracted to the facility if the attractants are not eliminated prior to or concurrent with other bird deterrent measures. Each of these conclusions was seriously flawed. The hazing of birds from Cyanotech has not led to nesting in lava fields adjacent to the facility. Although Hawaiian stilt still frequent the aquaculture facility, they do so in drastically reduced numbers. This suggests that hazing is having a behavioral effect on the birds that leads them to seek other areas to feed and procreate. A comparison of the overall population numbers of Hawaiian Stilts along the Kona Coast during the 1998 through 2001 breeding season, along with the estimated number of nesting pairs that occurred Cyanotech during the same period established Cyanotech as a significant breeding site for stilt on the Big Island. The estimated number of breeding pairs at Cyanotech increased from 20 in 1998 to 69 in 2001 (Table 1). Beginning with the 2002 breeding season, Hawaiian stilt were hazed from Cyanotech. During the last three breeding seasons, the total number of breeding pairs on the facility and adjacent lava fields was zero. This is another example of the success of hazing.

2.6 Potential for and Assessment of Future Incidental Take

Following the issuance of Incidental Take Permits in March 2002 there have been 16 mortalities of Hawaiian stilt on Cyanotech property. During the one-year extension (2004-2005), to date, there was only one incidence of take. It is suspected that the reduction of the invertebrate food source in the production raceways and improved hazing strategies have resulted in a significant reduction of stilts frequenting the facility. In breeding year 2002, the last year the Lake was managed for stilt nesting, the mean number of stilts at the facility per week was 104 $\pm$ 9 (SE) individuals. In breeding year 2003, the first year the nesting habitat was not managed after five years, the weekly mean number of stilts at the facility was 50 $\pm$ 7 (SE) individuals. Weekly means for breeding years 2004 and 2005 to date were 23 $\pm$ 3 (SE) and 0.4 $\pm$ 0.2 (SE) stilts respectively.

The number of occurrences of take is not expected to exceed two per year with a maximum of 10 individuals per year. The maximum take of 10 individuals was determined from the 12-week time span beginning December 2003 where the 10 cases of take occurred. Due to the reduced number of stilts at the Cyanotech facility in 2005 it is not anticipated that there will be a repeat of the take that occurred in the December 2003-February 2004 time span.

2.7.1 Direct Effects

Prior to January 2003,Cyanotech and the nearby Kealakehe WTP supported the majority of the Hawaiian Stilt population along the Kona Coast. The birds moved regularly (3-4 miles) between these areas and acclimated to the varying levels of human activity. While the birds were temporarily disturbed during some operations at Cyanotech (e.g., cleaning, draining, and harvesting ponds), no injuries or harassment of any Hawaiian Stilts were observed or directly attributed to daily maintenance activities at the aquaculture facility. Direct effects leading to the possible mortality of stilts at Cyanotech include the imbibing of Spirulina media by the birds during intraspecific confrontations. Spirulina media has a very high salt content and alkalinity typically between 14 and 16. Although rare,

confrontations near pond paddle wheels can result in a stilt being washed under the wheel. This could result in physical damage to the bird leading to its demise. Since hazing began in 2003 the population distribution of Hawaiian stilt along the Kona coast has changed dramatically. The Kealakehe WTP and Waikoloa WTP now support the majority of the Hawaiian stilt on the Big Island. Therefore it is believed that continued hazing at Cyanotech will have minimal if any effect on the Hawaiian stilt.

The proposed non-lethal bird deterrent measures (e.g., increased driving on roads, Mylar tape, laser, and pyrotechnics) accompanied by the removal of pond attractiveness are intended to reduce foraging, nesting, promote abandonment of hazardous raceway nesting sites, and encourage dispersal to other wetlands where successful breeding is possible. This is important for meeting the permit requirement to minimize incidental take of Hawaiian stilt, the primary goal of the Conservation Plan. Non-lethal bird deterrent measures will help eliminate the number of birds attracted to the facility in the long-term. It has already been shown to deter adults from nesting and reduce nest site fidelity. The reduction of nest site fidelity has led to stilts dispersing to other wetlands and other islands where successful reproduction is possible. It is highly unlikely that our methods of hazing will result in he incidental take of Hawaiian stilt.

It is anticipated that implementation of minimization measures outlined in the Conservation Plan will reduce the amount of this incidental take to zero for all age groups of Hawaiian stilt; under the worst-case scenario no more than 10. Loss of Hawaiian Stilts that can be attributed to natural causes (e.g., predation, diseases, parasites) or complications not linked to the Cyanotech operation (e.g., band injuries, contaminants) do not represent incidental take of the species for Cyanotech.

2.7.2 Indirect Effects

2.7.2.1 Types of Indirect Effects

Indirect effects described by the previous HCP included continued nesting by Hawaiian stilt in lava fields adjacent to Cyanotech and at the Keahole International Airport in Kona. Nest site fidelity was the grounds for these assertions. Since the closure of the Bird Lake in January 2003, no stilt nests have been documented in the lava fields or at the airport. No stilt nests have been documented in the lava fields since the closing of the Bird Lake. Therefore, no indirect effects on the Hawaiian stilt population are anticipated; i.e., loss of eggs or chicks from the lava nests, or loss of adult stilts via collision with aircraft at the airport).

2.7.2.2 Addressing the Potential of a Wildlife Hazard

Since 1999, numerous meetings have taken place between the USFWS, Hawaii State DOFAW, USDA Wildlife Services, FAA, DOT, NELHA, DUI, and Cyanotech to discuss the bird strike issue at the Kona Airport, and determine how to address the concerns of the DOT in the DUI Conservation Plan of 2002. A general consensus was not reached, however, a common goal of all parties was to eliminate the attractive nuisance problem at Cyanotech. To achieve this goal, Cyanotech needs an incidental take permit to legally implement bird deterrent measures that may impact the Hawaiian Stilt. The objective to eliminate incidental take by eliminating stilt use can only be realized when Cyanotech, NELHA, the USFWS, HDLNR, and DOT take cooperative and proactive measures in concert.

With the approval of the USFWS and the HDLNR, Cyanotech implemented measures to decrease the invertebrate food source and potential stilt nesting areas in the raceways, and an aggressive hazing program to reduce Hawaiian Stilt presence at Cyanotech.

3.0 HAWAIIAN STILT CONSERVATION PLAN

3.1 Scope of the Plan

The Conservation Plan for Hawaiian Stilt at Cyanotech is proposed as a strategy to discourage Hawaiian Stilts from frequenting the facility. Stilts are attracted to this man-made site for foraging and previously for nesting. The strategy includes measures to minimize the invertebrate food source from the production raceways and reduce the attractiveness of the facility for stilts with respect to foraging, roosting and possibly nesting. The plan also includes mitigation that offsets incidental take of Hawaiian Stilts at Cyanotech and provides a net conservation benefit to Hawaiian Stilts. The period of time for which the incidental take permit is sought is 10 years.

The Kona Coast population now represents about 10 % of the entire population of stilts within the Hawaiian Islands. Surveys from 1998-2002 in Kona show that the majority of stilts forage at Cyanotech and the Kealakehe WTP, and that nearly all-successful stilt reproduction occurred at Cyanotech. Since the initiation of an active hazing program at Cyanotech in March 2003, Kealakehe WTP is now the most utilized site for stilt foraging and roosting on the Kona Coast.

This Conservation Plan applies to all lands leased by the Cyanotech Corporation for its microalgae farming operation along the Kona Coast of the Big Island. The incidental take permit will cover take of Hawaiian Stilt eggs and chicks that may occur at Cyanotech in association with all ongoing operations and maintenance activities at the facility, and adult and subadult stilts in association with deterrent measures.

This Conservation Plan is not intended to replace or reduce actions by resource agencies to develop a more comprehensive, long-term strategy for developing alternate, suitable habitat for Hawaiian Stilts on the Big Island or at other locations throughout the main Hawaiian Islands. It is the intent of the Conservation Plan to provide a sound impetus for the resource agencies to address the urgent need for habitat restoration and management

of Hawaiian Stilt by supporting conservation actions that complement the minimization and mitigation plans described above. The Conservation Plan creates an opportunity to integrate public and private habitat protection programs to support one another. Section 6 grants under the ESA are designed specifically to support Conservation Plan goals can be acquired for habitat improvements or land acquisitions to benefit Hawaiian Stilt.

Increased restoration, enhancement, and management (e.g., restore hydrology, remove vegetation, control predators) of protected wetlands designated for waterbirds is critical to the long-term recovery of Hawaiian Stilts. Examples of ongoing efforts on the Big Island are: predator control and restoration planning at Aimakapa Pond (National Park Service and DUI) and Opaeula Pond (Kamehameha Schools, DUI, USFWS, Natural Resources Conservation Service).

3.2 Biological Goals

Within the Habitat Conservation Planning process, biological goals and objectives of conservation plans may be either habitat or species based. Habitat based goals are expressed in terms of amount and/or quality of habitat. Species-based goals are expressed in terms specific to individuals or populations of the species covered in the conservation plan (U.S. USFWS and National Oceanic and Atmospheric Administration 2000).

The impacts to Hawaiian Stilts from operation and management of the Cyanotech aquaculture facility do not result from any alteration or loss of natural wetland habitat supporting Hawaiian Stilt. Rather, the aquaculture facility has increased the amount of artificial open-water habitat on the Big Island, which has resulted in the attractive nuisance problem described in this plan. The raceway ponds at Cyanotech have had the unintentional effect of attracting the endangered Hawaiian Stilt. Thus, the biological goals of the Conservation Plan are appropriately species-based rather than habitat-based.

The primary goal of the Conservation Plan for Hawaiian Stilt at Cyanotech is to eliminate incidental take of Hawaiian Stilt by eliminating the attractive nuisance problem at

Cyanotech. A secondary goal of the plan is continuation and improvement of deterrent and hazing methods, developed and implemented during the first conservation plan, to discourage adult stilts from frequenting the facility.

Specific biological goals of the plan are to:

- Eliminate foraging by adult/subadult Hawaiian Stilts and mortality of Hawaiian Stilts at Cyanotech;
- Eliminate nest site fidelity to the facility and former nesting habitat, and encourage dispersal to other wetlands and islands where successful reproduction is possible;
- Provide net environmental benefits through development of effective bird deterrents and hazing measures
- Provide a net conservation benefit that contributes to the recovery of Hawaiian Stilt by providing off-site improvements to known stilt nesting habitat during the permit term.

For specific information on the methods and measurements to be used to accomplish goals see the section on Success Criteria 3.4.

3.3 Minimization and Mitigation Measures

Cyanotech will appoint a biological monitor approved by the "Wildlife Agencies" to oversee the following minimization and mitigation measures of the Conservation Plan.

3.3.1 Minimization Measures

Measures aimed at reducing incidental take over the term of the permit are:

1) Cyanotech will continue to spray safflower oil 1) in the Spirulina ponds after harvests to control the water boatman (Family Corixidae) and 2) directly onto Euphedra flies (*Euphedra sp*.) during outbreaks of these species. The safflower oil causes both species to float on the pond surface as well as suffocating the Euphedra flies. These insects are removed from the ponds using surface filter screens. Cyanotech will also aggressively explore other options and pursue solutions to reduce or eliminate the invertebrate food source from its ponds in order to limit the number of stilts attracted to the site.

2) Cyanotech employees will use bird deterrents to keep adult stilts from raceway ponds. The bird deterrent measures used will be limited to driving or walking on raceway roads several times per day to increase the level of human activity, and placing

preventative devices (e.g., Mylar tape) in areas where nest building activities are observed. In addition, Cyanotech employees will utilize more aggressive non-lethal hazing methods (laser, pyrotechnics) approved by the Wildlife Agencies to haze any stilts away from the facility when necessary.

3) Cyanotech will immediately halt use of any bird deterrent or hazing method that results in the incidental take of adult or subadult stilt until an evaluation of the incident can be conducted by the Wildlife Agencies and Cyanotech is advised on how to proceed.

4) The former DU Pond will either a) be returned to an active microalgae production pond or b) used as a test site for a deterrent measure (e.g., netting) in order to force stilts to abandon this former breeding site.

5) The Lake will continue to be netted until an alternate use for the land is determined that would not encourage stilts to return to nest or until Cyanotech surrenders or transfers its interest in the basin to a third party or NELHA. Any new lessee will be required to use the basin in a manner that does not attract birds

6) Cyanotech will continue to educate its employees on the continuing activities to protect and conserve endangered Hawaiian Stilts at Cyanotech and on the behavioral cues for breeding stilts. Employees will be advised to continue aquaculture activities with caution if stilts are exhibiting these behaviors and to provide the biological monitor with any nest, egg, or chick sighting data within three days of any observations.

7) Cyanotech will work with the Wildlife Agencies on identifying additional bird deterrents that may be used as a long-term strategy for reducing incidental take of Hawaiian Stilts at Cyanotech and other future aquaculture facilities planned within NELHA. If a bird deterrent technique requires special training, Cyanotech personnel will seek the required training prior to use.

3.3.2 Mitigation Measures

Beginning in December of 2001, Kamehameha Schools initiated a predator control program at Opaeula pond utilizing tamper proof bait stations and Diphacinone bait. Prior to 2001 no Hawaiian Coot (*Fulica alai*) nests were documented at Opaeula. Since the predator control program was instituted, coot nesting has occurred every year. Monitoring the number of Hawaiian Coot and Hawaiian Stilt nests, eggs, and fledglings from year to year may give you a measure of increased survivorship. Since the closure of Bird Lake in January 2003, the overall number of Hawaiian Stilt has dropped considerably on the Kona Coast. What constitutes baseline stilt nesting data at Opaeula may have to be reevaluated.

Cyanotech will continue to work with Kamehameha Schools Land Management Division to

fund the labor for predator control at Opaeula pond an 8 acre coastal wetland located 4.8 miles to the north of the Cyanotech facility.

Cyanotech will also fund the on-going Kona coast waterbird and shorebird study that began in 1998 as part of their first conservation plan. Cyanotech will contract a qualified organization or individual to conduct the survey at six off-site wetlands of the Kona coast. Birds were counted every two weeks using a pair of Zeiss binoculars (10X40 magnification) and an 82 mm zoom Nikon Field Scope. The study sites are: Kealakehe Wastewater Treatment Plant, Honokohau Reef, Aimakapa pond, Kaloko pond, Opaeula pond and Kukio fishponds, Waikoloa Wastewater Treatment Plant? Surveys will be conducted once per month and an annual report will be submitted to the wildlife agencies by October 31st of each year. The estimated cost of the surveys is $3,900 per year.

3.4 Success Criteria

This Conservation Plan will be considered a success if:

1) An effective, environmentally safe deterrent for significantly reducing or eliminating Hawaiian Stilt use of raceway ponds at Cyanotech is identified. The deterrent will be deemed effective only if harm (injury or death) of adult and subadult Hawaiian Stilt can be maintained to an insignificant level (near zero).

2) Foraging and roosting by Hawaiian Stilts at Cyanotech is significantly reduced or eliminated so that incidental take of Hawaiian Stilts is eliminated or reduced to less than two per year.

3) The majority of adult Hawaiian Stilts have dispersed from Cyanotech to other wetland sites on the Big Island and on other islands (e.g., Maui, Molokai, and Oahu) where successful reproduction is probable.

4) The total number of Hawaiian Stilts fledged as a result of off-site efforts funded by Cyanotech is greater than the total number of Hawaiian Stilt eggs, chicks, fledglings, and adults incidentally taken during the course of the ten-year permit term.

3.4 Monitoring and Reporting

The following measures will be implemented as a part of the Conservation Plan in order to maintain an accurate census of Hawaiian Stilts at the project site, monitor and report on the level and impact of the incidental take, and monitor and evaluate fulfillment of the mitigation and minimization requirements and success of the Conservation Plan.

1) The Hawaiian Stilt population will be surveyed at Cyanotech at least once monthly during the non-breeding season. Number of adult and subadult stilts at Cyanotech will be documented and band combinations recorded, where possible.

2) Surveys for incidental take of Hawaiian Stilt will be conducted at least twice per week during the breeding season (March-August), and once per week or as needed during the non-breeding season.

3) No incidental take is anticipated with non-harmful bird deterrents currently in use. Cyanotech maintenance and operations staff will assist with the monitoring on a daily basis. Injured stilts and carcasses will immediately be brought to the attention of the biological monitor. The bio- monitor will record: date of collection, time, location, age of bird, suspected cause of death and other pertinent data.

4) If incidental take occurs, the recovery data will be given to the Wildlife Agencies at the end of the week that it occurs. All stilt remains will be collected and submitted to the USFWS or DOFAW for necropsy and/or scientific preservation. Cause of mortality will be determined if possible. The biological monitor will responsible for the proper handling, storage, and shipment protocols for all biological material collected on the facility.

5) An annual report will be submitted to the Wildlife Agencies by the end of October of each year. The report will include information on the:

   a) management actions taken by Cyanotech during the stilt breeding season;

   b) summary of off-site mitigation efforts;

   c) summary of off-site (Opaeula Pond) nesting results for stilts;

   d) the amount of any incidental take associated with operations and maintenance of the aquaculture facility throughout the entire year, and the suspected causes of the incidental take;

   e) average monthly stilt counts at Cyanotech during breeding and non-breeding seasons;

   f) a description of the deterrent methods evaluated including the number of raceway ponds tested and an assessment of the effectiveness of each deterrent;

g) Kona Coast stilt survey data;

6) With reasonable advance notification, Cyanotech will allow access to the facilities by the Wildlife Agencies for the purposes of ensuring compliance and providing technical assistance with this Conservation Plan; and

7) consultation between Cyanotech and the Wildlife Agencies will be ongoing throughout the year during the course of the permit term.

3.5 Funding

Cyanotech will be responsible for funding the minimization and mitigation measures, and monitoring outlined in the Conservation Plan. Costs for implementing the Conservation Plan are as follows:

Biological Monitoring and Reporting	$ 15,000
Purchase and Installation of Bird Deterrents	1,000
Research and develop methods of reducing invertebrate food source	1,500
Labor for Hazing activities	3,200
Funding off-site mitigation	5,000
Funding Kona Coast surveys	3,900
TOTAL PER YEAR	$ 29,600

All costs listed above will be provided by Cyanotech are budgeted as cash contributions to the implementation of the Conservation Plan.

3.6 Adaptive Management

The results of the annual monitoring reports will be evaluated by the Wildlife Agencies to determine whether the bird deterrents are effective whereby incidental take of stilts is no longer an issue. If the results of the biological monitoring indicate that the bird deterrent measures are not producing the desired effect (reduced stilt populations at Cyanotech, in particular during the nonbreeding season), the minimization strategy may be changed to investigate additional hazing methods. Approval of additional bird deterrents by Wildlife Agencies would be required prior to use. If incidental take exceeds the mitigation provided

at off-site locations, additional measures such as: habitat and vegetation removal, or a cooperative agreement with National Park Service at Aimakapa may be required.

4.0 CHANGED CIRCUMSTANCES

"Changed circumstances" means changes in circumstances affecting the Hawaiian Stilt or the geographic area covered by the Conservation Plan that can reasonably be anticipated by Cyanotech Corporation and that can reasonably be planned for in the Conservation Plan (e.g., the listing of a new species, or a fire or other natural catastrophic event in areas prone to such event). Changed circumstances are not Unforeseen Circumstances.

The only changed circumstance identified in this Conservation Plan is an outbreak of avian botulism. Avian botulism results from the ingestion of toxin produced by the bacterium, *Clostridium botulinum*. Not enough is known about avian botulism to precisely identify the factors leading to an outbreak. Bacterial growth and various environmental conditions may favor toxin production in wetlands. When an outbreak does occur it is usually perpetuated by the following bird-maggot cycle (Locke and Friend 1987):

> *toxins are produced in a decaying animal carcass - maggots concentrate toxins - additional birds eat the toxin-laden maggots - death of more birds and more toxin production perpetuates the outbreak.*

An outbreak of avian botulism occurred at Aimakapa in 1994. Botulism was also documented during the summer of 1997 and 2001 on Maui at the Kanaha Pond Wildlife Sanctuary and Kealia Pond NWR in the summer and fall of 2000 and 2001. The main clue to botulism is sick birds. Birds affected will display ataxia (loss of muscle control) and will have difficulty standing and holding their heads upright. Because the bacterium that causes botulism is found naturally in the environment and stilts travel between wetlands, the site of the outbreak cannot always be determined. If there are any signs of

birds with botulism at Cyanotech, the measures outlined in Appendix 2 will be initiated immediately.

Cyanotech Corporation will give notice to the Wildlife Agencies within seven days after learning that any of the changed circumstances listed in the Conservation Plan has occurred. As soon as practicable thereafter, but no later than 15 days after learning of the changed circumstances, Cyanotech Corporation will modify its activities in the manner described in the Conservation Plan to the extent necessary to address the effects of the changed circumstances on Hawaiian Stilt and will report to the Wildlife Agencies on their actions. Cyanotech Corporation will make such modification without awaiting notice from the Wildlife Agencies.

If the Wildlife Agencies determine that changed circumstances have occurred and that Cyanotech Corporation has not responded in accordance with the Conservation Plan, the Wildlife Agencies will so notify Cyanotech Corporation and will direct them to make the required changes. Within 15 days after receiving such notice, Cyanotech Corporation will make the required changes and report to the Wildlife Agencies on its actions. Such changes are provided for in the Conservation Plan and hence do not constitute unforeseen circumstances or require amendment of the permit or the Conservation Plan

Cyanotech will implement additional conservation and mitigation measures deemed necessary to respond to changed circumstances as provided for and specified in the HCP's adaptive management strategy (50 CFR 17.22(b)(5)(i and ii) and 50 CFR 17.32(b)(5)(i and ii). If such measures were not provided for in the HCP, and the HCP is otherwise being properly implemented, the USFWS will not require any conservation and mitigation measures in addition to those provided for in the HCP without the consent of Cyanotech (50 CFR 17.22(b)(5)(i and ii) and 50 CFR 17.32(b)(5)(i and ii).

5.0 UNFORESEEN CIRCUMSTANCES AND "NO SURPRISES" POLICY

It is further acknowledged that circumstances may arise that are not fully contemplated by this HCP and that may result in substantial or adverse impacts to the biological status of the Hawaiian Stilt or its habitat. Such impacts may or may not be a result of the operation of the proposed facility.

If and when Cyanotech, USFWS or HDLNR become aware any circumstances that may affect any listed species and/or the ability of Cyanotech to implement this HCP, all involved entities should be immediately notified and should meet as soon as possible to discuss the circumstances and identify appropriate action.

In negotiating unforeseen circumstances, the USFWS will not require the commitment of additional land, water, or financial compensation or additional restrictions on the use of land, water, or other natural resources beyond the level otherwise agreed upon for the species covered by the HCP without the consent of Cyanotech [50 CFR 17.22(b)(5)(iii) and 50 CFR 17.32(b)(5)(iii)]. If additional conservation and mitigation measures are deemed necessary to respond to unforeseen circumstances, and the HCP is being properly implemented, the USFWS may require additional measures of Cyanotech only if such measures are limited to modifications within conserved habitat areas, if any, or to the HCP's operating conservation program for the affected species, and maintain the original terms of the HCP to the maximum extent possible.

A "no surprises" policy provides that, in negotiating "unforeseen circumstances" provisions for HCPs, USFWS and HDLNR shall not require the commitment of additional land or financial compensation beyond the level of mitigation that was otherwise adequately provided for the four listed species under the proper implementation of this HCP. Additionally, USFWS and HDLNR will not seek, nor will Cyanotech be required to provide, any other mitigation beyond that provided for in the adaptive management program covered by the original terms and conditions, and goals and objectives, of this HCP. Any such changes will be limited to measures that can be

accomplished within the parameters of the existing wind energy generation facility and its operation and as agreed upon by Cyanotech. Additional conservation and mitigation measures will not involve the commitment of additional land, water or financial compensation or additional restrictions on the use of land, water, or other natural resources otherwise available for development or use under the original terms of the HCP without the consent of Cyanotech.

The USFWS and HDLNR will have the burden of demonstrating that unforeseen circumstances exist, using the best scientific and commercial data available. These findings must be clearly documented and based upon reliable technical information regarding the status and habitat requirements of the affected species. The USFWS and HDLNR will consider, but not be limited to, the following factors: (1) size of the current range of the affected species; (2) percentage of range adversely affected by the HCP; (3) percentage of range conserved by the HCP; (4) ecological significance of that portion of the range affected by the HCP; (5) level of knowledge about the affected species and the degree of specificity of the species' conservation program under the HCP; and (6) whether failure to adopt additional conservation measures would appreciably reduce the likelihood of survival and recovery of the affected species in the wild.

6.0 PERMIT AMENDMENTS

6.1 Minor Modifications

Informal amendments are permissible without amending the underlying section 10(a)(1)(B) permit provided that the changes do not 1) cause a net adverse effect on the Hawaiian Stilt that is significantly different from the effects considered in the original plan and issued permit or 2) result in a failure to meet the performance measures of the permit.

Examples of minor modifications to the Conservation Plan are changes in the design or management of the previously protected nesting site and changes in survey frequency or

monitoring procedures. The Conservation Plan may be informally amended by written notification to the USFWS's Pacific Islands Office and the HDLNR in Honolulu, Hawaii.

6.2 Formal Amendments

Formal amendments to the Conservation Plan are required based on changes that would produce a net adverse effect on the Hawaiian Stilt greater than those considered in the development of the Conservation Plan. Formal permit amendments require written notification to the Wildlife Agencies and the same justification and supporting information for compliance with a standard incidental take permit application, including conservation planning requirements and compliance with issuance criteria.

Examples of events that would require formal amendments to the Conservation Plan would include attraction to the project site of other listed species that may be subject to incidental take, incidental take of Hawaiian Stilts above the level authorized in the section 10(a)(1)(B) permit, or failure of Cyanotech Corporation to fulfill the mitigation requirements as outlined in the Conservation Plan.

When the Wildlife Agencies or Cyanotech Corporation believes that a formal amendment to the Conservation Plan is required, consultation with the Wildlife Agencies will include the USFWS's Pacific Islands Office and the HDLNR. Cyanotech will prepare the appropriate documentation for submission to the Wildlife Agencies. The documentation will include a description of the event or activity and an assessment of its impacts. The amendment will describe changes to the mitigation measures to ensure that the Hawaiian Stilt and any other species covered by the Conservation Plan are appropriately protected.

7.0 PERMIT RENEWAL OR EXTENSION

The permit may be renewed or extended with the approval of the USFWS and the Department of Land and Natural Resources. The request to renew or extend the permit must

be submitted in writing by the permittee and reference the permit number; certify that all statements and information in the original application are still correct or include a list of changes; and provide specific information concerning what take has occurred under the existing permit and what portions of the project are still to be completed. The request must be made to the USFWS's Regional and Pacific Islands Offices and the HDLNR at least 60 days prior to the permit's expiration date. The permit shall remain valid while the renewal or extension is being processed. The renewal or extension may be approved in writing by the Regional Director of the USFWS and the Chairperson of the Board of Land and Natural Resources. Changes to the Conservation Plan that would result in a net adverse effect on the Hawaiian Stilt will be handled in accordance with section 6.2.

8.0 OTHER MEASURES

Section 10(a)(2)(A)(iv) of the ESA states that a Conservation Plan must specify other measures that the Director may require as being necessary or appropriate for purposes of the plan. When conservation plans involve multiple parties, the USFWS may require that an Implementing Agreement be drafted and signed by each party to the Conservation Plan. The USFWS also requires that a monitoring program be developed and implemented to ensure that mitigation success criteria are met. A monitoring program for the Conservation Plan has been developed that describes the data to be collected, the frequency of monitoring, and the reporting procedures and schedules. The monitoring program is described in section 3.5 of this plan. A biologist approved by the Wildlife Agencies will perform the monitoring.

Based on the previous Conservation Plan approved by the Wildlife Agencies and reduction in anticipated take, Cyanotech believes this Plan constitutes a “low-effect” HCP with negligible or minor effects on listed species, whereby an Implementation Agreement is not required.

9.0 ALTERNATIVES CONSIDERED

9.1 No Action Alternative

Under a no action scenario, microalgae farming would occur at Cyanotech with no management of on-site habitat or bird deterrent measures. Adult birds would be attracted to the invertebrate-rich ponds for foraging and consequently would nest adjacent to active raceway ponds. Hawaiian Stilt chicks would die in raceway ponds and active nests would likely be destroyed or abandoned due to human disturbance factors associated with normal operations of the aquaculture facility. No successful reproduction of birds attracted to the project area would occur. Thus, the aquaculture facility would function as a reproductive sink for Hawaiian Stilts, and there would be little to no contribution to the recovery of Hawaiian Stilt. Under the No Action Alternative Cyanotech would not seek an incidental take permit. This alternative was not selected because Cyanotech Corporation would be at risk for prosecution for violating the take prohibitions of the ESA and State law HRS section 195D.

9.2 No Hazing - Long-term Management at other Off Site Locations

Under this alternative, Cyanotech Corporation would contribute funds to implement restoration, enhancement, and management actions at other off-site wetlands. The Lake would be maintained dry or leased to another entity. Based on the amount of time it has taken to complete other large wetlands restoration projects in Hawaii, it is anticipated that this alternative would take between 5 and 10 years to implement, which may extend beyond the term of this permit. The new habitat would require a long-term management and monitoring commitment.

Under this scenario, incidental take of Hawaiian Stilts would not be minimized at Cyanotech, as some birds would continue to forage and subsequently nest at the raceways and on the adjacent lava flats with zero reproductive success. This alternative was not selected because it would not meet the goal of significantly reducing the bird attractant problem at Cyanotech over the long-term. Because incidental take on site would continue to

occur, perhaps in perpetuity, a long-term permit with much greater financial obligations would be required. Because financial resources would be required to support off-site management, fewer resources could be dedicated to researching effective bird deterrents that could be of greater value in resolving the reproductive sink problem attributed to artificial wetland sites. This alternative is likely to be cost prohibitive and thus not economically feasible for Cyanotech Corporation.

9.3 Conservation Plan -- Hazing/Reduction of Attractiveness of Ponds -- Off-Site Management Alternative

Under this alternative, Hawaiian Stilts would be hazed from Cyanotech using noise or other human-induced deterrents. During the past 2 years, the results from hazing combined with efforts to reduce the attractiveness of the ponds were tremendously successful. One hundred percent of the nesting was eliminated at the Cyanotech aquaculture facility. Therefore, Cyanotech would continue with the current hazing measures and thereby reduce the attractiveness of ponds.

Concentrated hazing occurred during the "former" peak activity periods (dusk and dawn) of the birds. It was not necessary to haze stilts from Cyanotech 365 days per year, 24 hours per day as predicted in the former HCP. Since incidental take may not be completely avoided, at least some mitigation commitment would be required to meet the permit issuance criteria. An option for mitigation to offset the reproductive loss under this scenario would be for Cyanotech Corporation to contribute funds to the management of Hawaiian Stilts at other wetlands off-site. Payment of mitigation management fees could be dedicated to wetland restoration or management projects that would contribute to the recovery of the Hawaiian Stilt. The wetland site identified for predator control work and monitoring of water and shorebirds is Opaeula Pond. Twenty-seven Diphacinone rodentcide bait stations will be monitored twice a month. At the same time counts of water and shorebirds will be recorded. Smith et. al. (2000) found that the use of 0.005% Diphacinone bait blocks is an effective means of mongoose population control in Hawaii. Hawaiian coot and Hawaiian stilt have

been documented at Opaeula pond at least since 1986 (Table 3; Hawaii State Division of Forestry and Wildlife Biannual Waterbird Counts).

The size of the restoration area or created pond would determine the reproductive output of the new habitat, but the management would be designed to at least equal or exceed the mean number of fledglings produced per nest at natural wetlands within the main Hawaiian Islands. Once the habitat restoration is complete, this scenario would result in an increase in the Kona Coast population of Hawaiian Stilt and contribute to the recovery of the species. In addition, funding will be provided for bird counts at six offsite wetland areas (KWTP, Aimakapa Pond, Honokohau Reef, Kaloko Pond, Opaeula Pond and Kukio). The compilation of these data would provide a basis for future population analyses, and provide information for the creation of new habitat or closure of existing artificial habitats.

This alternative would implement ten-year management plan at Cyanotech to reduce and offset the incidental take of stilt eggs and chicks while long-term strategies to exclude the population of stilts at Cyanotech can be evaluated by Cyanotech and the Wildlife Agencies. Under this scenario, Cyanotech would aggressively explore options and pursue solutions to reducing the invertebrate food source from its ponds in order to limit the number of stilts attracted to the site. Breeding activity and nest site fidelity adjacent to the raceway ponds would be discouraged and minimized by deterring birds in these unprotected and hazardous sites. Non-lethal bird deterrents such as netting and biodegradable repellents would be investigated and used on raceway ponds with the intent of finding an effective method to exclude stilts from the ponds. The Cyanotech Lake would be netted during the stilt breeding season to prevent stilts from nesting there and to encourage stilt dispersal to other wetlands. The Lake would be maintained dry year round.

Implementing this alternative would minimize the incidental take of Hawaiian Stilts at Cyanotech. Since the closure of the Lake (September 2002) and increased hazing, no birds have nested on Cyanotech property (2003-2005). Although the presence of stilts at Cyanotech has not been eliminated, their numbers have been dramatically reduced. Thus,

Cyanotech has not been a reproductive sink as predicted in the earlier HCP. Cyanotech would be able to concentrate efforts to minimize take on site where resources would be dedicated to improving effective bird deterrents. This alternative will meet the issuance criteria.

Actions taken by Cyanotech during the past three breeding seasons (2003-2005) have shown that implementation the Conservation Plan can minimize stilt breeding activity in hazardous areas and contribute to a net conservation benefit for Hawaiian Stilt recovery goals. Implementation of a long-term exclusion plan is not feasible at this time. Implementation of this Conservation Plan in conjunction with application for an incidental take permit is therefore the preferred alternative.

If incidental take exceeds off-site mitigation, then Cyanotech will increase habitat management at Opaeula or an additional off-site location. Cyanotech will provide a contingency fund of $40,000 for the duration of the 10-yr HCP, with a maximum expenditure of $4,000/yr. The fund will be in the form of five Certificates of Deposit: $8,000 each.

10.0 DEFINITIONS

"Artificial wetlands" - in this document refers to wastewater treatment plants, aquaculture facilities, and other manmade open-water habitats whose primary purpose is not to attract birds.

Conservation Plan - Under section 10(a)(2)(A) of the ESA, a planning document that is a mandatory component of an incidental take permit application, also known as a Habitat Conservation Plan or HCP.

Deter – To keep or discourage from doing something by instilling fear, anxiety, or doubt (Neufeldt and Guralnik 1988).

Endangered Species – "…any species [including subspecies or qualifying distinct population segment] which is danger of extinction throughout all or a significant portion of its range." [Section 3(6) of ESA]'

Endangered Species Act (ESA) of 1973, as amended – 16 U.S.C. 1513-1543; Federal legislation that provides means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, and provides a program for the conservation of such endangered and threatened species.

Habitat – The location where a particular taxon of plant or animal lives and its surroundings, both living and non-living; the term includes the presence of a group of particular environmental conditions surrounding an organism including air, water, soil, mineral elements, moisture, temperature, and topography.

Habitat Conservation Plan (HCP) – See "conservation plan." A planning document to mitigate alteration or loss of natural habitat supporting a listed species.

"Harm" – Defined in regulations implementing the ESA promulgated by the Department of the Interior as an act "which actually kills or injures" listed wildlife; harm may include "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering." (50 CFR 17.3)

"Harass" – Defined in regulations implementing the ESA promulgated by the Department of the Interior as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, and sheltering." (50 CFR 17.3)

"Haze" – To punish or harass by forcing to do hard, unnecessary work; to initiate or discipline by forcing to do ridiculous, humiliating, or painful things (Neufeldt and Guralnik 1988).

Implementing Agreement – An agreement that legally binds the permittee to the requirements and responsibilities of a conservation and section 10 permit. It may assign the responsibility for planning, approving, and implementing the mitigation measures under the HCP.

Incidental take - Take of any federally listed wildlife species that is incidental to, but not the purpose of, otherwise lawful activities (see definition for "take") [ESA section 10(a)(1)(B)].

Incidental take permit – A permit that exempts a permittee from the take prohibition of section 9 of the ESA issued by the FWS pursuant to section 10(a)(1)(B) of the ESA.

Listed species – Species including subspecies and distinct vertebrate populations, of the fish, wildlife, or plants, listed as either endangered or threatened under section 4 of the ESA.

"Low-effect HCPs" – Those involving: (1) minor or negligible effects on federally listed,

proposed, or candidate species and their habitats covered under the HCP; and (2) minor or negligible effects on other environmental values or resources. "Low-effect" incidental take permits are those permits that despite their authorization of some small level of incidental take, individually or cumulatively have a minor or negligible effect on species covered.

Mitigation – Under NEPA regulations, to moderate, reduce or alleviate the impacts of a proposed activity, including: a) avoiding the impact by not taking a certain action or parts of an action; b) minimizing impacts by limiting the degree or magnitude of the action; c) rectifying the impact by repairing, rehabilitating or restoring the affected environment; d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; e) compensating for the impact by replacing or providing substitute resources or environments (40 CFR 1508.20).

National Environmental Policy Act (NEPA) – Federal legislation establishing national policy that environmental impacts will be evaluated as an integral part of any major Federal action. Requires the preparation of an EIS (Environmental Impact Statement) for all major Federal actions significantly affecting the quality of the human environment (42 U.S.C. 4321-4327).

"Net conservation benefit" – "…contribute either directly or indirectly, to the recovery of the covered species. This contribution to recovery will vary and may not be permanent…Conservation benefits from SHAs [Safe Harbor Agreements] include, but are not limited to, reduction of habitat fragmentation rate; the maintenance, restoration, or enhancement of habitats; increase in habitat connectivity; maintenance or increase of population number or distribution; reduction of the effects of catastrophic events; establishments of buffers for protected areas; and establishment of areas to test and develop new an innovative conservations strategies." (FR 32723, June 17, 1999; definition under federal Safe Harbor Agreements; no definition available under the State law)

"Recovery" – The number of individuals of the protected species has increased to the point that the measures provided under this ESA are no longer needed.

Take – Under section 3(18) of the ESA, "… to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" with respect to federally listed endangered species of wildlife. Federal regulations provide the same taking prohibitions for threatened wildlife species [50 CFR 17.31(a)].

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Appendix 1. Avian Botulism Protocol, 1997

NWHC-HFS

MCMXCII

FAX TRANSMITTAL

NBS-NWHC-HFS
PO BOX 50167, ROOM 3317A
300 ALA MOANA BLVD.
HONOLULU, HI 96850
808-541-3445, FAX 808-541-3472
EMAIL: R8_NWHR.HON@NBS.GOV

THIS FAX HAS ___ PAGES INCLUDING THIS PAGE DATE:_____

TO:_____

FROM (CHECK ONE):

☐ THIERRY M. WORK, DVM (WILDLIFE DISEASE SPECIALIST)

☐ BOB RAMEYER (BIOLOGICAL TECHNICIAN)

☐ OTHER_____

SUBJECT:_____

To: ☐ Kealia Pond NWR; ☐ Kauai NWR; ☐ Oahu NWR; ☐ DOFAW-Kauai (Telfer); ☐ DOFAW Maui (Ueoka); ☐ DOFAW Oahu (Conry); ☐ DOFAW-Hawaii (Bachman); ☐ Kaloko NP (Kuallani).

BOTULISM ALERT!!

As some of you may know, Kanaha Pond in Maui is experiencing a suspected botulism outbreak. We are attempting to confirm this. In the interim, I encourage all of you to keep an eye out for similar outbreaks since this is the time of year where we commonly encounter Botulism in Hawaiian waterfowl. This alert also serves as a refresher of how to recognize botulism and manage it.

BOTULISM-is a natural toxin produced by a bacterium in pond soil. Although the bacteria are probably present year-round, it takes the convergence of unique environmental conditions for the bacteria to produce toxin. The exact nature of these environmental conditions remains a mystery.

Once botulism toxin is produced, it is ingested and concentrated by invertebrates in the pond. These invertebrates are ingested by birds who succumb to the toxin. Avian botulism is not transmissible to humans; the botulism toxin affecting humans is different than that affecting birds.

PLEASE CALL IMMEDIATELY IF YOU DO NOT RECEIVE ALL PAGES

HOW TO DEAL WITH BOTULISM

Because we do not know the environmental conditions that cause botulism outbreaks, our best defense is early detection and management.

1. BE VIGILANT

Botulism can occur in any area with standing fresh or brackish water frequented by waterfowl. Botulism is typically detected through observation of sick birds or sudden appearance of bird carcasses.

Typical clinical signs in birds include inability to use legs or wings, inability to hold head up or loss of fear of humans

If your pond is not experiencing bird mortalities, I recommend surveying ponds at least once to twice a week. If your pond is experiencing bird mortality, surveys should be done daily.

Ideally, the entire pond should be examined. If the area is too large or manpower is limiting, concentrate on the following areas of the pond:

- ☛ Places where birds typically aggregate.
- ☛ Edges where vegetation meets pond water (sick birds will seek cool areas, such as brush, to hide and try to recuperate).
- ☛ Areas of pond that are downwind or down current where carcasses may be aggregated.

2. BE PROACTIVE

Botulism is best addressed when detected early. If you suspect botulism in your pond, take the following action:

☛ Inform your local State of Hawaii Dept. Fish and Wildlife (DOFAW) Biologist.

☛ On a daily basis, remove dead birds and fish from the pond. This will help mitigate mortalities for two reasons:

- Protein from the carcasses is used by bacteria to make toxin.
- Carcasses breed fly maggots which concentrate toxin. Birds become poisoned when they ingest maggots.

☛ Keep a tally of what dies each day. This allows you to determine whether things are getting better or worse. For birds that are fresh dead, place the carcass in a plastic bag with date of collection and store frozen or ship to the Honolulu Field Station (call first). The carcass can be used to confirm presence of botulism.

Exhibit 1. Cyanotech Aquaculture Facility at Keahole Point

Exhibit 2. Hawaiian Stilt (*Himantopus mexicanus knudseni*) in natural habitat

Table 1. Hawaiian Stilt Breeding Activity and Density at Cyanotech Aquaculture Facility 1998-2005

The Lake

Year	1998	1999	2000	2001	2002	2003	2004	2005
No. Nests	10	29	48	26	96	0	0	0
No. Eggs	39	109	167	81	340	0	0	0
No. Hatchlings	35	80	100	65	257	0	0	0
No. Fledglings	33	31	84	41	48	0	0	0

Ducks Unlimited Pond

Year	1998	1999	2000	2001	2002	2003	2004	2005
No. Nests	1	5	8	0	0	0	0	0
No. Eggs	4	20	24	0	0	0	0	0
No. Hatchlings	4	11	9	0	0	0	0	0
No. Fledglings	5[a]	0	0	0	0	0	0	0

Among Raceway Ponds

Year	1998	1999	2000	2001	2002	2003	2004	2005
No. Nests	6	15	26	14	5	0	0	0
No. Eggs	23	53	92	47	10	0	0	0
No. Hatchlings	8	12	14	20	5	0	0	0
No. Fledglings	0	0	0	0	0	0	0	0

Lava Fields

Year	1998	1999	2000	2001	2002	2003	2004	2005
No. Nests	9	3	8	2	7	0	0	0
No. Eggs	33	9	24	7	24	0	0	0
No. Hatchlings	2	0	9	3	3	0	0	0
No. Fledglings	0	0	0	0	0	0	0	0

Cyanotech Stilts/Week[b]	36 ± 8	n/a	n/a	97 ± 7	104 ± 9	16 ± 7	9 ± 3	0.3 ± 0.2
Cyanotech Stilts/Week[c]	75 ± 11	n/a	n/a	n/a	109 ± 9	84 ± 10	38 ± 4	0.4 ± 0.4
Cyanotech Stilts/Week[d]	53 ± 11	n/a	n/a	n/a	106 ± 6	50 ± 7	23 ± 3	0.4 ± 0.2
Lava Field Stilts/Week[b]	n/a	n/a	n/a	0.8 ± 0.2	2.3 ± 0.4	0	0	0
Lava Field Stilts/Week[c]	n/a	n/a	n/a	0	0	0	0	0
Lava Field Stilts/Week[d]	n/a	n/a	n/a	0.3 ± 0.2	1.1 ± 0.4	0	0	0
Kona Coast Survey Stilts/Month[b]	n/a	n/a	n/a	n/a	n/a	192 ± 28	122 ± 14	113 ± 14
Kona Coast Survey Stilts/Month[c]	n/a	n/a	n/a	n/a	n/a	249 ± 26	214 ± 17	123 ± 11
Kona Coast Survey Stilts/Month[d]	n/a	n/a	n/a	n/a	n/a	206 ± 23	168 ± 18	118 ± 9

[a] Extra fledgling came from raceway nest and was adopted

[b] Breeding season (mean + Standard Error)

[c] Non-breeding Season (mean + Standard Error)

[d] September through August (mean + Standard Error)

[n/a] Data not available

Table 2. Incidental Take of Hawaiian Stilt at Cyanotech Aquaculture Facility from 1998-2005 (a=adult; f=fledgling; c=chick)

Year	1998	1999	2000	2001	2002	2003	2004	2005
Incidental Take	None Documented	28c 1f	10c	14c	3c	2a	10a	0

Table 3. Hawaiian Stilt and Hawaiian Coot observations at Opaeula Pond during summer and winter surveys from 1986 to present; Hawaii State Division of Wildlife and Forestry biannual waterbird counts.

Season	Year	Coot Total	Stilt Total
Winter-January	2005	4	10
Winter-January	2004	7	6
Winter-January	2003	6	6
Winter-January	2002	6	47
Winter-January	2001	8	2
Winter-January	2000	7	6
Winter-January	1999	na	na
Winter-January	1998	na	na
Winter-January	1997	1	4
Winter-January	1996	8	4
Winter-January	1995	3	5
Winter-January	1994	1	3
Winter-January	1993	9	7
Winter-January	1992	7	9
Winter-January	1991	18	9
Winter-January	1990	7	4
Winter-January	1988	8	11
Winter-January	1987	13	8
Winter-January	1986	11	5

Season	Year	Coot Total	Stilt Total
Summer-August	2005	2	4
Summer-August	2004	2	5
Summer-August	2003	6	2
Summer-August	2002	8	3
Summer-August	2001	11	8
Summer-August	2000	5	3
Summer-August	1999	8	0
Summer-August	1998	3	2
Summer-August	1997	9	2
Summer-August	1995	0	18
Summer-August	1994	3	0
Summer-August	1993	0	5
Summer-August	1992	8	9
Summer-August	1991	0	10
Summer-August	1990	12	9
Summer-August	1989	8	3
Summer-August	1988	12	3
Summer-August	1987	23	5
Summer-August	1986	19	10

na = data not available