National Park Service
U.S. Department of the Interior

Kaloko-Honokōhau
National Historical Park

73-4786 Kanalani Street # 14
Kailua-Kona, Hawai‘i 96740

808 329-6881 Phone
808 329-2597 Fax

# Kaloko-Honokōhau

IN REPLY REFER TO:
L54 [2013-12]

September 13, 2013

William J. Ailā, Jr., Chairperson
Commission on Water Resource Management
P.O. Box 621
Honolulu, Hawai‘i 96809

Subject: Petition to Designate the Keauhou Aquifer System a Water Management Area

Dear Mr. Ailā:

I respectfully submit this petition to designate the Keauhou Aquifer System a Water Management Area. Thirty-five years ago, the Honokōhau Study Advisory Commission recognized that management of fresh water flowing underground from mauka areas was necessary to preserve and protect the spirit of Kaloko-Honokōhau for the enjoyment of residents, visitors, and future generations. This petition is submitted so that their vision may be fulfilled.

We must act now because the fresh water that sustains North Kona’s residents and economy is threatened by growing water demand, declining rainfall, and rising sea level. Large-scale groundwater pumping, injection and desalinization in the Keauhou Aquifer System are imminent. Fresh water must be preserved for unique cultural and natural resources along the Kona Coast before any more water is allocated for consumptive uses.

Water for non-consumptive public trust uses has not yet been explicitly considered by the State of Hawai‘i in its sustainable yield determinations or well permitting process. Designation proceedings, however, provide an opportunity to openly and transparently consider how much water is needed for traditional and customary Native Hawaiian practices and the maintenance of waters in their natural state.

Stewardship of water resources is an enduring responsibility shared by both of our agencies. I look forward to cooperating with you and your staff in the pursuit of this goal. Please contact me at (808) 329-6881 x1201 or Jeff Zimpfer at (808) 329- 6881 x1500 with any questions regarding this submittal.

Sincerely,

Tammy Ann Duchesne
Superintendent

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
**COMMISSION ON WATER RESOURCE MANAGEMENT**
P.O. BOX 621
HONOLULU, HAWAII 96809

# PETITION FOR WATER MANAGEMENT AREA ACTION for

■ **Ground Water** ☐ **Surface Water**

**Instructions:** Please print in ink or type and send completed petition with attachments to the Commission on Water Resource Management, P.O. Box 621, Honolulu, Hawaii 96809. For assistance, call the Regulation Branch at 587-0225.

1. **PETITIONER**

Firm/Name: National Park Service

Contact Person: Tammy A. Duchesne Phone: 808-329-6881 x1201

Address: 73-4786 Kanalani St., Suite #14, Kailua-Kona, HI 96740

2. **PROPOSED WATER MANAGEMENT AREA(S)**

Island: Hawaii

Aquifer Sector(s): Hualalai (809)

Aquifer System(s): Keauhou (80901)

Watershed(s): Keahole, Honokohau

3. **PROPOSED ACTION** (Check one only): ■ DESIGNATION ☐ MODIFICATION ☐ RESCINDMENT

4. **JUSTIFICATION FOR PROPOSED ACTION ON WATER MANAGEMENT AREA(S)**

Please attach a sheet to state reasons why the above hydrologic unit(s) under item 2 should be designated as a ground and/or surface water management area(s) or the boundaries of an existing water management area(s) modified or rescinded. If petition is for water management area designation, please state which criteria specified by 13-171-7 and/or 13-171-8, HAR, are met and why (see back of form). If petition is for modifying or rescinding existing water management area boundaries, please establish your standing to petition (13-171-10 HAR). Complete and detailed explanations are encouraged.

**Submitted by (print):** CHRISTINE LEHNERTZ **Title:** Acting Pacific West Regional Director

**Signature** for [signature] **Date:** 9/3/13

PWMAA Form (02/25/2004)

## RELEVANT SECTIONS OF 13-171, HAR & 174C, HRS
## REGARDING WATER MANAGEMENT AREA PETITIONS

§13-171-3 Initiation by chairperson. The designation of a water management area by the commission may be initiated upon recommendation by the chairperson. In addition to this prerogative, it shall be the duty of the chairperson to make the recommendations from time to time when it is desirable or necessary to designate a water management area for the purposes stated in this chapter and there is data for a decision by the commission. [Eff. MAY 27 88] (Auth: HRS §174C-8) (Imp: HRS §§174C-5, 174C-41)

§13-171-4 Initiation by petition. (a) The designation of a water management area by the commission may also be initiated by any interested person by written petition to the chairperson proposing the designation of a specified area and presenting the reasons for such designation. The petition for designation of a water management area shall be made on forms provided by the commission. It shall be the duty of the chairperson, after consultation with the appropriate county mayor and county water board, to act upon the petition by making a recommendation for or against the proposed designation to the commission within sixty days after receipt of the petition or additional time as may be reasonably necessary to determine whether there is factual data to warrant the proposed designation.

(b) Designated ground water areas established under chapter 177, HRS, the Ground Water Use Act, and remaining in effect at the effective date of this chapter shall continue as water management areas. [Eff. MAY 27 88] (Auth: HRS §174C-8) (Imp: HRS §§174C-5,174C-41)

§13-171-7 Ground water criteria for designation. In designating an area for ground water use regulation, the commission shall consider the following:

(1) Whether an increase in water use or authorized planned use may cause the maximum rate of withdrawal from the ground water source to reach ninety percent of the sustainable yield of the proposed water management area;
(2) That the rates, times, spatial patterns, or depths of existing withdrawals of ground water are endangering the stability or optimum development of the ground water body due to upconing or encroachment of salt water;
(3) That the chloride contents of existing wells are increasing to levels which materially reduce the value of their existing uses;
(4) Whether excessive preventable waste of water is occurring;
(5) There is an actual or threatened water quality degradation as determined by the department of health;
(6) Serious disputes respecting the use of ground water resources are occurring;
(7) Whether regulation is necessary to preserve the diminishing ground water supply for future needs, as evidenced by excessively declining ground water levels; or
(8) Whether water development projects that have received any federal, state, or county approval may result, in the opinion of the commission, in one of the above conditions.

Notwithstanding an imminent designation of a water management area conditioned on a rise in the rate of ground water withdrawal to a level of ninety percent of the area's sustainable yield, the commission, when such level reaches the eighty percent level of the sustainable yield, may invite the participation of water users in the affected area to an informational hearing for the purposes of assessing the ground water situation and devising mitigative measures. [Eff. MAY 27 88] (Auth: HRS §174C-8) (Imp: HRS §§174C-5, 174C-44)

§13-171-8 Surface water criteria for designation. In designating an area for surface water use regulation, the commission shall consider the following:

(1) Whether regulation is necessary to preserve the diminishing surface water supply for future needs, as evidenced by excessively declining surface water levels, not related to rainfall variations, or increasing or proposed diversions of surface waters to levels which may detrimentally affect existing instream uses or prior existing off stream uses;
(2) Whether additions to or the diversions of stream waters are reducing the capacity of the stream to assimilate pollutants to an extent which adversely affects public health or existing instream uses; or
(3) Whether serious disputes respecting the use of surface water resources are occurring.

[Eff. MAY 27 88] (Auth: HRS §174C-8) (Imp: HRS §§174C-5, 174C-45)

§13-171-10 Modifying and rescinding designated areas. The modification of the boundaries or the rescinding of existing water management areas by the commission may be initiated by the chairperson or by a petition to the commission by any person with proper standing. The procedure for modifying the boundaries of an existing water management area or for rescinding an existing water management area shall be as provided in subchapter 2 for the designation of a water management area. [Eff. MAY 27 88] (Auth: HRS §174C-8) (Imp: HRS §§174C-5, 174C-47)

# Contents

1. Introduction ..... 1
1.1 Establishment of the Commission on Water Resource Management ..... 3
1.2 Establishment of Kaloko-Honokōhau National Historical Park ..... 4
1.3 Cultural and Natural Public Trust Resources ..... 6
1.4 Adverse Effects of Reduced Freshwater Discharge ..... 11
1.5 Protecting Public Trust Resources in Kaloko-Honokōhau ..... 17
1.51 Stewardship Responsibilities of the State ..... 17
1.52 Stewardship Responsibilities of the National Park Service ..... 20
2. Statutory Criteria for a Water Management Area ..... 23
2.1 Sustainable Yield [HAR §13-171-7(1)]: ..... 23
2.11 Sustainable Yield for the Keauhou Aquifer System ..... 23
2.12 Reported Water Use and Future Water Demand in the Keauhou Aquifer System ..... 25
2.13 Declining Rainfall and Rising Sea Level ..... 28
2.2 Saltwater Intrusion [HAR §13-171-7(2) & HAR §13-171-7(3)]: ..... 31
2.3 Waste [HAR §13-171-7(4)]: ..... 37
2.4 Disputes [HAR §13-171-7(6)]: ..... 38
2.41 Cumulative Impact Assessments ..... 38
2.42 Significance of Saltwater Intrusion on Public Trust Resources ..... 41
2.43 Source of Recharge to the Basal Groundwater System ..... 43
2.5 Federal, State, County Approval [HAR §13-171-7(8)]: ..... 47
3. Summary ..... 48
4. Conclusions ..... 51
5. References ..... 53
Appendix A: Federally-protected species in Kaloko-Honokōhau National Historical Park. ..... 58
Appendix B: Pumping capacity of permitted wells in the Keauhou Aquifer System ..... 59
Appendix C: Water demand for proposed development in the area of Kaloko-Honokōhau. ..... 60
Appendix D: Existing and proposed desalination systems in the area of Kaloko-Honokōhau. ..... 61
Appendix E: Record of groundwater development issues in the area of Kaloko-Honokōhau. ..... 62

# 1. Introduction

The National Park Service (NPS) respectfully requests that William Ailā, the chairperson of the Commission on Water Resource Management (the Commission), accept this petition and formally recommend that the process for designating the Keauhou Aquifer System a "Ground Water Management Area" be continued. Designation is necessary so the Commission may regulate the location and pumpage of wells in the Keauhou Aquifer System for the protection of vital water-related public trust resources located within Kaloko-Honokōhau National Historical Park (the Park) and the remainder of the management unit for the benefit of present and future generations.

In Kaloko-Honokōhau, "*the dynamic thread that ties the environment together is water*" (Honokōhau Study Advisory Commission 1974). The coastal fishponds, anchialine pools, wetlands, tidepools, and nearshore marine waters are fed by fresh water from the Keauhou Aquifer System. Traditional and customary Native Hawaiian practices rely heavily on the quality and quantity of groundwater in Kaloko-Honokōhau (Maly & Maly 2002; Peterson & Orr 2005). Noting the connection between the natural and cultural resources in the Park, the State Land Use Commission found that "*any impacts to waters in the National Park would, in and of itself, be an impact to cultural resources*" (Docket A00-732, Finding of Fact 190).

Support for the stewardship of water-dependent cultural and natural resources transcends the boundaries of the Park. In 2010, citizens of Hawai‘i County voted to amend Article XIII, Section 13-29 of the County Charter to "*conserve and protect Hawai‘i's natural beauty and all natural and cultural resources*" and to affirm that "*all public natural and cultural resources are held in trust by the county for the benefit of the people*." In 2011, the Office of Hawaiian Affairs and the Association of Hawaiian Civic Clubs passed resolutions encouraging all stakeholders to actively work to protect cultural and natural resources that are dependent upon the Keauhou Aquifer. As noted by the Review Commission on the State Water Code, groundwater must be conserved for these non-consumptive public trust purposes before it is allocated to any other uses (State of Hawai‘i 1994).

If the chairperson does not recommend initiating designation proceedings and consequently, the Commission does not act to designate a water management area, new wells

will continue to be located near sensitive habitat for culturally important and rare native species, thereby imperiling traditional and customary Native Hawaiian rights and practices and other public trust resources that are vulnerable to changes in water supply. Waters that support fisheries, tourism, subsistence, and cultural heritage are at risk.

In support of its request, the NPS offers the following historical, legal, and scientific reasons for the Commission to exercise its constitutional obligation to actively manage the freshwater resources of the Keauhou Aquifer System. Initially, it should be noted that the Commission and the Park were both created to protect and perpetuate traditional and customary Native Hawaiian practices and the natural resources on which these practices depend. Thus, the Commission by giving careful and deliberate consideration to this petition can faithfully discharge its lawful duties, and thereby further its stewardship of the cultural and natural public trust resources of the state.

## 1.1 Establishment of the Commission on Water Resource Management

On November 7, 1978, citizens of the State of Hawaiʻi ratified the amendment later codified as Article XI, Section 7 of the Hawaiʻi Constitution calling for the establishment of what has become the Commission, "*a water resources agency which, as provided by law, shall set overall water conservation, quality and use policies; define beneficial and reasonable uses; protect ground and surface water resources, watersheds and natural stream environments; establish criteria for water use priorities while assuring appurtenant rights and existing correlative and riparian uses and establish procedures for regulating all uses of Hawaii's water resources.*"

Some of the essential duties of the Commission arise from the public trust doctrine, a core element in Hawaiian constitutional law, appearing both in Article XI, Section 1 and Article XI, Section 7. In re Waiāhole Ditch Combined Contested Case Hearing, 9 P.3d 409, at 444 (2000) ("Waiāhole"). The doctrine requires that public trust purposes, such as traditional and customary Native Hawaiian practices and the maintenance of waters in their natural state, be safeguarded in the allocation and management of water resources by the state and its subdivisions for the benefit of its people. Waiāhole, 9 P.3d at 449-51.

Subsequent to the establishment of the Commission and the State Water Code [HRS §174C], the Hawaiʻi Supreme Court (the Court) has issued opinions resolving a number of legal disputes regarding the allocation and management of water resources, thereby clarifying the duties of the Commission, particularly as they relate to the state's public trust in water. Thus, the Commission must meaningfully consider the effects of groundwater withdrawals because it has an "*affirmative duty to take the public trust into account in the planning and allocation of water resources, and to protect public trust uses whenever feasible.*" Waiāhole, 9 P.3d at 453 (emphasis retained).

## 1.2 Establishment of Kaloko-Honokōhau National Historical Park

> *Along the western coastline of the Island of Hawai'i lies the hot, rugged lava of Ka-loko, Hono-kō-hau. This seemingly barren and harsh landscape does not appear to be suitable for human existence, and yet, long before written history, the Hawaiian people built a thriving settlement upon the 'a'ā lava, which was to last well into the 19th century when the forces of western culture slowly brought an end to the Hawaiian way of life…the spirit of Ka-loko, Hono-kō-hau revealed itself to the ancient Hawaiians in another form which was, perhaps, the most critical factor in their decision to settle in the area. What they found scattered along the shoreline and among the jagged lava, were cool, brackish water springs. To the Hawaiians, the presence of these springs throughout the area was indication that there was enough of an underground water source to sustain the everyday needs of a settlement of people…The Hawaiian settlement at Ka-loko, Hono-kō-hau did not just survive. It thrived, because the ancient Hawaiians touched and understood the spirit, but did not disturb it. They nurtured the spirit tenderly, like a rare and precious plant, and it grew until it filled everything around it with its being. Their philosophy was a simple and effective one -- "provide for nature and it will provide." In this way they maintained the delicate balance that existed in their sacred relationship with nature. To misuse the natural resources at Ka-loko, Hono-kō-hau would bring upon them the wrath of their all-powerful gods Kine, Ku, Lono, and Kanaloa, and devastation to their land* (Honokōhau Study Advisory Commission 1974).

National recognition of the cultural and historical importance of the area so well described above occurred in 1962 when the Honokōhau Settlement was designated a National Historic Landmark. Then in 1972, local Native Hawaiians who were concerned about proposals to develop the National Historic Landmark for urban and resort uses approached the Hawai'i Congressional delegation about preserving Kaloko-Honokōhau as a part of the National Park System. The United States Congress directed the Secretary of the Interior to appoint an advisory commission of 15 people including prominent Native Hawaiian leaders to study the issue. The Honokōhau Study Advisory Commission (1974) produced "The Spirit of Ka-loko-Hono-kō-hau, a proposal for the establishment of a Ka-loko Honō-ko-hau National Cultural Park, Island of Hawai'i, State of Hawai'i," often referred to as the "Spirit Report." In the transmittal letter to the Secretary of the Interior, the Advisory Commission stated, "*we take special pleasure in presenting this study because perhaps for the first time Native Hawaiians have been able to tell their story and tell it in their own way.*"

On November 10, 1978, Congress established Kaloko-Honokōhau National Historical Park "*to provide a center for the preservation, interpretation, and perpetuation of traditional*

*Native Hawaiian activities and culture, and to demonstrate historic land use patterns as well as to provide a needed resource for the education, enjoyment, and appreciation of such traditional Native Hawaiian activities and culture by local residents and visitors*" [16 U.S.C. §396d(a)]. In creating Kaloko-Honokōhau National Historical Park, Congress required that the NPS administer the Park according to the laws applicable to all units of the National Park System and "*in accordance with the guidelines*" provided in the Spirit Report [16 U.S.C. §396d(c)].

Recognizing that urban and resort development threatened resources in Kaloko-Honokōhau, Congress also authorized the Secretary of the Interior "*to enter into agreements with other governmental entities and private landowners to establish adequate controls on air and water quality and the scenic and esthetic values of the surrounding land and water areas*" [16 U.S.C. §396d(d)(4)]. The federal government invested approximately $70 million in public funds to acquire three of the four privately owned parcels within the authorized boundaries, so that the land and culture would live on in Kaloko-Honokōhau (Figure 1).

Figure 1. Annual Children's Cultural Festival hosted by Kaloko-Honokōhau National Historical Park to connect fourth graders with traditional Hawaiian culture (NPS photos). The festival marks the start of the *Makahiki*.

## 1.3 Cultural and Natural Public Trust Resources

Kaloko-Honokōhau National Historical Park comprises over 500 acres of terrestrial ecosystems, including native coastal shrublands, three fishponds, more than 185 anchialine pools, and almost 600 acres of marine, intertidal and coral reef habitat (Figure 2). Approximately 25% of the Hawai‘i’s estimated anchialine pool resources are located within the Park, including two short stream segments where the seaward flow of brackish water can be readily observed. The State of Hawai‘i has indicated its intent to maintain Kaloko-Honokōhau’s water resources in pristine condition by classifying all of the Park’s inland waters as Class 1a, and marine waters as Class AA.

Cultural resources in Kaloko-Honokōhau include over 450 known archeological sites comprised of multiple *heiau*, burials, house sites, planters, modified anchialine pools, enclosures, and traditional Hawaiian fishponds and their associated wetlands (Figures 3 & 4). The interconnection between cultural and natural resources in the Park is exemplified by its water resources, which were used for aquaculture and historically provided fish and bait for Hawaiian families. Kaloko Fishpond, a 11-acre *loko kuapā* is one of the most significant cultural resources in Kaloko-Honokōhau (Figure 5). The fishpond is a spring-fed embayment that provides habitat for culturally important fish species; the restored *kuapā*, or seawall, is 800-ft long. ‘Aimakapā Fishpond, a 15-acre *loko i‘a*, and its wetland provide important foraging and breeding habitat for endangered native waterbirds and migratory waterfowl (Figure 6). ‘Ai‘ōpio Fishtrap is an enclosure modified by Hawaiians to trap fish at low tide (Figure 4).

Kaloko-Honokōhau is home to ten endangered or threatened plant and animal species protected under the Endangered Species Act; the anchialine pool resources support three species that are candidates for listing (Appendix A). The tidepools and coral reef support a variety of marine life and are inhabited by resident juvenile threatened green sea turtles and the endangered hawksbill sea turtle (Figures 7 & 8). The endangered Hawaiian monk seal is an occasional visitor to the marine waters and shoreline of the Park, along with endangered humpback whales and the recently listed false killer whale.

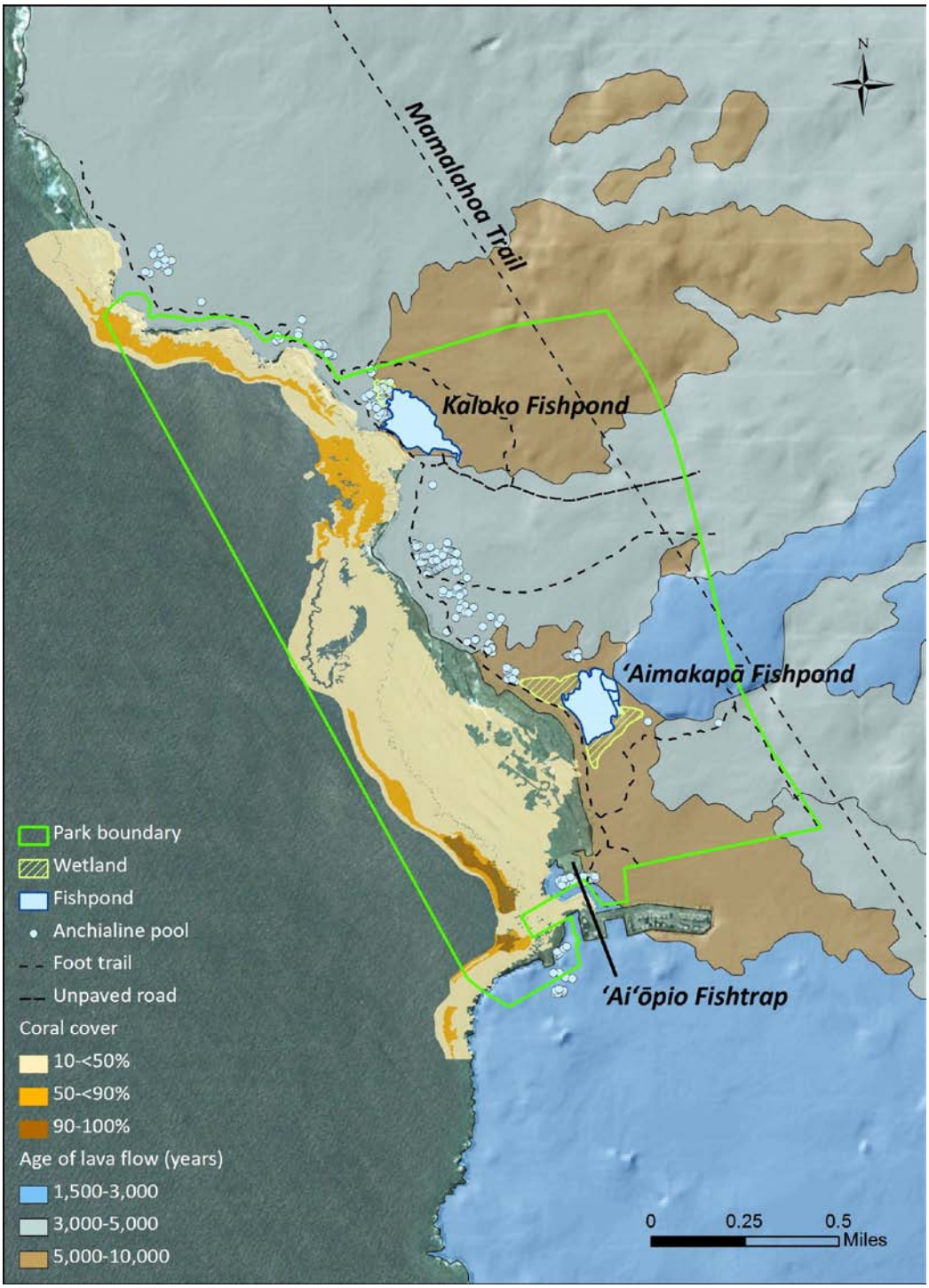


Figure 2. Cultural and natural resources in Kaloko-Honokōhau National Historical Park.

Figure 3. Kahinihini‘ula anchialine pool with *ahu* in the background (NPS photo).

Figure 4. Pu‘uoina Heiau overlooks ‘Ai‘ōpio fishtrap; Hualalai looms over the horizon (NPS photo).

Figure 5. Aerial view of Kaloko Fishpond in 1977 (left) (photo by R.J. Shallenberger); restored kuapā at Kaloko Fishpond in 2012 (right) (NPS photo).

Figure 6. Aerial view of ʻAimakapā Fishpond (NPS photo).

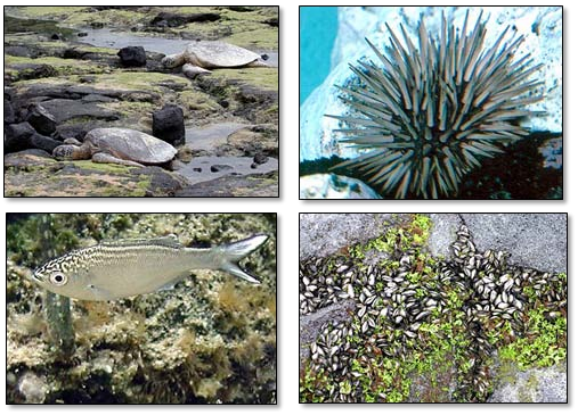

Figure 7. Marine life attracted to tidepools in Kaloko-Honokōhau National Historical Park. Clockwise from top left: *honu* or green sea turtles, *ʻina kea* or sea urchin, shells and *limu* or seaweed, and *aholehole* or reticulated Hawaiian flagtail (NPS photos).

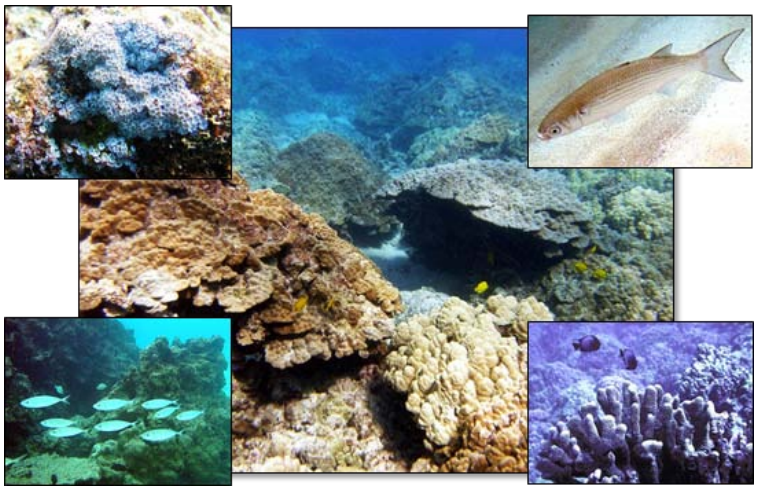

Figure 8. Marine life in the nearshore waters of Kaloko-Honokōhau National Historical Park. In the background is the coral reef; clockwise from top left are blue octocoral, *ʻamaʻama* or striped mullet, *pohaku* or finger coral, and *akule* or bigeye scad (NPS photos).

The NPS is working with *Makani Hou o Kaloko-Honokōhau*, the Park's primary friends group and partner organization, to build the Cultural Center within the Park, a place where Hawaiians and others will be able to immerse in traditional Hawaiian activities and cultural practices. The NPS is actively restoring the natural and cultural functions of Kaloko Fishpond to operate as traditional and productive aquaculture for the community as part of the Cultural Center, and is restoring the wetlands of ʻAimakapā Fishpond to benefit native and migratory waterbirds. Also underway is the Hawaiian Legacy program, which will support the preservation of traditional knowledge and artisan skills, including Hawaiian *uhau humu pohaku* – traditional Hawaiian dry-set masonry.

The coastal and marine ecosystems in Kaloko-Honokōhau and along the Kona Coast are a great economic asset for Hawaiʻi. Whether stemming from tourism or other commercial activities such as fishing, marine resources provide significant economic value to their local communities. Coral-reef associated economic benefits along the Kona Coast were estimated to be about $17 million annually, 45% of which was attributed to recreation and tourism (Cesar et al. 2002). For example, marine resources in the Park include diverse fish populations for shoreline and nearshore fishing and 15 day-use mooring buoys for recreational diving. The State Land Use Commission has recognized "*the economic value of this coastal National Park, providing such exquisite natural, recreational and cultural resources*" (Docket A00-732, Finding of Fact 156).

## 1.4 Adverse Effects of Reduced Freshwater Discharge

The adverse effects of reducing freshwater discharge to coastal areas have been documented in numerous peer-reviewed studies. A comprehensive analysis of the potential cumulative effects of groundwater withdrawals on the water resources of Kaloko-Honokōhau was completed by the U.S. Geological Survey (USGS). The USGS, using a numerical groundwater-flow model, estimated that about 6.48 Mgal/d of fresh groundwater discharged to the ocean within the Park when it was established in 1978 (Oki et al. 1999). The USGS also simulated the effects of groundwater use on freshwater discharge. They concluded that if all wells permitted prior to 1998 were pumped at their maximum rate, groundwater discharge at the coastline in the Park would be reduced to 47% of the 1978 rate and water levels would decline by about 0.6 ft (Oki et al. 1999) (Figure 9).

Maintaining the flow of groundwater to the coast is critical because fresher, colder, buoyant groundwater creates estuarine conditions for diverse aquatic ecosystems and cultural practices along the Kona Coast (e.g., Parrish et al. 1990; Johnson et al. 2008; Knee et al. 2008;

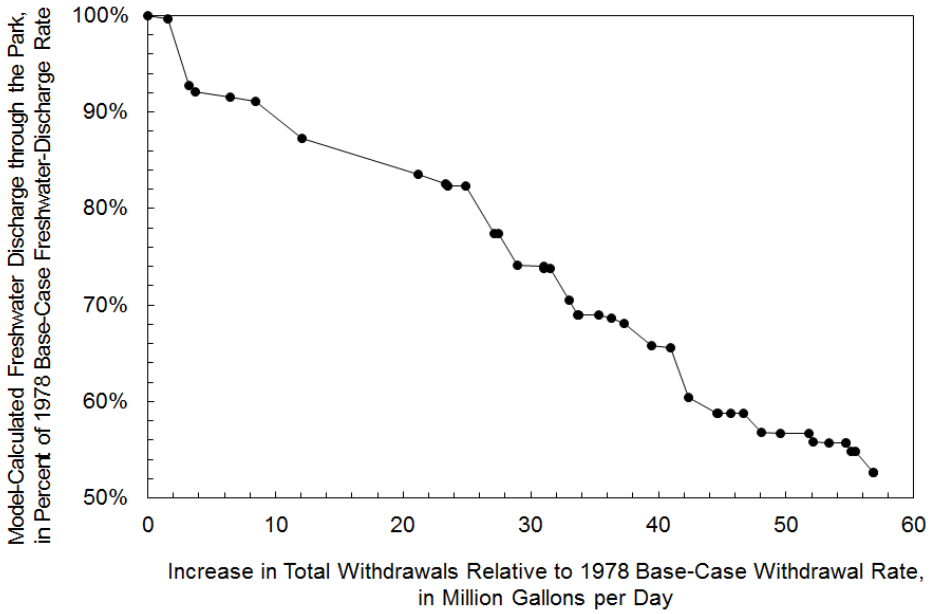


Figure 9. Reduction in model-calculated freshwater discharge through Kaloko-Honokōhau National Historical Park in excess of average 1978 withdrawal rates in western Hawaii (modified from Oki et al. 1999). Groundwater discharge is reduced as simulated withdrawals increase; wells upgradient of the park have the largest effect on discharge.

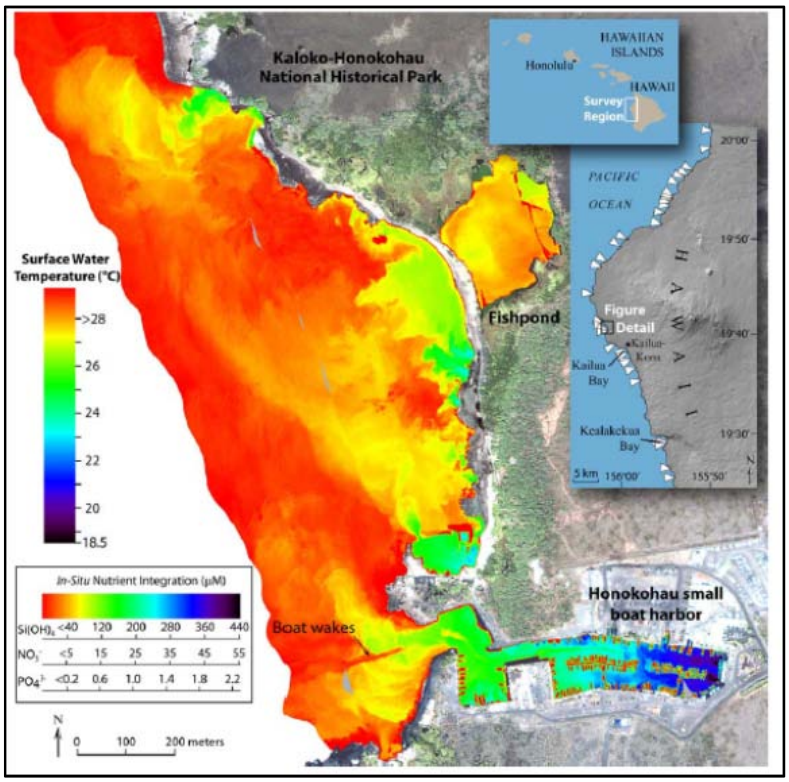


Figure 10. Sea-surface temperature map produced from August 2005 aerial infrared imaging in the vicinity of Kaloko-Honokōhau National Historical Park (*from* Johnson et al. 2008; Figure 1). White triangles in the inset indicate 31 major submarine groundwater discharge plumes identified by the University of Hawaii School of Ocean and Earth Sciences.

Beets et al. 2010; Grossman et al. 2010) (Figure 10). Traditional Native Hawaiian knowledge and experience as well as scientific research tell us that important keystone and indicator species are sensitive to changes in the salinity and temperature of this groundwater discharge.

Reducing the flow of fresh, clean water to Kaloko Fishpond could result in a loss of nursery habitat for the *'ama'ama* or striped mullet (*Mugil cephalus*), one of two species of native mullet and a culturally significant estuarine species in Hawai'i. "*Traditional fishponds were located at sites which more than likely attracted great number of fingerlings since the areas provided a protective habitat and optimal growing conditions*" (Nishimoto et al. 2007). The Commission has acknowledged that mullet as well as "*aholehole and milkfish (awa) depend on a euryhaline or brackish water environment for the nursery stage of their life cycle*" (Contested Case Hearing CCH-MO97-1, Finding of Fact 147). Because the NPS is working to restore Kaloko Fishpond for traditional aquaculture, maintaining optimal growing conditions is essential

to support these harvesting practices. The State of Hawaiʻi is also working to protect essential nursery habitat for striped mullet fingerlings and juveniles, and found that traditional Hawaiian fishponds may need further protection (Nishimoto et al. 2007).

Excessive groundwater withdrawals may limit the productivity and distribution of *limu* or seaweeds as groundwater discharge to coastal waters along the Kona Coast decreases (Duarte et al. 2010). *Limu* were the third component of the traditional Hawaiian diet of fish and *poi*, and wide varieties were harvested in Kaloko-Honokōhau (Abbott 1984; Maly & Maly 2002; Peterson & Orr 2005). Laboratory studies indicate that the growth rate of an economically, ecologically, and culturally important species native to the Kona Coast, *limu manauea* (*Gracilaria coronopifolia*), increases as salinity decreases below that of seawater, or about 35 parts per thousand (ppt) total dissolved solids, with optimal conditions occurring at a salinity of about 27 ppt (about 80% seawater) (Amato 2009) (Figure 11a). Similar observations were made at a major harvest site on Molokaʻi, where severe drought conditions slowed the growth of one of the most prized species, *limu kohu* (*Asparagopsis taxiformis*) (Poepoe et al. 2001). The Commission also found that because "*limu frequently grows best in a mixture of seawater and freshwater,*" increased salinities may be detrimental to its growth on Molokaʻi (Contested Case Hearing CCH-MO97-1, Finding of Fact 144).

Native Hawaiians once utilized certain anchialine pools in Kaloko-Honokōhau for drinking water (e.g., Honokōhau Study Advisory Commission 1974; Maly & Maly 2002), but there is no potable water in the Park today. A 2008 – 2009 inventory indicates that the mean salinity of the Park's anchialine pools is 15 ppt (about 43% seawater) (NPS 2013) (Figure 11). Some of the Park's anchialine pools provide habitat for a native species of *pinaoʻula* – the orange-black Hawaiian damselfly (*Megalagrion xanthomelas*) (Figure 12). This endemic stream-dwelling species was once one of the most abundant damselflies in the Hawaiian Islands, but habitat loss through dewatering has contributed to its current status as a candidate for listing as endangered or threatened by the U.S. Fish and Wildlife Service. Laboratory studies indicate the eggs and naiads of the orange-black Hawaiian damselfly are sensitive to increased salinity and

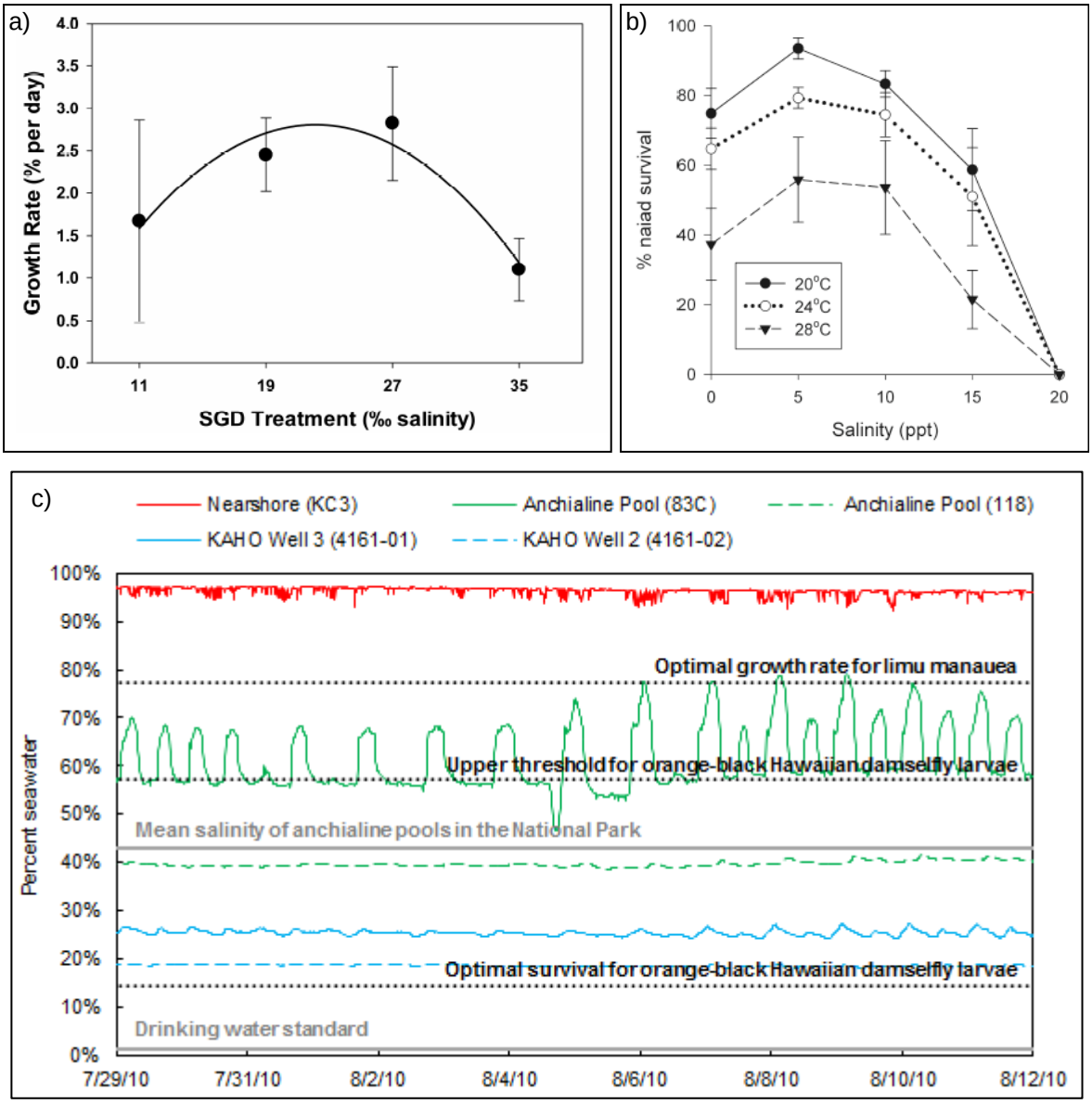


Figure 11. Freshwater discharge to inland and nearshore marine waters provides diverse habitat for native species along the Kona Coast. Although these fragile coastal ecosystems exist where salinity fluctuates due to the ocean tide, a long-term increase in salinity due to reduced freshwater flows will adversely affect the productivity and survival of culturally important and rare native species: a) pooled mean growth rate (mean ± 1 standard deviation) for *limu manauea* vs. salinity (parts per thousand) (SGD treatment = simulated submarine groundwater discharge) (Amato 2009); b) percent naiad survival (mean ± standard error) vs. salinity (parts per thousand) for the candidate-endangered orange-black damselfly among three temperature levels (Tango 2010); c) continuous salinity-monitoring data from five sites in Kaloko-Honokōhau National Historical Park over one tidal cycle in 2010 (nearshore data courtesy of E. Grossman, USGS; anchialine pool data courtesy of D. Oki, USGS; well data downloaded from USGS (2013); mean salinity of anchialine pools from NPS (2013)).

Figure 12. Protected native species in Kaloko-Honokōhau National Historical Park. Clockwise from left is the *ae'o* or Hawaiian stilt (Pacific Island Parks photo), *'alae ke'oke'o* or Hawaiian coot (NPS photo), and the orange-black Hawaiian damselfly (Hawaii Biological Survey photo by D. Preston).

temperature, and that naiads exhibit a threshold response to salinity above 15 ppt, with no naiads surviving at 20 ppt (about 57% seawater) (Tango 2010) (Figure 11b). Increases in the salinity of anchialine pools or dewatering of pools may therefore adversely affect the ability of this candidate species to reproduce in Kaloko-Honokōhau.

Anchialine pools in Kaloko-Honokōhau also provide substantial habitat for *'ōpae 'ula* or the endemic shrimp *Halocaridina rubra*, which have profound cultural significance to Native Hawaiians who use them both as a food source and as bait for catching fish such as *'opelu* along the shore and in the nearshore waters (e.g., Maly & Maly 2002; Peterson & Orr 2005). Two species of Hawaiian anchialine pool shrimp found in the Park (*Metabetaeus lohena* and *Palaemonella burnsi*) are now candidates for listing.

In addition, anchialine pools and fishponds along the Kona Coast provide important feeding and breeding sites for the endangered *a'eo* or Hawaiian stilt (*Himantopus mexicanus knudseni*) and the endangered *'alae ke'oke'o* or Hawaiian coot (*Fulica alai*) (Figure 12). 'Aimakapā Fishpond is listed as a Core Wetland by the U.S. Fish & Wildlife Service in their Recovery Plan for Hawaiian Waterbirds (2011); the wetlands are maintained by subterranean sources of fresh groundwater. Avian botulism is the most prevalent disease affecting waterbirds. In 1994, an avian botulism outbreak at 'Aimakapā Fishpond decimated the endangered Hawaiian coot population in the pond; changes in physical and biotic factors, including salinity and

reduced freshwater influx, were identified as potential contributing factors (Morin 1996; Morin 1998). Saltwater intrusion and reduced freshwater discharge may adversely affect the food availability and integrity of coastal wetland habitat for Hawaiian waterbirds, and ultimately the long-term recovery of these species (U.S. Fish & Wildlife Service 2011).

The fishponds, anchialine resources, wetlands, tidepools, and coral reef along the Kona Coast depend upon fresh groundwater discharge to maintain their current salinity, temperature, nutrient concentration and residence time (e.g., Johnson et al. 2008; Knee et al. 2008; Beets et al. 2010; Grossman et al. 2010). The amount of groundwater that discharges to these coastal ecosystems in the Keauhou Aquifer System is a function of groundwater levels in the aquifer itself, and freshwater discharge will decrease with a decline in water levels. The health of these ecosystems are therefore susceptible to wells that capture groundwater that would otherwise discharge to coastal waters, yet cultural and environmental "uses" of groundwater discharge were not recognized in the County of Hawai‘i's 2010 Water Use and Development Plan Update (WUDP) (Fukunaga & Associates, Inc. 2010), nor were they explicitly protected when the state determined the sustainable yield (SY) for the Keauhou Aquifer System.

Saltwater intrusion and species extinction are irreversible impacts. Without designation and active management of the freshwater resources of the Keauhou Aquifer System, future groundwater withdrawals will be located in areas that threaten the economic, cultural, and environmental utility of public trust resources. Proactive measures are essential for preventing otherwise unavoidable impacts to Hawai‘i's vital coastal resources.

## 1.5 Protecting Public Trust Resources in Kaloko-Honokōhau

The Commission and the NPS have embraced *the precautionary principle* in their approach to managing the cultural and natural resources for which both agencies have an enduring responsibility. Given the abundant public trust resources in Kaloko-Honokōhau, their management is guided not only by the statutory mandate of the NPS, but also by NPS management policies that specify that the protection of natural resources prevail in decisions regarding activities that could potentially affect park resources.

### 1.51 Stewardship Responsibilities of the State

The Hawaiʻi constitution, the Water Code, and the Hawaiʻi Supreme Court have declared the protection of traditional and customary Native Hawaiian rights and practices, as well as the protection of fish and wildlife and the maintenance of ecological balance to be public trust purposes. Therefore, the Commission must consider the cumulative effects of its actions even when the established process, such as the issuance of well construction and pump installation permits, does not explicitly require an analysis of the effect of a proposed withdrawal on public trust resources.

Pursuant to the precautionary principle, when "*the water resources in an area may be threatened by existing or proposed withdrawals or diversions of water,*" the Commission has a duty to designate a water management area [HRS §174C-41]. The designation of a water management area places the designated area under the Commission's administrative control and allows the Commission to regulate "*withdrawals and diversions of ground and surface waters in the area to ensure reasonable-beneficial use of the water resources in the public interest*" [HRS §174C-41]. No person shall make any withdrawal of water in a designated water management area without first obtaining a water use permit from the Commission [HRS §174C-48]. A water management area therefore establishes the additional regulatory framework within which the Commission can take actions to effectively manage those resources entrusted to its care by the constitution and the Water Code.

In the absence of such designation, the Commission is powerless to protect the public interest in the state's water resources. In the face of reasonably foreseeable threats to public trust resources, the lack of designation, coupled with the absence of effective and enforceable

management strategies, gravely undermines the ability of the Commission to faithfully discharge its duty as custodian of Hawai‘i’s water resources.

The absolute certainty of danger to the water resources of an area is not a prerequisite for designation. For in keeping with the intent of the precautionary principle, the Water Code only requires that the subject area’s water resources “*may be threatened”* by existing or proposed withdrawals or diversions of water. The Commission, in its landmark 1997 decision in the Waiāhole Ditch Combined Contested Case Hearing recognized that, as trustee of the state’s water resources, its duty to protect those resources required it when faced with “*scientific evidence [that] is preliminary and not yet conclusive regarding the management of fresh water resources which are part of the public trust*” to adopt “*precautionary principles*” to protect those resources. Conclusions of Law at 7. The Court endorsed the Commission’s adoption of the precautionary principle as a guidepost in the exercise of its statutorily-defined duties, noting that “*at minimum, the absence of firm scientific proof should not tie the Commission’s hands in adopting reasonable measures designed to further the public interest.*” Waiāhole, 9 P.3d at 467; reaffirmed In re Kukui (Molokai), Inc., 174 P.3d at 320, at 338 (2007).

The Court has also observed that the precautionary principle “*simply restates the Commission’s duty under the constitution and Code.*” Waiāhole, 9 P.3d at 467. As observed by former Commissioner Lawrence Miike in the recent decision regarding the adoption of amended instream flows for four streams on Maui, the Court’s approval of the Commission’s adoption of the precautionary principle converted what was a prudent agency policy into a legal mandate of the first order (Case Hearing CCH-MA06-01, p. 1 of dissenting opinion).

Furthermore, the statutory criteria set forth in the Water Code and its administrative rules as mandatory considerations for the designation of water management areas cannot be deemed as exclusive, for none of the criteria explicitly seek to safeguard traditional and customary Native Hawaiian rights and practices. For instance, the Commission has previously determined that a reduction in groundwater discharge to nearshore resources, such as *limu* – the gathering of which is recognized as a protected Native Hawaiian practice – may adversely impact the growth and availability of these resources (Contested Case Hearing CCH-MO97-1, Finding of Fact 144). The criteria for designation set forth in the Water Code [HRS §174C-44] completely ignores this

protected public trust purpose. Such an omission can be explained by recognizing that explicit listing of public trust purposes as criteria for designation would be superfluous as overarching constitutional and statutory provisions require their consideration by the Commission when contemplating the designation of water management areas.

Clearly, such considerations must be in the forefront whenever the Commission, either in response to a recommendation by the chairperson or in response to a petition, deliberates a possible designation, because the Commission is charged with taking "*the initiative in considering, protecting, and advancing public rights in the resource at every stage of the planning and decision-making process.*" Waiāhole, 9 P.3d at 456.

The Commission has in fact boldly advanced this initiative when in 1995 it denied a stream construction permit for the proposed Makaleha Stream Project on Kaua‘i. The denial was based upon the adverse effects of the proposed diversion on the Makaleha Springs and the associated endangered species, even though these public trust resources are not explicitly stated in the applicable statute – HRS §174C-93.

The initiative in considering, protecting, and advancing public rights in public trust resources can be taken by the chairperson of the Commission, who as head of the Board of Land and Natural Resources has public trust obligations that extend beyond the waters of the state to encompass all of the state's natural resources. The importance of the chairperson's obligation to safeguard the state water-resources trust is highlighted by the Code's express authorization "*to make recommendations when it is desirable or necessary to designate an area and there is factual data for a decision by the commission*" (emphasis supplied) [HRS §174C-41(b)]. The statutory directive that permits the chairperson to recommend designation of a water management area when it is not obviously necessary, yet desirable from a water-resources management standpoint is clearly a nod by the legislature to the importance of the precautionary principle in protecting and preserving the state water-resources trust. Thus, when there is factual data available that, while not conclusory, is suggestive that public trust resources are threatened by current and reasonably foreseeable water uses, the chairperson is obliged by the constitution and the Water Code to recommend to the Commission, either on his own accord or in response to a petition, that a water management area be designated.

### 1.52 Stewardship Responsibilities of the National Park Service

As mandated by Congress, the NPS administers Kaloko-Honokōhau National Historical Park pursuant to the laws, regulations, and policies applicable to units of the National Park System. The fundamental law for national parks is the Organic Act, which requires the NPS "*to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations*" [16 U.S.C. §1]. In addition, the Park is managed under the provisions in the General Management Plan (NPS 1994) and the 1973 Endangered Species Act.

The Park's General Management Plan was adopted in 1994 after almost two years of preparation including extensive public testimony regarding the future management, development, and use of the Park. The General Management Plan sets out the policies and actions to perpetuate the traditional use of Kaloko-Honokōhau's cultural sites and features, to provide for cultural and natural resource protection, restoration, and management based on sound scientific data, and to provide quality visitor experience and education.

The NPS also applies the precautionary principle as recognized in Hawaiian case law by virtue of the following directive that is contained in the official Management Policies of the NPS: "*in cases of uncertainty as to the impacts of activities on park natural resources, the protection of natural resources will predominate. The Service will reduce such uncertainty by facilitating and building a science based understanding of park resources and the nature and extent of the impacts involved*" (NPS 2006).

The NPS is committed to advancing scientific and cultural understanding of how Kaloko-Honokōhau's ecosystems function to inform resource management strategies. Since 1995, the NPS has obligated over $800,000 to develop groundwater models to better understand effects of groundwater withdrawals on water resources in the Park, to ecological studies to better understand the role of groundwater discharge in providing suitable habitat for a variety of culturally and ecologically important species, and to geochemical studies to better understand freshwater flow paths in Kaloko-Honokōhau.

The NPS also seeks to collaborate with stakeholders to preserve public trust resources. Since 2005, the NPS has provided public comment on permit applications for 14 new wells in the Keauhou Aquifer System, provided public comment on the 2008 Water Resource Protection Plan (WRPP) and the 2010 Hawaiʻi County WUDP, commented on 6 environmental assessments for infrastructure improvements at existing higher-elevation wells, commented on 6 environmental disclosure documents for new residential and commercial developments surrounding the Park, held 4 working group meetings with stakeholders, and participated in 9 meetings of the Kona Water Roundtable. Yet, these efforts are not enough – they have not resulted in actions that will preserve and protect groundwater-dependent cultural and natural resources from the adverse effects of groundwater withdrawals.

The Hawaiʻi County General Plan Land Use Pattern Allocation Guide, Hawaiʻi County Zoning, and the 2008 Kona Community Development Plan all indicate that Kaloko-Honokōhau National Historical Park will become a *kīpuka* – surrounded by urban development (Figure 13). With great foresight, the authors of the Spirit Report recognized the need for "*the establishment of a watershed management area based on specific water management criteria*" to preserve the integrity of Kaloko-Honokōhau's water resources (Honokōhau Study Advisory Commission 1974). By taking precautionary action at this time, we can continue to work together to ensure that development occurs in a manner that is consistent with the spirit of Kaloko-Honokōhau.

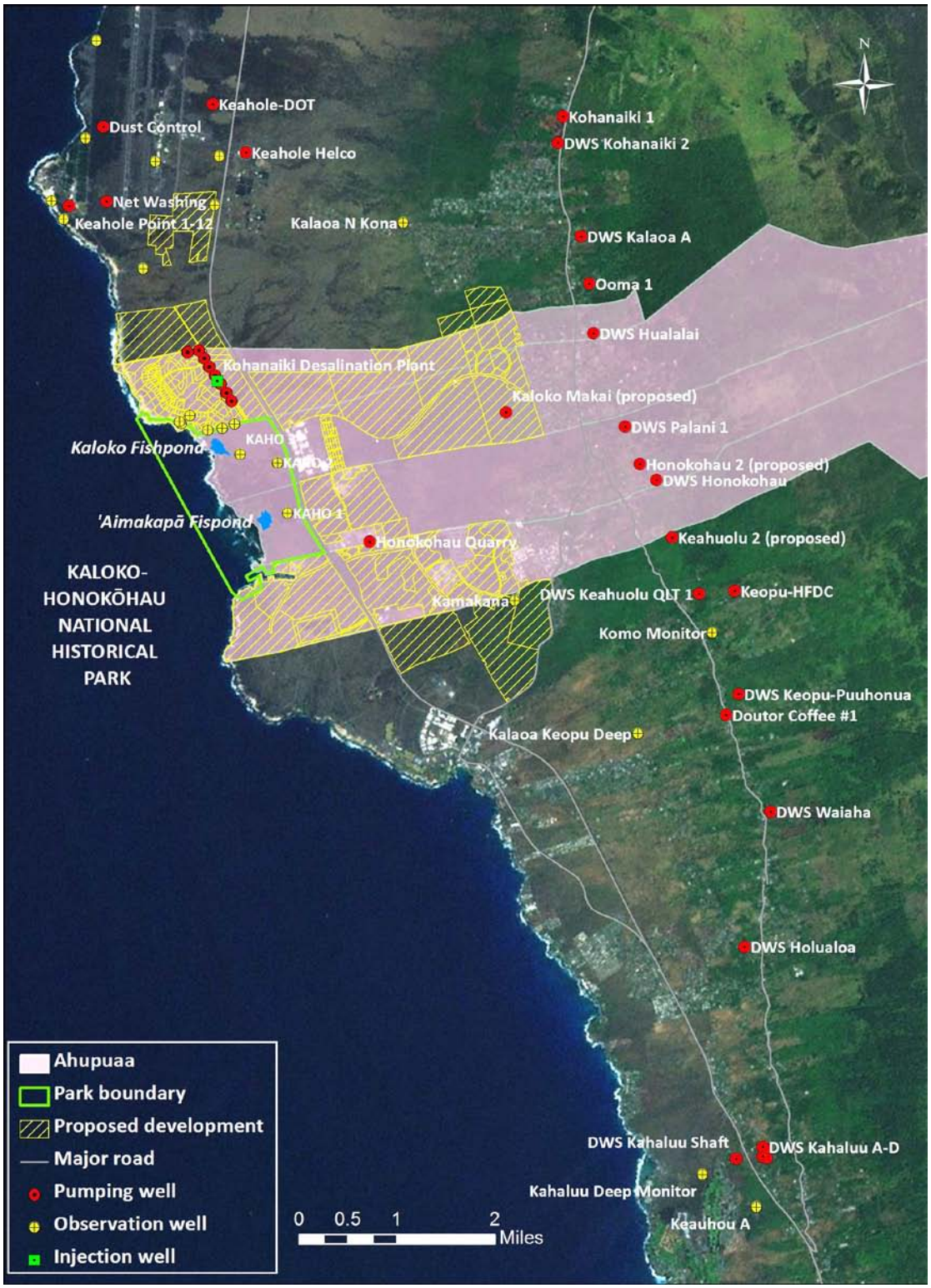


Figure 13. Existing and proposed wells and proposed development in the vicinity of Kaloko-Honokōhau National Historical Park. The white arrow indicates the only permitted potable water supply wells in the Keauhou Aquifer System when the Park was established in 1978.

# 2. Statutory Criteria for a Water Management Area

The following addresses six of the eight statutory criteria for designating a water management area for groundwater.

## 2.1 Sustainable Yield [HAR §13-171-7(1)]:

> ***Whether an increase in water use or authorized planned use may cause the maximum rate of withdrawal from the ground water source to reach ninety per cent of the sustainable yield of the proposed water management area.***

This criterion questions whether future water demands are sustainable. We address the development of the state-determined sustainable yield (SY), reported water use, and future water demand for the Keauhou Aquifer System. However, increasing groundwater withdrawals are only one of the complex environmental changes confronting Hawai‘i today. Truly sustainable practices with regard to water use involve choices, decisions, actions and ethics that will best achieve ecological and biological integrity and preserve human cultures, as well as protect the utility and quality of the groundwater source (NPS 2006). We therefore also describe why limiting withdrawals to the SY – or waiting for withdrawals to reach 90% of the SY – does not ensure the sustainability of groundwater-dependent cultural and natural resources for future generations.

### 2.11 Sustainable Yield for the Keauhou Aquifer System

The Water Code defines SY as "*the maximum rate at which water may be withdrawn from a water source without impairing the utility or quality of the water source as determined by the Commission*" [HRS §174C-3]. In 1990, the Commission set the SY for the Keauhou Aquifer System at 38 million gallons per day (Mgal/d) based upon the results of the Robust Analytical Model (RAM) (Mink 1981) and incomplete groundwater data (George A.L. Yuen and Associates, Inc. 1990).

The RAM methodology for determining the SY assumes there is a sharp interface between fresh water and underlying salt water, that pumping is uniformly distributed and optimally located, and "*that all groundwater is pumped from basal aquifers seaward of the high level zone*" (George A.L. Yuen and Associates, Inc. 1990). In reality, the Keauhou Aquifer System includes higher elevation groundwater as well as basal groundwater with a relatively

thick transition zone, and wells are not equally distributed. The simplifying assumptions and the lack of site-specific groundwater data led the Commission to caution that estimates of the SY "*should be used as a guide in planning rather than an inflexible constraint*" (George A.L. Yuen and Associates, Inc. 1990).

The following equation, which is the basis for RAM, was used to calculate the SY for the Keauhou Aquifer System (e.g., George A.L. Yuen and Associates, Inc. 1990):

$$Sustainable\ Yield = Groundwater\ recharge\ \times \left\{1 - \left(\frac{Equilibrium\ head}{Initial\ head}\right)^2\right\}$$

The values for the parameters in the above equation were chosen to protect a theoretical well with a pre-development water level (initial head) between 4 and 10 ft above sea level from saltwater intrusion (George A.L. Yuen and Associates, Inc. 1990). For reference, groundwater levels in the Park's observation wells average less than two feet above mean sea level (e.g., Oki et al. 1999). These data indicate that the Park is situated between this theoretical well and the ocean.

To limit saltwater intrusion and preserve the quality of water at this theoretical well, the Commission chose to limit water-level declines due to pumping to 25% of the initial head; the ratio of the post-development water level (equilibrium head) to initial head for the Keauhou Aquifer System is therefore 0.75 or 75% (George A.L. Yuen and Associates, Inc. 1990; Wilson Okamoto Corporation 2008b). This ratio represents the "impact" that the state is willing to accept to maximize consumptive use of groundwater in the aquifer system.

The 1990 WRPP set the SY for the Keauhou Aquifer System to 38 Mgal/d based upon this ratio and an estimated groundwater recharge of 87 Mgal/d (11 inches/year). The aquifer responds to withdrawals by reducing the rate of natural discharge; theoretically, limiting pumping to 38 Mgal/d allows a 44% reduction in groundwater discharge everywhere along the coastline of the Keauhou Aquifer System.

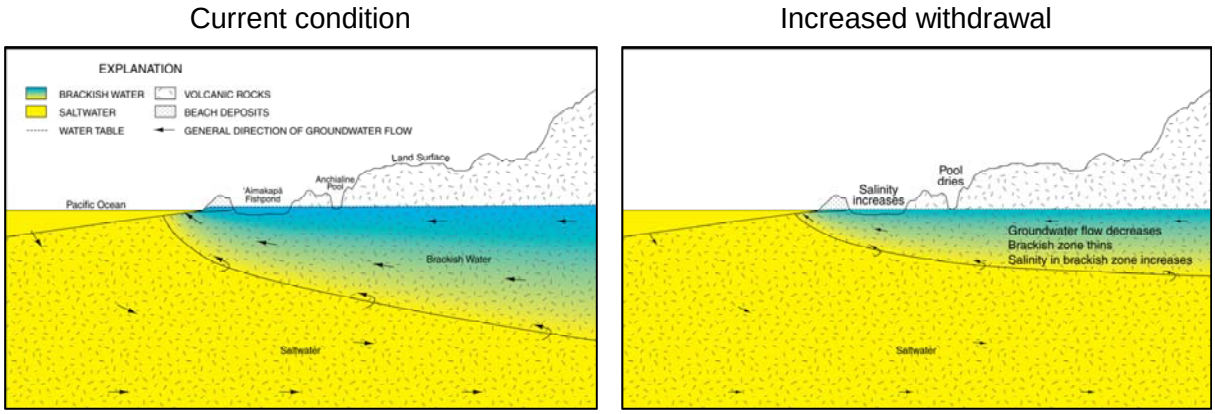


Figure 14. Hydrologic effects of groundwater withdrawals on non-drinking water resources (courtesy of S. Anthony, USGS, 2012). Water levels decline and the saltwater interface rises and moves inland.

While limiting pumping to 38 Mgal/d may protect the water quality at an inland well, it does not prevent saltwater intrusion at the coastline (Figure 14). The RAM methodology therefore leaves some areas of the aquifer system more vulnerable to saltwater intrusion (e.g., Meyer & Souza 1995; Oki & Meyer 2001). Kaloko-Honokōhau National Historical Park is located in a vulnerable area due to its proximity to the coast.

Aside from the specific value of the SY, it is essential to recognize that the RAM methodology for determining the SY does not explicitly consider the impacts of reducing groundwater discharge by 44% on traditional and customary Native Hawaiian rights and practices and other public trust resources along the Kona Coast.

Consequently, the impacts of reducing freshwater discharge to coastal areas through groundwater pumping, and the fact that it has not been factored into estimates of SY, was identified by the Commission as an emerging concern in the 2008 WRPP (Wilson Okamoto Corporation 2008b).

### 2.12 Reported Water Use and Future Water Demand in the Keauhou Aquifer System

The potential 24-hour production capacity of currently permitted pumping wells in the Keauhou Aquifer System accounts for 100% of the SY (Appendix A). Actual water use is not known because pumpage is not being reported for over two-thirds of the permitted production

wells in the aquifer system (State of Hawai‘i 2013). Reported water use in the Keauhou Aquifer System is only about 13 Mgal/d or 34% of the SY.

Because reported water use is only 34% of the SY, the Commission will continue to permit new withdrawals from the Keauhou Aquifer System. Such additional withdrawals will be necessary to support large-scale projects for up to 16,000 homes that are now planned or being built in North Kona (Honolulu Star Advertiser, October 17, 2010, p. D1 and D8). Water demand for these and other proposed developments in just the area of Kaloko-Honokōhau may be as high as 19 Mgal/d (Figure 1; Appendix B). All of the proposed developments shown on Figure 1and listed in Appendix B are in areas designated for urban development or urban expansion in the Hawai‘i County General Land Use Pattern Allocation Guide and are within the Kona Urban Area defined by the 2008 Kona Community Development Plan.

Reported water use in the aquifer system (13 Mgal/d) and future water demand in the area of the Park (19 Mgal/d) combined are 32 Mgal/d. Future water demand throughout the Keauhou Aquifer System is likely higher because this estimate does not include unreported water use, future demand in other *ahupua‘a* in the aquifer system, or the full amount of water to be reserved for Department of Hawaiian Home Lands to carry out its federal mandate to enable Hawaiians to use the lands that were set aside for them in the Keauhou Aquifer System.

Future water demand throughout the aquifer system was estimated by the County of Hawai‘i Department of Water Supply in the 2010 WUDP. The 2010 WUDP includes estimates of long-term water demands based upon the Hawai‘i County General Plan Land Use Pattern Allocation Guide and Hawai‘i County Zoning. According to the 2010 WUDP, land-use based projections of water demand exceed the SY of the Keauhou Aquifer System by over 600% (Fukunaga & Associates, Inc. 2010) (Figure 15). This situation has been characterized by the Center for Island Climate Adaptation and Policy as an obvious “disconnect between Hawai‘i County’s land use vision and its water reality” (Wallsgrove & Penn 2012).

Furthermore, despite the directive of the Hawai‘i County Charter to conserve and protect public trust resources, the County’s water demand projections do not consider the supply of water necessary to protect traditional and customary Native Hawaiian rights and practices, ecosystems, or endangered species that depend upon fresh groundwater discharge. The

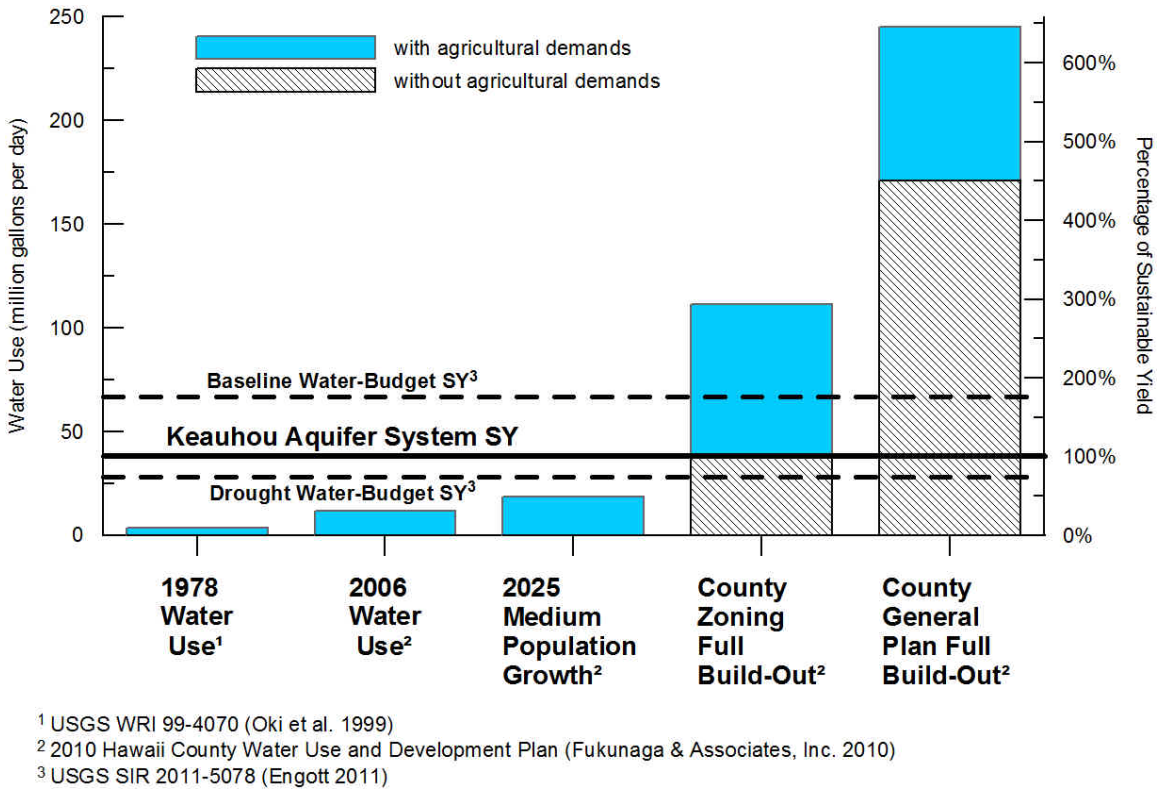


Figure 15. Water use and water-demand projections for the Keauhou Aquifer System. Engott (2011) used new estimates of groundwater recharge to recalculate the SY based upon baseline and drought conditions.

Commission's well construction and pump installation permitting process likewise ignores these trust resources is insufficient to protect non-consumptive public trust uses of water under the scenario of increasing and potentially unsustainable water demand.

Given these facts, delaying the active management of groundwater until water use in the Keauhou Aquifer System is 90% of the SY (34 Mgal/d) promotes an imprudent "*crisis-oriented*" approach to water management (Chang 1987; State of Hawai‘i 1994). However, by identifying non-consumptive public trust uses of groundwater now, and protecting them in a designated water management area, the Commission can provide applicants for water-use permits with a clearer understanding of the amount of water available for future allocation. Thus, the Commission through careful and well-informed management of freshwater resources can create greater economic certainty in the Keauhou Aquifer System.

### 2.13 Declining Rainfall and Rising Sea Level

The sustainability of the Keauhou Aquifer System's freshwater supplies are also threatened by drought and climate change (State of Hawaiʻi 2011; Wallsgrove & Penn 2012). Rainfall has been declining over the past century in Hawaiʻi (Giambelluca et al. 2011) (Figure 16). The nearshore areas and coral reefs are most vulnerable to warmer, drier conditions (Keener et al. 2012).

The Commission's study of 1991 to 2002 water-level data indicated a slow decline of water levels in some of North Kona's higher elevation wells and an apparent relationship between water-level decline and climatic conditions (Bauer 2003; Wilson Okamoto Corporation 2008b). The 2011 USGS Water-Budget and Groundwater Recharge study indicates that the Drought Water-Budget Condition would lower the SY for the Keauhou Aquifer System to 28 Mgal/d (Engott 2011) (Figure 15).

In addition, sea level in Hawaiʻi has risen as much as 1 foot over the past century (NOAA 2013) (Figure 16). Rising sea level is expected to exacerbate saltwater intrusion into coastal groundwater and wells. Although sparse, salinity data for pools and ponds in Kaloko-Honokōhau may reflect the changing environmental conditions described above (Figure 16).

Over the past half-century, pumpage in the Keauhou Aquifer System has doubled while rainfall steadily declined and sea level rose (Figure 16). It is important to understand that the RAM methodology for determining the SY did not consider these trends in rainfall and sea level. In 2012, the State of Hawaiʻi passed Senate Bill 2745 encouraging state and county agencies to integrate climate adaptation policy into their long-term planning, and to consider traditional Native Hawaiian knowledge and practices in planning for the impacts of climate change for the benefit of future generations. A designated water management area is one forward-looking adaptive tool that the Commission can use to make a critical difference in Hawaiʻi's water future and adaptation to declining rainfall and rising sea level (Wallsgrove & Penn 2012).

Opinions on whether this criterion is met in the Keauhou Aquifer System will likely vary. Stakeholders will disagree over the definition of "authorized planned use" and whether the SY should be raised or lowered. These disagreements are, however, a distraction from the greater concern – that the use of a sustainable yield that does not recognize the potential adverse

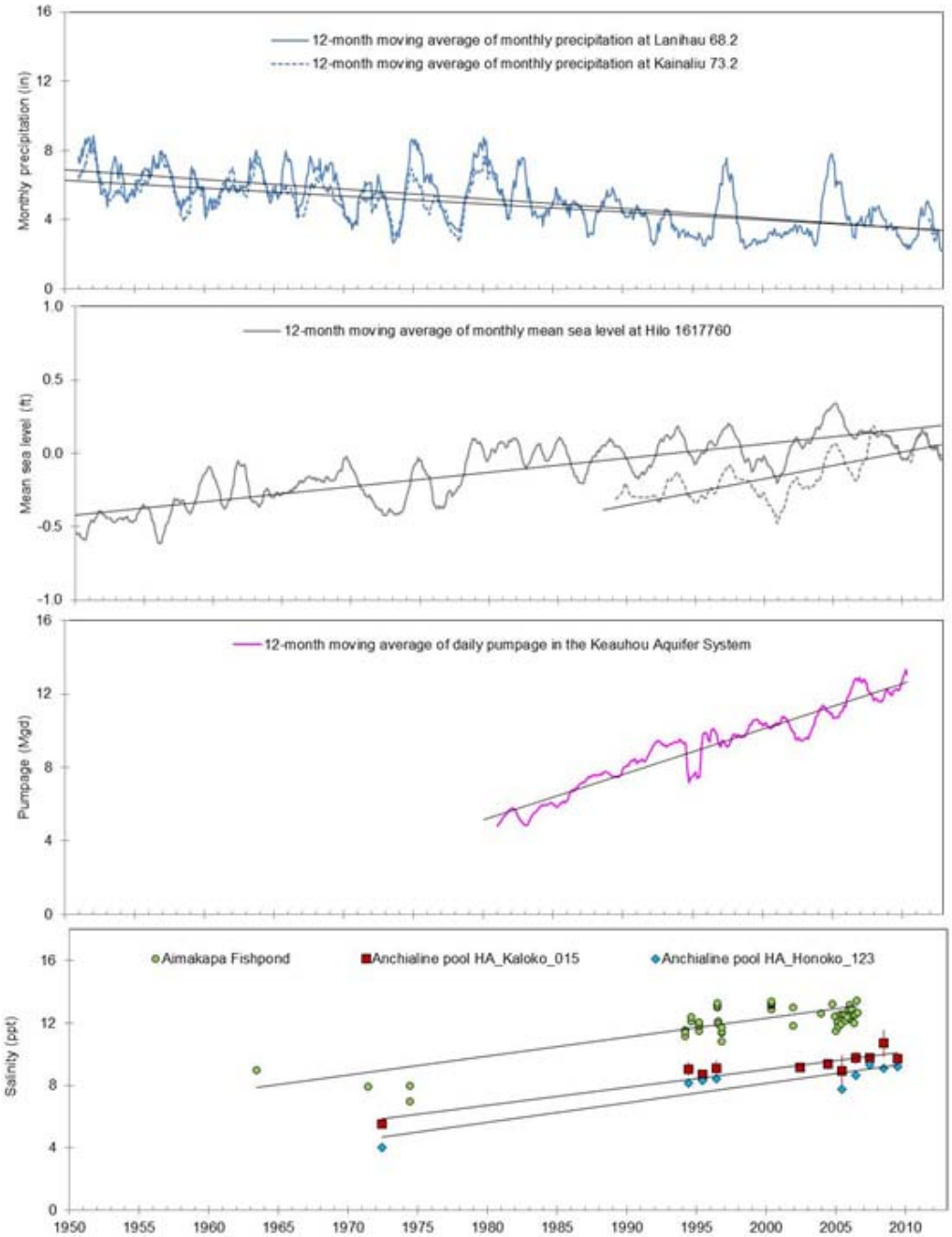


Figure 16. Twelve-month moving average and linear fits of monthly rainfall at two rain gauges in the Keauhou Aquifer System (http://www.wrcc.dri.edu), monthly mean sea level at two tide gauges in Hawaii (http://tidesandcurrents.noaa.gov/index.shtml), and reported average daily pumpage in the Keauhou Aquifer System (http://hi.water.usgs.gov/recent/westhawaii/pumpage.html); and average salinity and standard deviation with linear fits in two anchialine pools in the Park (Maciolek & Brock 1974; Brock & Kam 1997; NPS 2013) and salinity in Aimakapa Fishpond with linear fit (Sparks 1963; Kikuchi & Belshe 1971; Maciolek & Brock 1974; Brock & Kam 1997; Marine Research Consultants 2000; TNWRE 2002; Bienfang 2007; Knee et al. 2008).

effects of saltwater intrusion on coastal public trust resources and does not take into account changing environmental conditions, is not truly “sustainable” in the broader context of the term. The Commission has a duty to consider the cumulative and long-term effects of maximizing consumptive use of freshwater resources on public trust resources. A water management area provides the Commission with tools to maintain waters in their natural state and to determine what is reasonable, beneficial, and sustainable with regard to water use.

## 2.2 Saltwater Intrusion [HAR §13-171-7(2) & HAR §13-171-7(3)]:

> ***That the rates, times, spatial patterns, or depths of existing withdrawals of ground water are endangering the stability or optimum development of the ground water body due to upconing or encroachment of salt water; and***
>
> ***That the chloride contents of existing wells are increasing to levels which materially reduce the value of their existing uses.***

The spatial pattern of existing withdrawals is critical because pumping wells lower water levels and reduce the rate of natural discharge within their capture zones. The RAM methodology, however, does not account for the spatial pattern of wells – it assumes that wells are uniformly distributed and optimally located (e.g., Oki & Meyer 2001). In truth, "*positioning of development, that is, the location, depth, and pumping rates of wells is a choice made by those who manage development of a given aquifer*" (Meyer & Souza 1995).

The following information addresses how the spatial pattern of existing withdrawals has evolved in the Keauhou Aquifer System as a consequence of the encroachment of salt water in basal wells supplying the North Kona Water System, and why this evolution threatens to place a disproportionate stress on basal groundwater in Kaloko-Honokōhau.

By 1976, the Kahaluʻu Shaft (3557-05) and Kahaluʻu Wells A, B, C, and D (3557-01 to -04) were completed in the basal groundwater system of the Keauhou Aquifer; the wellfield is located about seven miles south of Kaloko-Honokōhau (Figure 13). Kahaluʻu Shaft is an inclined shaft connected to tunnels that skim the top of the basal lens and provide much of the drinking water for the North Kona System. Chloride concentrations at the Kahaluʻu wellfield have increased with pumpage (Figure 17) and the top of the transition zone (5000 microsiemens/centimeter or about 10% seawater) at the Kahaluʻu deep monitoring well has risen over 10 feet since 2000 (Figure 18).

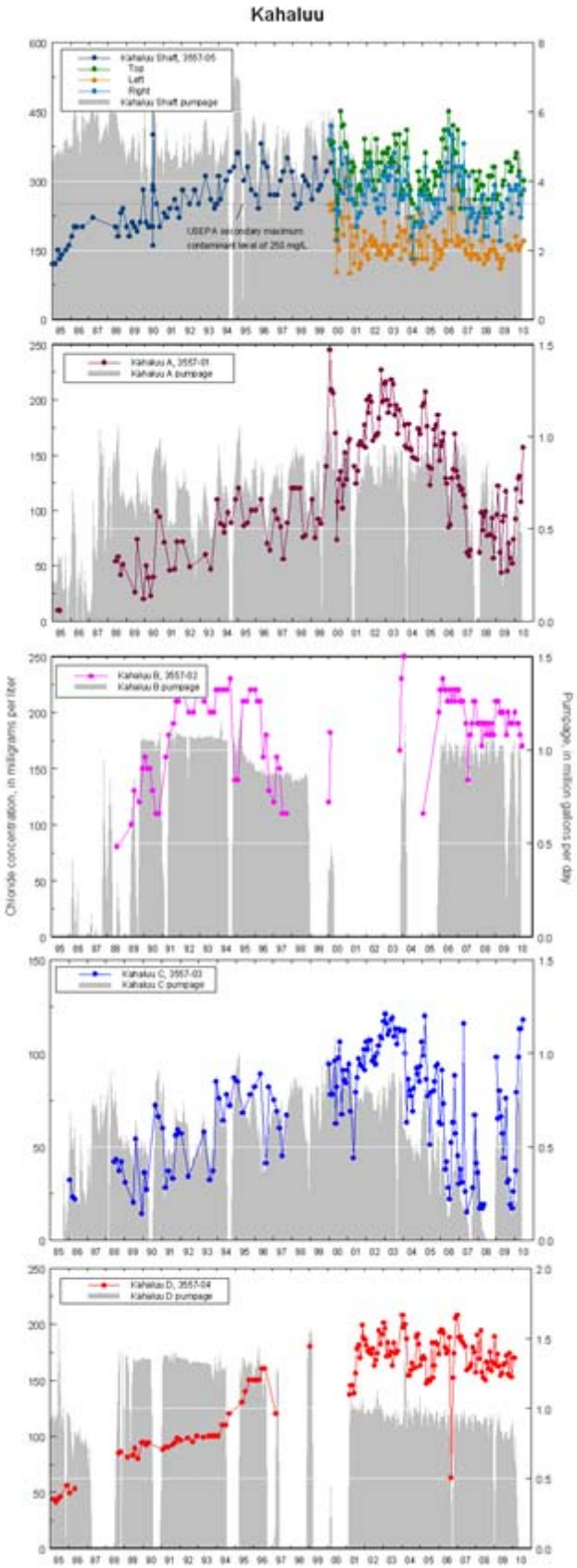


Figure 17. Chloride concentrations and monthly pumpage for the Kahaluu well field, 1985 to 2010. Please visit the following website for higher quality images of these charts: http://hi.water.usgs.gov/recent/westhawaii/chloride.html).

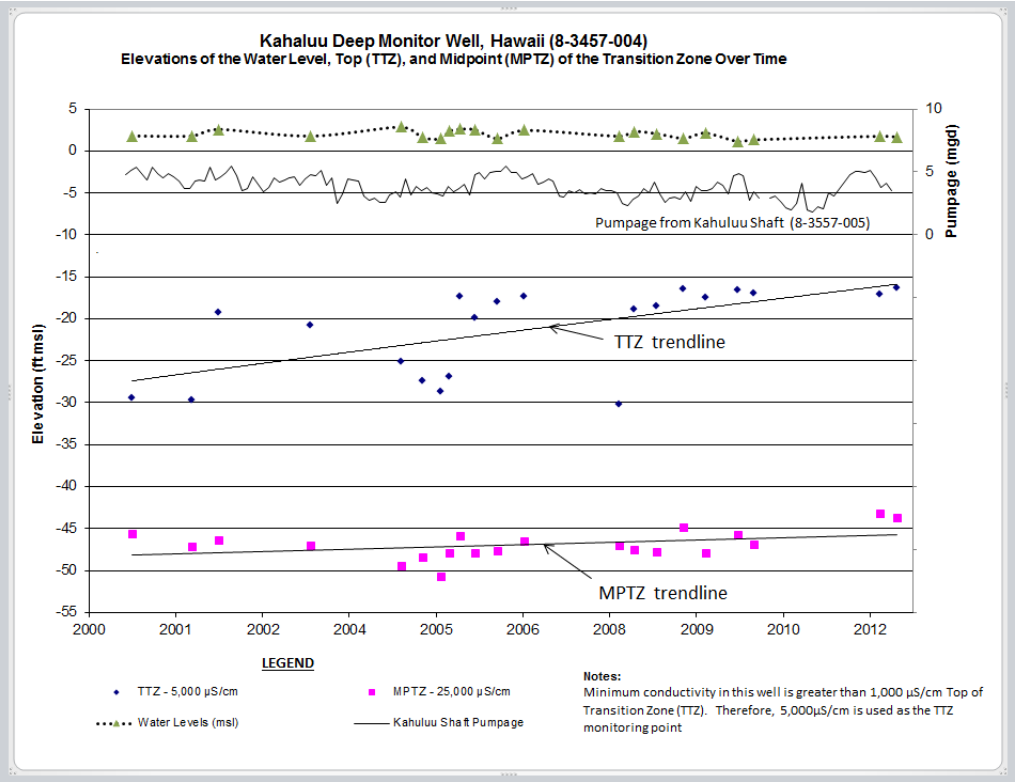


Figure 18. Elevations of the midpoint and top of the transition zone at Kahaluʻu Deep Monitor Well (3457-04) from 2000 to 2012 (*from* State of Hawaii 2013).

In 2004, the County of Hawaiʻi Department of Water Supply notified the public that water from the Kahaluʻu Shaft and Wells and the Hōlualoa Well (3657-01) showed elevated levels of sodium and chloride. In 2011, sodium levels in drinking water from the Kahaluʻu wellfield were as high as 185 milligrams per liter (mg/L) (County of Hawaiʻi 2011). As of January 2013, chloride levels in Kahaluʻu wellfield remained as high as 410 mg/L (County of Hawaiʻi 2013). For reference, the U.S. Environmental Protection Agency recommends that sodium and chloride levels in drinking water not exceed 60 mg/L and 250 mg/L, respectively.

Saltwater intrusion in Kahaluʻu wellfield led to the development of higher-elevation water sources to improve the overall quality and taste of drinking water in North Kona (Wilson Okamoto Corp. 2008a; Geometrician Associates and Akinaka & Associates 2009; County of Hawaiʻi 2011). By 1994, the Department of Water Supply had begun pumping high-level groundwater for the North Kona Water System. All seven of the higher-elevation wells operated by the Department [Keopu Puʻuhonua (3957-01), Waiaha (3857-04), Kalaoa (4358-01), Hualalai

(4258-03), Honokōhau (4158-02), Keahuolu QLT No. 1 (4057-01), and Holualoa (3657-01)] are located closer to Kaloko-Honokōhau than the Kahaluʻu wellfield (Figure 13).

Thus, saltwater intrusion in the Kahaluʻu Shaft and Wells has resulted in higher rates of groundwater withdrawals within the four *ahupuaʻa* of the Park. This increase in the number of pumping wells located in the vicinity of Kaloko-Honokōhau threatens public trust resources because groundwater withdrawals from wells directly upgradient of the Park will have a greater effect on freshwater discharge to coastal ecosystems within the Park (e.g., Oki et al. 1999).

The impact of the higher-elevation wells on water quality is not well understood in part because there are no wells between the Park and higher-elevation pumping wells dedicated to monitoring salinity or the movement of the transition zone. In the November 16, 2011, briefing to the Commission, Commission staff noted that only two wells were being monitored by the Commission in the Keauhou Aquifer System: Keauhou A (3457-02) & Kahaluʻu Deep (3457-04). These observation wells are located over seven miles south of Kaloko-Honokōhau (Figure 13).

By 2007, competition among large landowners and developers for higher-elevation groundwater renewed interest in developing basal groundwater. Five desalination facilities and a high-capacity well for aquaculture have been proposed in the coastal groundwater system within 2.5 miles of the Park (Appendix D). Equally alarming is that <u>the 2010 WUDP recommended desalinating brackish groundwater upgradient from the Park as an alternative to meet growing water demand</u> (Fukunaga & Associates, Inc. 2010). Large-scale desalination now appears imminent – the 2013 Kaloko Makai Draft EIS includes a proposal to withdrawal about 11 Mgal/d of brackish (30 ppt) groundwater directly upgradient of the Park and to dispose of the hypersaline (50 ppt) concentrate on-site (Wilson Okamoto Corporation and Hoʻokuleana LLC 2013).

In a November 21, 2011 letter to Chairman Ailā, Park Superintendent Kathleen Billings expressed concerns regarding the potential effects of the desalination of brackish groundwater near the Park. The Shores at Kohanaiki began operating their production wells, desalination plant, and injection well adjacent to the Park in November 2008 (Figure 13). This system is permitted to withdraw up to 3 Mgal/d of basal groundwater and 0.3 Mgal/d of higher elevation

groundwater to irrigate a golf course and common areas, and to re-inject up to 0.7 Mgal/d of by-product back into basal groundwater (Waimea Water Services, Inc. 2007). The Commission requires The Shores at Kohanaiki to measure chlorides on a monthly basis in eight observation wells within the project area and the State Department of Health requires quarterly reporting of standard water quality parameters for the Kohanaiki injection well (UH-2594). The injectant has an average chloride concentration of about 11,000 mg/L (about 60% seawater) and relatively high levels of nitrate nitrogen (Figure 19).

Monitoring data presented at the Kona Water Roundtable indicates that The Shores at Kohanaiki's activities are affecting groundwater on the boundary of the Park (Figure 19). At the September 2010 Kona Water Roundtable, the USGS reported that in July 2009, concentrations of nitrate-nitrogen in shallow groundwater from MW401 (4161-11) were over ten times higher than concentrations in the NPS headquarters tap water and shallow monitor wells; the cause of elevated nitrogen in MW401 was ascribed to "turf grow-in" at The Shores at Kohanaiki golf course (C. Hunt, USGS, Sept. 2010 Kona Water Roundtable). Information presented at the July 2012 Kona Water Roundtable indicated that declining chlorides in MW400 (4162-04) was due to an open irrigation valve on the golf course (S. Bowles, Waimea Water Services, July 2012 Kona Water Roundtable) (Figure 19).

Although desalination offers the potential to increase the supply of fresh water on the arid Kona Coast, decision-makers must take a careful look at the advantages and disadvantages of desalination when evaluating proposals for new facilities. The State of Hawai‘i has already the recognized "*the superior economic value*" of protecting existing high-quality groundwater as opposed to compensating for its degradation with expensive desalination plants (State of Hawai‘i 2011).

Existing and planned withdrawals of brackish groundwater, as well as the disposal of saline water, endangers the stability of the coastal groundwater system. A water management area will provide the Commission with a framework to explicitly consider the spatial distribution of wells and the potential adverse effects of pumping basal groundwater and disposing saline concentrate on traditional and customary Native Hawaiian rights and practices and other public trust resources.

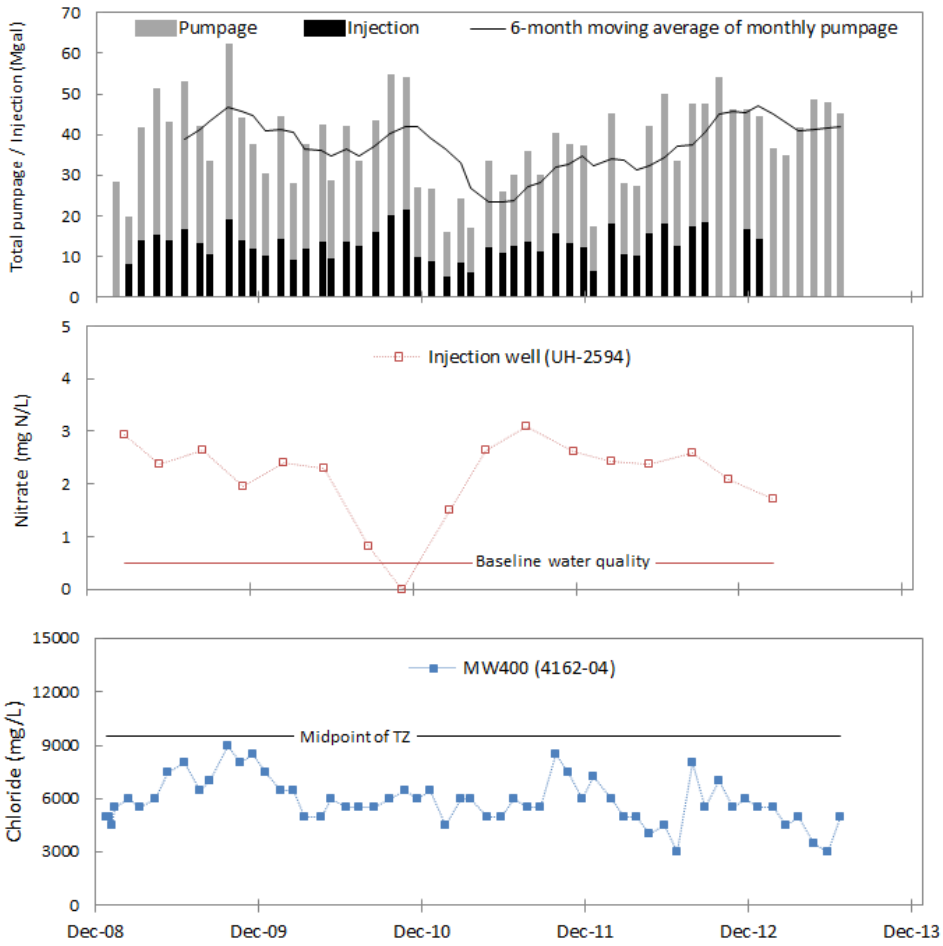


Figure 19. Monitoring data reported for The Shores at Kohanaiki wellfield: total monthly pumpage and injection, quarterly nitrate concentrations for the injection well, and monthly chloride concentrations for observation well MW400 located on the Kaloko-Honokōhau boundary, from December 2008 until June 2013. Decreasing chloride levels in MW400 in early 2012 were attributed to an open valve in the golf course irrigation system (S. Bowles, Waimea Water Services, July 2012 Kona Water Roundtable). Baseline receiving formation water quality was reported in Burns & Bowles (2008).

## 2.3 Waste [HAR §13-171-7(4)]:

***Whether excessive preventable waste of water is occurring.***

According to the County of Hawai‘i 2010 WUDP, water consumption in North Kona is 1000 gallons per day per single-family residential unit – 2.5 times higher than other areas of the county (Fukunaga & Associates, Inc. 2010). A permitting process that requires well owners or operators to show that such a rate is a reasonable-beneficial use of limited freshwater resources is needed to prevent waste and to conserve this vital resource.

## 2.4 Disputes [HAR §13-171-7(6)]:

***Serious disputes respecting the use of ground water resources are occurring.***

Since 2005, the NPS has commented on at least 26 issues with respect to the use of groundwater in the vicinity of Kaloko-Honokōhau (Appendix E). Responses to NPS comments suggest that serious water disputes in the Keauhou Aquifer System are occurring and cannot be resolved through working groups and roundtables, or through the environmental review and land-use planning and permitting processes.

The following summarizes three areas of serious dispute regarding the use of groundwater within the Keauhou Aquifer System: (1) cumulative impact assessments, (2) the significance of saltwater intrusion on ecosystems, and (3) the source(s) of recharge to the coastal groundwater system. In each case, we ask that the Commission consider its constitutional and statutory obligations in safeguarding the state's water resources and the role of the precautionary principle in resolving these disputes.

### 2.41 Cumulative Impact Assessments

On May 30, 2007, Park Superintendent Geraldine Bell met with staff of the Commission and the USGS to discuss options for protecting water resources in Kaloko-Honokōhau from the cumulative effects of groundwater withdrawals. The issues discussed are described in more detail in the NPS's follow-up letter to the deputy director of the Commission dated November 13, 2007. Commission staff suggested that the NPS try a "*working group*" approach to resolve disputes with water users. According to the 2008 WRPP, the Commission initiated this type of approach in the 1990's to diffuse disputes in Kailua-Kona and to forestall the designation of the West Hawaiʻi region as a water management area (Wilson Okamoto Corporation 2008b).

In 2008, the NPS held four working-group meetings with a diverse group of stakeholders. The stated purpose of the working group was to "*investigate opportunities to conserve and manage water resources for the protection of the cultural resources, ecosystems, and endangered species that depend upon groundwater and to provide for compatible human uses, as an alternative to state administrative control of groundwater withdrawals*" and to "*provide a forum for all stakeholders to share information and work toward mutually acceptable science-*

*based water-management goals*" (NPS letter dated Jan. 28, 2008). The dates and themes of the four meetings of the NPS groundwater working group were

- *February 27, 2008* – North Kona hydrology, goals, expectations
- *April 9, 2008* – Park visit, working group mission statement
- *July 23, 2008* – Goals, objectives, role in water management
- *November 3, 2008* – Monitoring, modeling

Stakeholder meetings revealed a significant obstacle to resolving disputes and managing groundwater for the protection of Park and public trust resources. Many stakeholders argued that any governmental management of groundwater withdrawals would constitute a "*taking*" of their private property rights for which they should be compensated.

At about the same time, the County of Hawaiʻi Department of Water Supply formed the Kona Water Roundtable as an "*informal public forum to discuss scientific information on the status and use of water resources in Kona.*" NPS representatives attended the first organizational meeting of the Kona Water Roundtable and all eight subsequent public meetings. The dates and themes of the Kona Water Roundtable meetings were

- *February 21, 2008* – Organizational meeting
- *May 14, 2008* – Informational meeting
- *July 23, 2008* – Ecological significance of freshwater discharge in coastal areas
- *November 3, 2008* – Watersheds, recharge, geology, hydrology of Kona
- *July 22, 2009* – History, design, and use of injection wells
- *September 23, 2010* – Understanding our resource
- *March 29, 2012* –Water Use & Develop Plan Update, historic watershed stewardship, groundwater recharge, Kamakana deep well
- *July 11, 2012* – Keauhou Watershed, Rain Follows the Forest, deep monitor wells, waste water reuse, The Shores at Kohanaiki monitor wells
- *January 17, 2012* – History of Kaloko-Honokōhau, the importance of estuary habitat to native species, protecting water resources, water and law

The NPS also participated in the March 28, 2008, May 15, 2008, and August 2, 2011, meetings of a water professionals group convened by the Commission staff. Despite the beneficial exchange of information that these meetings provided, neither the NPS working-

group, the Kona Water Roundtable, nor the water professionals group has implemented a plan to analyze, monitor, and mitigate the cumulative effects of groundwater pumping in the Keauhou Aquifer System.

On June 14, 2010, Superintendent Billings and NPS staff met with Commission staff to inform them that the working group and roundtable, as well as NPS' efforts to address groundwater use on a case-by-case basis, had not been effective in producing cumulative impact assessments of groundwater development on cultural and natural resources in Kaloko-Honokōhau.

The cumulative effects of current and reasonably foreseeable future groundwater withdrawals from the Keauhou Aquifer System are therefore unknown. The NPS, in comments on environmental review documents, has therefore requested that public and private water developers consider the overall and cumulative effects of their proposed actions on the quality of the environment in their environmental disclosure documents, as required by HAR §11-200-12.

In most cases, the cumulative effects of increasing groundwater withdrawals were not addressed for new development projects or were deferred by the responsible entities to other agencies such as the Commission and the Department of Water Supply, or to the working groups and roundtables (e.g., Belt Collins Hawai‘i Ltd. 2008; Yukie Ohashi Planning Consultant LLC 2008; Geometrician Associates LLC 2009; PBR Hawai‘i & Associates, Inc. 2009). Although Findings of No Significant Impact were issued for these projects, the cumulative impacts of these projects on traditional and customary Native Hawaiian rights and practices and other public trust resources remain unquantified.

Some developers have attempted to quantify the direct and/or cumulative effects in response to NPS comments. One study for the proposed Kona Kai Ola project predicted that the direct effect of withdrawing 2.6 Mgal/d southeast of the Park would result in a 17% decline in groundwater flux through the Park (Oceanit 2007); this project did not move forward. The 2009 Final Environmental Assessment for Palani Well No. 1 (4158-03) (Geometrician Associates and Akinaka & Associates 2009) included the results of an analytical model developed to approximate the effects of groundwater use. The results of the model indicated that the cumulative impacts of pumping the Palani Well in combination with other high-level wells could

raise the salinity of groundwater within the Park by up to 80% over pre-development levels (TNWRE 2009). Despite the predicted significant adverse effects on the salinity of groundwater in Kaloko-Honokōhau, the Department of Water Supply issued a Finding of No Significant Impact for the Palani Well and the Commission approved the pump installation permit in 2011.

The Commission has an obligation to analyze the cumulative effects of issuing well construction and pump installation permits on public trust resources and to safeguard these resources from adverse impacts. The NPS has funded the USGS to develop a variable-density groundwater-flow model of the Keauhou, Kealakekua, and Kaapuna Aquifer Systems, which will incorporate new information acquired since the 1999 USGS groundwater model (e.g., D. Oki, USGS, September 2010 Kona Water Roundtable; Engott 2011; D. Oki, USGS, September 19, 2012 meeting of the Commission). The model will evaluate the effects of decreased recharge and saline wastewater injection on coastal areas.

The model will be a useful tool for better understanding the potential response of the aquifer system to changing conditions, but a water management area is necessary for the model results to effectively inform management decisions regarding the location, depth and pumping rates of wells in the Keauhou Aquifer System. In designated water management areas, the Commission can require applicants for water use permits to assess direct and cumulative impacts of their proposed actions to ensure that public trust resources will not be harmed.

### 2.42 Significance of Saltwater Intrusion on Public Trust Resources

On March 20, 2012, Superintendent Billings and NPS staff met with the Commission staff to discuss the latest research on the potential impacts of groundwater withdrawals on culturally and environmentally important coastal ecosystems. On September 19, 2012, Superintendent Billings and NPS staff briefed the Commissioners on this topic. In general, there is some agreement among stakeholders that groundwater withdrawals from the Keauhou Aquifer System will reduce freshwater discharge to coastal areas, lowering water levels and increasing salinity. But there is uncertainty regarding the timing and magnitude of these impacts, and there are disputes regarding the severity of these impacts on traditional and customary Native Hawaiian rights and practices and other public trust resources along the Kona Coast.

Some water users and developers in the Keauhou Aquifer System assert that raising the salinity of groundwater discharging to anchialine pools, fishponds, and nearshore marine waters will not adversely affect these ecosystems because they are inhabited by species that have evolved to tolerate great variations in salinity (e.g., Wilson Okamoto Corporation 2008a; Geometrician Associates and Akinaka & Associates 2009; Wilson Okamoto Corporation 2009; Wilson Okamoto Corporation and Hoʻokuleana LLC 2011). For example, an environmental assessment for well infrastructure improvements in North Kona notes that although large changes in the quality of groundwater are to be expected with development, "*anchialine pond biota have evolved in an environment with high variability in nutrient and salinity concentrations so the biota are not sensitive to the changes*" (Wilson Okamoto Corporation 2008a).

Assertions that anchialine pool communities are not sensitive to changes in water quality are, however, in direct conflict with the results of controlled laboratory experiments on two rare Hawaiian anchialine pools species found in Kaloko-Honokōhau and elsewhere in the Keauhou Aquifer System. Laboratory studies on the orange-black damselfly (*Megalagrion xanthomelas*) and the Hawaiian anchialine pool shrimp *Metabetaeus lohena* determined that these two candidate species are sensitive to both temperature and salinity (Tango 2010; D. Foote, USGS, oral communication, Mar. 20, 2012 meeting with Commission staff).

Such factual data emphasizes the essential role of monitoring in managing for changing environmental conditions. The NPS has implemented an anchialine pool monitoring protocol to assess the status and trends over time in the abundance of anchialine pool fauna; the protocol includes the collection of water-quality data and these data are available online (NPS 2013). In 2007, the NPS began a program to monitor water levels and specific conductivity in the Park's observation wells (Izuka et al. 2011). Data from July 2007 to January 2012 were reviewed and processed by the USGS and are available online (NPS 2012). During 2009-2010, the USGS took over the monitoring for the numerical groundwater modeling study and their data are also available online (USGS 2013). Data analysis and model results are expected to be published by the USGS in September 2014.

Although scientific research and monitoring data increase understanding of how coastal ecosystems function and respond to change, the significance of changes in water quality and quantity on the purposes and values of Kaloko-Honokōhau National Historical Park must be determined within the context of the 1916 Organic Act and the National Park's enabling legislation. The NPS relies on the highest quality scientific and scholarly processes to inform these determinations. In designated water management areas, the Commission can seek the best available information regarding the significance of changes in water quality and water quantity on public trust resources before approving new uses.

### 2.43 Source of Recharge to the Basal Groundwater System

An accurate conceptual model of the aquifer system is important because it is used by the Commission to issue well construction and pump installation permits and to guide monitoring programs. The generally accepted conceptual model of the Keauhou Aquifer System that has formed the basis for the Commission's management decisions thus far is described in reports such as the North Kona Water Master Plan (Fukunaga & Associates, Inc. 1995) and the USGS Water-Resources Investigations Report 99-4070 (Oki et al. 1999). According to this model, as much as 90% of the recharge to the basal groundwater system originates from the seaward flow of higher-elevation groundwater across an undefined low permeability geologic structure (Figure 20). Fresh groundwater not withdrawn by wells in the high water-level area is believed to flow down-gradient to the basal lens (Oki et al. 1999). Recharge to the basal system is reduced by pumping at higher-elevation wells (Fukunaga & Associates, Inc. 1995).

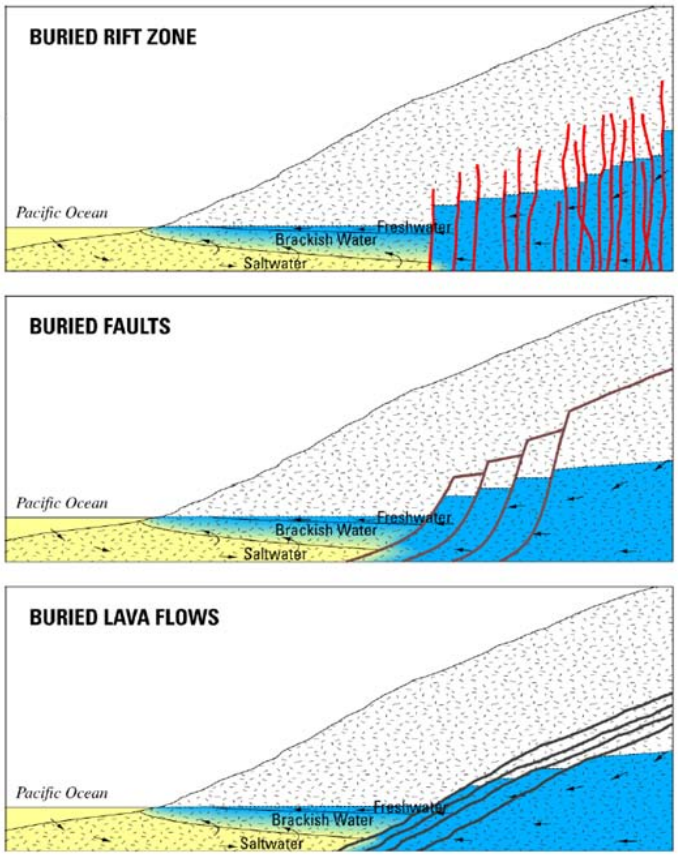


Figure 20. Schematic cross sections of the Keauhou Aquifer System depicting the coastal freshwater lens and likely geologic features associated with the high water-level area (>40 ft above mean sea level) (courtesy of S. Anthony, USGS, 2012).

Recently, an alternative conceptual model of the aquifer system was proposed by consultants and water users in North Kona. The model was described in response to NPS comments on the 2010 Environmental Assessment for the Laiopua Community Center (Geometrician Associates 2010):

> *Based on discussions with hydrologists Tom Nance and Steve Bowles, who have experience in many of the wells in the area, we respectfully disagree with the National Park's model of the hydrology in the area, although we fully understand that there is much still to be investigated. The State's deep monitor well (3858-01), about two miles south of Kealakehe at 730 feet in elevation, hit potable water beneath the basal lens, suggesting that the subsurface feature creating the high level groundwater lies conformably within lava flows and is likely to be dense, poorly permeable flows. This also indicates that at least some of the high level potable water is not passing through the basal lens but is instead passing beneath it and discharging offshore. Two of the high level wells in the region (3957-05 and 4258-03), when drilled deeper, had water levels rise higher, again supporting*

> *the concept of conformable poorly permeable lava flows being the feature creating the high level groundwater. There are no peer-reviewed publications documenting this, but the field results as described above are actually measured and indisputable results as opposed to numerical models. This information has been added to the EA* (Letter from R. Terry – Geometrician Associates, LLC to K. Billings, NPS, dated Apr. 1, 2010).

At the September 23, 2010 Kona Water Roundtable, information was presented indicating that the Kamakana Well (3959-01) had been drilled to a depth of 1760 ft below sea level in the basal system and that fresh water was encountered below salt water (T. Nance, Tom Nance Water Resource Engineering, Sept. 2010 Kona Water Roundtable). According to the Well Construction and Pump Installation Permit application, the applicant planned to convert the well to a potable water-supply well if sufficient fresh water was encountered.

Although the extent of the newly discovered freshwater zone is not known, it is being targeted to supply potable water to large new developments in North Kona (Figure 21). The August 2013 Kaloko Makai Draft Environmental Impact Statement cites "*fresh or slightly brackish artesian groundwater which exists at depth below the basal lens and saline groundwater*" as the preferred alternative to supply potable water for up to 5000 homes, 3 schools, a hospital, and commercial and light industrial uses, directly upgradient of Kaloko-Honokohau National Historical Park (Wilson Okamoto Corporation and Hoʻokuleana LLC 2013) (Appendix C).

The alternative conceptual model may be supported by the results of the Hawaiʻi Scientific Drilling Project on the eastern flank of the Island of Hawaiʻi. The borehole Kahi Puka 1 (KP-1) has been drilled to a depth of over 11,000 ft and cased to about 9900 ft just south of Hilo Bay. Fluid samples collected from KP-1 indicate that fresh water exists below salt water at the Mauna Kea/Mauna Loa interface about 1050 ft below land surface, and that this freshwater body is actively being recharged by precipitation occurring at 7000 ft on the slopes of Mauna Kea (Thomas et al. 1996). In 2012, the NPS, the Commission, and the USGS jointly funded a study to further evaluate the connection between high-level and coastal groundwater systems in Kona using stable isotopes and other natural tracers. As of August 2013, two rounds of sampling have been completed and the USGS is awaiting the analytical results from several laboratories (S. Anthony, USGS, letter dated Aug. 26, 2013).

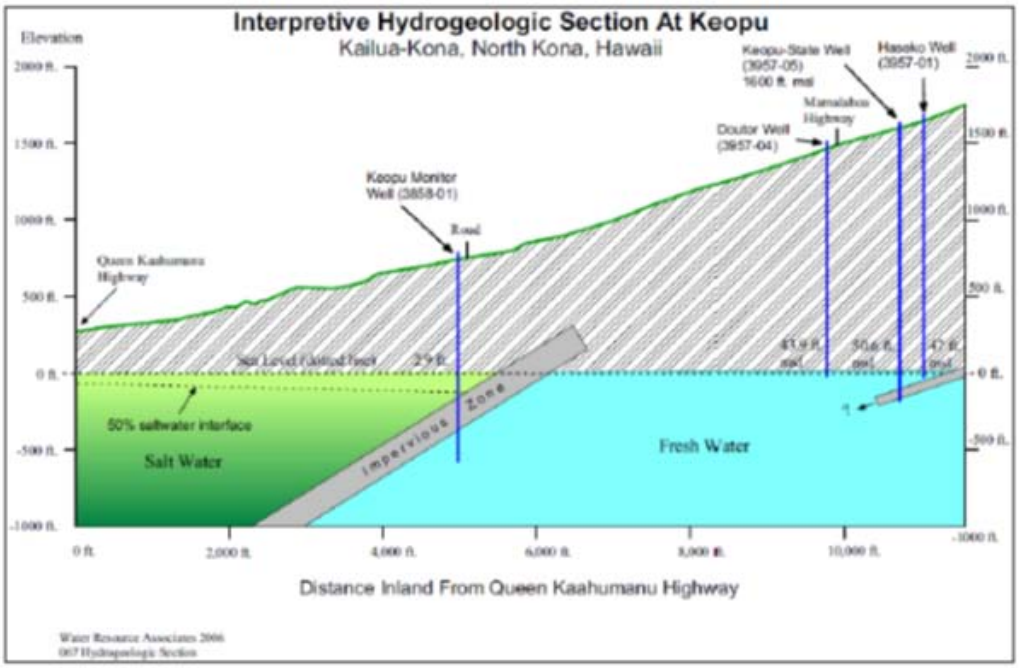


Figure 21. Alternative conceptual model of the Keauhou Aquifer System presented in the 2011 Kaloko Makai Draft Environmental Impact Statement (*from* Wilson Okamoto Corporation and Hoʻokuleana LLC 2011, Figure 3-6).

The feasibility of developing one or more artesian freshwater zones below salt water for drinking water, however, is highly speculative, as is the assertion that wells tapping this zone will not reduce groundwater discharge to coastal ecosystems. At this time, the conceptual model the Commission will use to approve new wells in the aquifer system is uncertain. If the existing model is sufficient to approve new wells, then it must also be sufficient to deny new wells that threaten public trust resources. If the Commission accepts that hydrologic communication between high-level and basal groundwater is significantly less than previously believed, the SY of the coastal groundwater system should be reduced to account for the portion of recharge that does not discharge to the basal lens.

Therefore, the source and quantity of recharge to basal groundwater in the Keauhou Aquifer System is uncertain, yet has important implications for the management and allocation of freshwater resources. In designated water management areas, the Commission can require applicants for water use permits to provide supporting information in cases where the source of water to wells is uncertain or speculative, thereby ensuring that public trust resources are not harmed.

## 2.5 Federal, State, County Approval [HAR §13-171-7(8)]:

> ***Whether water development projects that have received any federal, state, or county approval may result, in the opinion of the commission, in one of the above conditions.***

All of the pumping wells and the residential and commercial development projects requiring additional groundwater withdrawals to meet their water demand listed in Appendix C are located within the Keauhou Aquifer System and have received or will require federal, state, or county approval. These projects have the potential to contribute to cumulative adverse effects on groundwater-dependent traditional and customary Native Hawaiian rights and practices and public trust resources in Kaloko-Honokōhau and along the Kona Coast.

## 3. Summary

The NPS urges Chairperson Ailā to recommend to the Commission that designation proceedings be initiated for the Keauhou Aquifer System on the basis of the legal rationale and factual data contained in this petition and set forth below because

1) The discharge of abundant and clean, fresh groundwater is necessary to maintain and perpetuate traditional and customary Native Hawaiian practices and other public trust resources in the Keauhou Aquifer System.

2) The maintenance of the natural rate of groundwater discharge and the natural fluctuation of water levels, salinity, temperature, and residence time in all inland and nearshore marine waters in Kaloko-Honokōhau National Historical Park are necessary to fulfill the specific purposes and values for which the Park was established, including but not limited to the propagation of flora and fauna traditionally and customarily used by Native Hawaiians.

3) The continued discharge of abundant and clean, fresh groundwater is essential to maintaining the state's current classification of the Park's inland waters as Class 1a and the Park's marine waters as Class AA.

4) Land-use based projections of water demand far exceed the state-determined sustainable yield of the Keauhou Aquifer System.

5) The determination of the sustainable yield for the Keauhou Aquifer System fails to explicitly consider drought conditions, climate change, or the quality and quantity of groundwater needed to preserve and perpetuate traditional and customary Native Hawaiian rights and practices and other public trust resources.

6) Limiting pumping to the sustainable yield without regulating the location of groundwater withdrawals will not protect traditional and customary Native Hawaiian rights and practices or other public trust resources that depend upon abundant and clean, fresh groundwater in the Park and along the Kona Coast.

7) Reducing the quantity of groundwater that discharges along the Kona Coast up to 44% as a result of reasonably foreseeable groundwater withdrawals would adversely affect the productivity and habitat of culturally important and rare native species, thereby imperiling traditional and customary Native Hawaiian rights and practices and other public trust resources.

8) Saltwater intrusion in the Kahaluʻu wellfield has led to an increase in groundwater withdrawals in the *ahupuaʻa* of the Park, despite information that traditional and customary Native Hawaiian rights and practices and other public trust resources will be adversely affected by these withdrawals.

9) Competition for high-level groundwater has led to new proposals to develop basal groundwater at a time when the potential economic, cultural and environmental costs of desalinating brackish groundwater along the Kona Coast remain high.

10) Serious disputes regarding the direct and cumulative impacts of groundwater use on traditional and customary Native Hawaiian rights and other public trust resources that depend upon groundwater discharge in the Keauhou Aquifer System exist and are not resolvable through working groups or roundtables.

11) Serious disputes regarding the source of freshwater recharge to the basal groundwater system in the Keauhou Aquifer System exist and are not resolvable through the well construction and pump installation permitting process.

12) The state environmental-review process, the land-use planning process, working groups, water professionals groups, and roundtables have not and cannot sufficiently protect and preserve traditional and customary Native Hawaiian rights and practices and other public trust resources from the cumulative adverse effects of existing and reasonably foreseeable groundwater withdrawals in the Keauhou Aquifer System.

13) The Commission's public trust responsibilities extend to the protection and preservation of those natural and cultural resources that were recognized in the congressional legislation establishing the Park and to the flora and fauna protected pursuant to the 1973 Endangered Species Act. Consequently, the Commission has a general affirmative duty

to take precautionary actions to safeguard those vital resources even in the face of scientific uncertainty, when such resources are threatened by existing and reasonably foreseeable future groundwater withdrawals.

14) The Commission cannot manage and allocate groundwater to ensure the protection of traditional and customary Native Hawaiian rights and practices and other public trust resources in an area that has not been officially designated a water management area.

# 4. Conclusions

This petition provides sufficient information to conclude that traditional and customary Native Hawaiian rights and practices and other public trust resources in Kaloko-Honokōhau and along the Kona Coast are threatened by reasonably foreseeable withdrawals of groundwater from the Keauhou Aquifer System.

Accepting this petition will allow the Commission to take the initiative in considering and protecting traditional and customary Native Hawaiian rights and practices and other public trust resources.

Initiating designation proceedings will allow the Commission to investigate disputes with a level of openness, diligence, and foresight commensurate with the high priority that traditional and customary Native Hawaiian rights and practices and public trust resources command under the laws of the State of Hawaiʻi.

Designation of the Keauhou Aquifer System is necessary to ensure that optimal conditions exist for the fragile ecosystems that support coastal fisheries, traditional and customary subsistence fishing and shoreline gathering, recreational opportunities, and rare native species along the Kona Coast because

- Designated water management areas provide the Commission the authority to regulate the location and pumpage of wells in the Keauhou Aquifer System via a permitting system.
- Designated water management areas allow the transfer of water from one watershed to another and allow the Commission the authority to reserve water for conservation purposes.
- Designated water management areas provide the Commission with tools to ensure that the burden of proof with regard to adverse effects on traditional and customary Native Hawaiian rights and practices and public trust resources rests with the water user, and to evaluate whether mitigating measures such as improved water conservation and efficiency can be used to meet growing water demands in North Kona.

- Designation is consistent with the public interest as capital investments in water infrastructure may be placed at risk by potential future limits on groundwater development due to adverse effects on traditional and customary Native Hawaiian rights and practices and other public trust resources.

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# Appendix A: Federally-protected species in Kaloko-Honokōhau National Historical Park.

| Common Name | Species Name | Listing Category | Status in Park | Taxa |
|---|---|---|---|---|
| Hawaiian coot | *Fulica americana alai* | Endangered | Current | Birds |
| Hawaiian stilt | *Himantopus mexicanus knudseni* | Endangered | Current | Birds |
| *hala pepe* | *Pleomele hawaiiensis* | Endangered | Outplant | Flowering Plants |
| *loʻulu* | *Pritchardia affinis* | Endangered | Restored | Flowering Plants |
| false killer whale | *Pseudorca crassidens* | Endangered | Current | Mammals |
| Hawaiian hoary bat | *Lasiurus cinereus semotus* | Endangered | Current | Mammals |
| Hawaiian monk seal | *Monachus schauinslandi* | Endangered | Current | Mammals |
| humpback whale | *Megaptera novaeangliae* | Endangered | Current | Mammals |
| hawksbill sea turtle | *Eretmochelys imbricata* | Endangered | Current | Reptiles |
| *koʻokoʻolau* | *Bidens micrantha ctenophylla* | Proposed Endangered | Outplant | Flowering Plants |
| green sea turtle | *Chelonia mydas* | Threatened | Current | Reptiles |
| anchialine pool shrimp | *Metabetaeus lohena* | Candidate | Current | Crustaceans |
| anchialine pool shrimp | *Palaemonella burnsi* | Candidate | Current | Crustaceans |
| orange-black Hawaiian damselfly | *Megalagrion xanthomelas* | Candidate | Current | Insects |

# Appendix B: Pumping capacity of permitted wells in the Keauhou Aquifer System

| Well No. | Well Name | Year | Owner/user | Use Code | Pump Capacity (Mgal/d) | Note |
|---|---|---|---|---|---|---|
| 4363-01 | Keahole Point 1 | 1989 | Uwajima Fisheries | AGRAQ | 0.36 | |
| 4363-02 | Keahole Point 2 | 1989 | Uwajima Fisheries | AGRAQ | 0.36 | |
| 4363-03 | Keahole Point 3 | 1989 | Uwajima Fisheries | AGRAQ | 0.36 | |
| 4363-04 | Keahole Point 4 | 1989 | Uwajima Fisheries | AGRAQ | 0.36 | |
| 4363-05 | Keahole Point 5 | 1989 | Uwajima Fisheries | AGRAQ | 0.36 | |
| 4363-06 | Keahole Point 6 | 1989 | Uwajima Fisheries | AGRAQ | 0.36 | |
| 4363-08 | Keahole Point 8 | 1989 | Uwajima Fisheries | AGRAQ | 0.36 | |
| 4363-09 | Keahole Point 9 | 1989 | Uwajima Fisheries | AGRAQ | 0.36 | |
| 4363-10 | Keahole Point 10 | 1989 | Uwajima Fisheries | AGRAQ | 0.36 | |
| 4363-11 | Keahole Point 11 | | Uwajima Fisheries | AGRAQ | | |
| 4363-12 | Keahole Point 12 | | Uwajima Fisheries | AGRAQ | | |
| 3957-04 | Doutor Coffee #1 | 2001 | Doutor Coffee Co. | AGRCP | 0.331 | |
| 4461-02 | Keahole Helco | 1993 | HELCO | INDEL | 0.72 | |
| 4060-01 | Honokohau Quarry | 1995 | Honokohau Prop | INDMI | 0.036 | |
| 4459-03 | Hilu Hilu Irr 1 | | Hilu Hilu Dev. LLC | IRR | 0.72 | Well Permit Issued 1/14/04 |
| 4459-04 | Hilu Hilu Irr 2 | | Hilu Hilu Dev. LLC | IRR | 0.72 | Well Permit Issued 1/14/04 |
| 4459-05 | Hilu Hilu Irr 3 | | Hilu Hilu Dev. LLC | IRR | 0.72 | Well Permit Issued 1/14/04 |
| 3759-01 | Kaneyoshi Irr | 1999 | Kaneyoshi Co Ltd | IRR | 0.108 | |
| 4161-04 | Kohanaiki 3 | 2007 | Discovery Land Co. | IRRGC | 0.36 | |
| 4161-05 | Kohanaiki 4 | 2007 | Discovery Land Co. | IRRGC | 0.36 | |
| 4161-06 | Kohanaiki 5 | 2007 | Discovery Land Co. | IRRGC | 0.36 | |
| 4161-07 | Kohanaiki 6 | 2007 | Discovery Land Co. | IRRGC | 0.36 | |
| 4161-08 | Kohanaiki 7 | 2007 | Discovery Land Co. | IRRGC | 0.36 | |
| 4262-02 | Kohanaiki 2 | 2007 | Discovery Land Co. | IRRGC | 0.36 | |
| 4161-09 | Kohanaiki 8 | 2010 | Discovery Land Co. | IRRGC | 0.36 | Permit approved 8/19/08 |
| 4262-01 | Kohanaiki 1 | 2010 | Kohanaiki Shores, LLC | IRRGC | 0.36 | Permit approved 3/13/07 |
| 3457-01 | Keauhou 1 | 1956 | Kona Country Club | IRRGC | 0.864 | |
| 3357-01 | Keauhou 2 | 1966 | Kona Country Club | IRRGC | 1.008 | |
| 3457-03 | Keauhou Irr 3 | 1985 | Kona Country Club | IRRGC | 0.72 | |
| 3357-04 | Keauhou-Kona C C | 1990 | Kona Country Club | IRRGC | 0.677 | |
| 3558-01 | Keauhou-Robertson | 2006 | | IRRLA | 0.057 | |
| 4258-05 | Lee | | Elizabeth Lee | MUN | 1.008 | Permit approved 2/20/05 |
| 4258-06 | Ooma 1 | | Wai O Kula, LLC | MUN | 1.008 | Pump Permit Issued 1/10/08 |
| 3957-01 | Keopu-Puuhonua | 1993 | Haseko-Hawai‘i | MUNCO | 0.936 | |
| 3557-01 | Kahaluu A | 1959 | Hawai‘i DWS | MUNCO | 1.008 | |
| 3557-02 | Kahaluu B | 1959 | Hawai‘i DWS | MUNCO | 1.008 | |
| 3557-03 | Kahaluu C | 1969 | Hawai‘i DWS | MUNCO | 1.008 | |
| 3557-04 | Kahaluu D | 1970 | Hawai‘i DWS | MUNCO | 1.44 | |
| 3557-05 | Kahaluu Shaft | 1976 | Hawai‘i DWS | MUNCO | 6.048 | |
| 3657-01 | Holualoa | 1983 | Hawai‘i DWS | MUNCO | 0.72 | |
| 4358-01 | Kalaoa A | 1990 | Hawai‘i DWS | MUNCO | 0.432 | |
| 4158-02 | Honokohau | 1991 | Hawai‘i DWS | MUNCO | 2.016 | |
| 4458-02 | Kohanaiki 2 | 1991 | Hawai‘i DWS | MUNCO | | |
| 4258-03 | Hualalai | 1993 | Hawai‘i DWS | MUNCO | 1.512 | |
| 4057-01 | Keahuola QLT 1 | 1994 | Hawai‘i DWS | MUNCO | 1.44 | |
| 3857-04 | Waiaha-DWS | 2000 | Hawai‘i DWS | MUNCO | 2.016 | |
| 4158-03 | Palani 1 | 2007 | Hawai‘i DWS | MUNCO | 1.44 | Permit approved 9/6/2011 |
| 4559-01 | Huehue Ranch 1 | 1985 | Huehue Ranch | MUNPR | 0.489 | |
| 4459-01 | Huehue Ranch 2 | 1991 | Huehue Ranch | MUNPR | 0.821 | |
| 4459-02 | Huehue Ranch 4 | 1992 | Huehue Ranch | MUNPR | 0.821 | |
| 4363-13 | Net Washing | 1987 | Cyanotech Corp | OTH | 0.115 | |
| **Total permitted pumping capacity in the Keauhou Aquifer System =** | | | | | **38 Mgal/d** | Potential 24-hour production |

# Appendix C: Water demand for proposed development in the area of Kaloko-Honokōhau.

(TBD = to be determined).

| Development Name | Water Demand (Mgal/d) | Proposed Water Source | Reference |
|---|---|---|---|
| The Shores at Kohanaiki | 1.10<br>2.20 | Keauhou high-level<br>Keauhou basal | 2003 Special management area use permit petition; Water Resources Bulletin |
| Kula Nei | 0.12 | Keauhou high-level | 2007 Final EIS, Vol.I, Page 4-177; Water Resources Bulletin |
| Kealakehe Planned Community | 4.75 | Keauhou high-level | 1990 Final EIS, Section 5.3 |
| Keahuolu Housing | 1.11 | Keauhou high-level | 2008 Final EIS; Keopu Well Draft EA |
| Kaloko Heights | 0.86 | TBD | LUC Decision & Order Docket A81-525, Page 10 |
| West Hawaiʻi Business Park / Palani Ranch | 1.36 | Keauhou high-level | 2003 Final EIS, Page 4-128; 2009 Palani Well No. 1 Draft EA, Page 1-8 |
| Kaloko Industrial Park Phases III & IV | 0.33 | Keauhou basal | 2000 Final EIS, Page 3-49; Palani Well No. 1 Final EA, App. 7 |
| Honokohau Business Park | 0.21 | TBD | 1991 LUC Decision & Order Docket A89-643, Page18 |
| Lokahi Kau Affordable Apartments | 0.10 | Keauhou high-level | 12-17-08 letter from R. Terry of Geometrician Associates, LLC to G. Bell of KAHO; Palani Well No. 1 Final EA, App. 7 |
| Kaloko Transitional Housing | 0.04 | TBD | 2009 Kaloko Housing Program Final EA, Page 12 |
| Kaloko Makai | 4.50 | TBD | Kaloko Makai 2013 Draft EIS, Pages 2-31 - 2-61; 2010 WUDP, Page 2-12 (estimated from 2354 single-family units x 1000 gpd/unit; 2646 multi-family units x 400 gpd/unit; 200 resort units x 400 gpd/unit; 242 school, park, hospital, light industrial, infrastructure acres x 4000 gpd/acre; 14 commercial acres x 3000 gpd/acre) |
| Palamanui & UH Center at West Hawaiʻi | 0.80<br>1.80 | Keauhou high-level<br>Keauhou basal | 2004 Final EIS, Page 6-18; Palamanui Waterline, 343-foot Elevation Reservoir & Main Street Collector Road Extension<br>Water Resources Bulletin |
| LaiOpua Community Center | 0.02 | Keauhou high-level | Letter dated April 1, 2010 from R. Terry of Geometrician Associates, LLC |
| BioEnergy Hawaiʻi | 0.04 | TBD | 2010 EISPN, Page 34 |
| **Estimated future water demand in Kaloko-Honokōhau =** | **19** | **Mgal/d** | |

# Appendix D: Existing and proposed desalination systems in the area of Kaloko-Honokōhau.

(TBD = to be determined).

| Desalination System | Status | Distance from National Park | Proposed pumping/injection rate (Mgal/d) |
|---|---|---|---|
| Kona Kai Ola | Proposed 2007<br>Terminated 2009 | Adjacent | TBD |
| The Shores at Kohanaiki | Operating since 2008 | Adjacent | 2.2 / 1.7 |
| Oʻoma Beachside Village | Proposed 2009<br>Boundary amendment denied 2010 | ≈ 1 mile | 1.8 / 1.0 |
| BioEnergy Hawaiʻi | Proposed 2010 | ≈ 2 miles | 0.04 / TBD |
| Kona Coast Shellfish | Proposed 2011 | ≈ 2.5 miles | 1.08 / 0 |
| Kaloko Makai | Proposed 2013 | ≈ 1 mile | ≈ 10.9 / 4.9 |

# Appendix E: Record of groundwater development issues in the area of Kaloko-Honokōhau.

Summary of wells and residential and commercial development projects on which the NPS has commented with respect to the use of groundwater.

| No. | Issue | NPS Comment | Response |
|---|---|---|---|
| 1 | The Shores at Kohanaiki Dust Suppression Well Construction/Pump Installation Application | 9/23/05 letter to D. Nakano - CWRM | - |
| 2 | Kona Kai Ola Project EIS | 8/18/06 letter to S. Condra - Jacoby Development, LLC<br>2/6/07 letter to S. Condra - Jacoby Development, LLC<br>12/5/07 letter to L. Thielen - DLNR | 10/20/06 letter from J. Merz<br>7/23/07 letter from D. Vithanage<br>- |
| 3 | Water Resource Protection Plan Update | 1/10/07 letter to K. Kawahara - CWRM | 8/14/08 letter from K. Kawahara |
| 4 | Kohanaiki 1-7 Well Construction/Pump Installation Application | 3/7/07 letter to R. Hardy - CWRM<br>8/18/08 letter to R. Hardy - CWRM<br>9/2/08 letter to K. Kawahara - CWRM<br>1/28/09 letter to K. Kawahara - CWRM | 7/15/08 letter from K. Kawahara<br>Pump Installation Permit dated 9/19/08<br>- |
| 5 | Oʻoma Beachside Village EIS | 6/7/07 letter to T. Whitten - PBR Hawaiʻi<br>7/3/08 letter to M. Moresco - Ooma Beachside Village, LLC | 5/9/08 letter from T. Schnell<br>12/10/08 letter from T. Schnell |
| 6 | The Shores at Kohanaiki Water Development Impacts, SMA Use Permit No. 439, Condition 41 | 6/11/07 letter to C. Yuen - County of Hawaiʻi<br>6/29/07 letter to C. Yuen - County of Hawaiʻi | 10/2/08 letter from C. Yuen |
| 7 | Keahuolu Affordable Housing Project EIS | 8/21/07 letter to M. O'Leary - Belt Collins Hawaiʻi, Ltd.<br>4/8/08 letter to M. O'Leary - Belt Collins Hawaiʻi, Ltd. | 2/12/08 letter from M. O'Leary<br>9/25/08 letter from L. Sichter |
| 8 | The Shores at Kohanaiki UIC Application No. UH-2594 | 9/18/07 letter to S. Yamada - DOH<br>7/25/08 letter to S. Yamada - DOH<br>Letter dated 11/24/08 to S. Yamada - DOH | 6/26/08 letter from S. Yamada<br>10/29/08 letter from S. Yamada<br>UIC Permit No. UH-2594 dated 12/1/08 |
| 9 | Kaloko Transitional Housing EA | 12/21/07 letter to R. Terry - Geometrician Associates, LLC<br>12/4/08 letter to R. Terry - Geometrician Associates, LLC | -<br>1/26/09 letter from R. Terry |
| 10 | Ooma 1 Well Construction/Pump Installation Permit Application | 3/14/08 letter to R. Hardy - CWRM | - |
| 11 | Kaloko Makai Project EIS | 3/18/08 letter to A. Suwa - Wilson Okamoto Corp.<br>10/22/10 letter to E. Matsukawa - Wilson Okamoto Corp.<br>10/5/11 letter to E. Matsukawa - Wilson Okamoto Corp. | -<br>-<br>7/25/2013 letter from E. Matsukawa |

| No. | Issue | NPS Comment | Response |
|---|---|---|---|
| 12 | Keopu-Puuhonua Well Construction/Pump Installation Permit Application | 4/4/08 letter from C. Pettee to R. Hardy - CWRM | - |
| 13 | Waiaha Water Systems (Transmission Mains and Reservoirs) EA | 4/7/08 letter from C. Pettee to Y. Ohashi - Waiaha System, LLC | 7/2/08 letter from Y. Ohashi |
| 14 | Hina Lani St. 1.0-Million Gallon Reservoir and Transmission Waterline EA | 4/7/08 letter from C. Pettee to G. Yorita - DWS | 8/31/08 letter from J. Sagaguchi |
| 15 | Kalaoa Water Systems Improvements EA | 5/23/08 letter from C. Pettee to E. Matsukawa - Wilson Okamoto Corp. | 3/10/09 letter from E. Matsukawa |
| 16 | Palamanui Waterline and Reservoir EA | 7/2/08 letter from C. Pettee to V. Shigekuni - PBR Hawaiʻi | 7/10/08 letter from V. Shigekuni |
| 17 | Lokahi Kaʻu Affordable Apartments EA | 12/8/08 letter from G. Bell to R. Terry - Geometrician Associates, LLC | 12/17/08 letter from R. Terry |
| 18 | Palani Well No. 1 EA and Pump Installation Application | 5/8/09 letter from C. Pettee to R. Terry - Geometrician Associates<br>11/21/11 letter from B. Hansen to W. Aila - CWRM | 10/5/09 letter from R. Terry<br>12/15/11 letter from W. Tam |
| 19 | Kamakana Well Construction / Pump Installation Application | 11/18/09 letter from C. Pettee to K. Kawahara - CWRM | - |
| 20 | Keopu Well, Reservoir, and Water Transmission Lines Hienaloli 1-6, North Kona, Hawaiʻi EA | 11/5/09 letter from C. Pettee to G. Koyama - Belt Collins Hawaiʻi Ltd. | 2/25/10 letter from G. Koyama |
| 21 | Laiopua Community Center EA | 3/18/10 letter from G. Bell to R. Terry - Geometrician Associates, LLC<br>8/3/10 letter from G. Bell to M. Chandler, U.S. HUD | 4/1/10 letter from R. Terry<br>8/9/10 letter from C. Kuhui |
| 22 | Honokōhau 2 Well Construction/Pump Installation Permit Application | 5/13/10 letter from C. Pettee to K. Kawahara - CWRM | - |
| 23 | BioEnergy Hawaiʻi Waste Conversion Facility EIS preparation notice | 1/21/11 letter from K. Billings to G. Kaniho - BioEnergy Hawaiʻi | - |
| 24 | Hawaiʻi County Water Use & Development Plan Update | 8/17/11 letter from K. Billings to W. Aila - CWRM<br>12/13/11 letter from K. Billings to W. Tam - CWRM | 10/26/11 letter from W. Tam<br>- |
| 25 | Desalination activities in N. Kona | 11/21/11 letter from K. Billings to W. Aila - CWRM | - |
| 26 | Keauholu 2 Well Construction/Pump Installation Application | 6/6/12 letter from B. Hansen to W. Tam - CWRM | - |