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DEPARTMENT OF LAND AND NATURAL RESOURCES
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COMMISSION ON WATER RESOURCE MANAGEMENT

February 14, 2017
Kailua-Kona, Hawaii

STAFF SUBMITTAL

U.S. Department of Interior
National Park Service
Kaloko-Honokōhau National Historical Park
Chairperson Recommendation on Petition for
Ground Water Management Area Designation
Keauhou Aquifer System Area, North Kona, Hawaii

PETITIONER:

Ms. Tammy Duchesne, Superintendent
U.S. Department of Interior
National Park Service
Kaloko-Honokōhau National Historical Park
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SUMMARY OF REQUEST:

Petitioner U.S. National Park Service (NPS) requests that the Commission on Water Resource Management (Commission) designate the *Keauhou Aquifer System Area* (KASA) as a *Ground Water Management Area* (GWMA) due to uncertainties in sustainable yield and future demand that may cause potential harm to near shore biota and loss of opportunity to practice traditional and customary rights (Exhibit 1).

BACKGROUND:

The *Keauhou Aquifer System Area* (KASA) is located in North Kona within the Hualalai Aquifer Sector Area on the west side of the Big Island of Hawaii (Exhibit 2).

On September 13, 2013, the NPS submitted a written petition to designate the *Keauhou Aquifer System Area* (KASA) as a *Ground Water Management Area* GWMA. Since the petition submission, there has been lengthy discussions and community involvement on this petition through eleven (11) Commission meetings (including two (2) Commission field investigations with videos) covering eight (8) action submittals, 42

presentations/briefings/updates, 466 written testimonies, and various consultations with federal, state and county agencies, presentations to community groups, , and staff field investigations. Much of this was a result of the December 29, 2014 Commission Preliminary Order HA-WMA 2013-1 (Order) that outlined the various information, scientific investigation & studies , and the update of the Keauhou Water Use and Development Plan (KWUDP) items the Commission requested before they would entertain the Chair's recommendation of continuing the designation process. Studies not listed in the Order, but nonetheless were discussed as important towards decision making at the December 10, 2014 public meeting, are listed below with their current status:

1. Evapo-transpiration Study (Tom Giambelluca). This study will provide a new and sophisticated method to calculate how much water evaporates back into the atmosphere from different kinds of vegetation and environments. It is an essential factor in estimating the overall water budget. The study is [was] due in 2013. **Done:** *Evapotranspiration of Hawai'i Final Report, Feb 2014.*
2. Ground-Water Recharge Update (USGS). This study will use data from other reports to calculate recharge. The study is [was] due June 30, 2014. **Cancelled.** *Phase I Scientific Investigation Report (SIR) 2015-5164 as part of this study was posted online June 13, 2016. No new updates to current 2011 SIR 2011-5078 used for 2008 & 2017 Water Resource Protection Plan (WRPP) update. Phase II **WILL NOT** update Big Island as errors in other island recharge estimates do not appear to be present in the current Big Island update.*
3. Isotope Study. This study will analyze the relationship between the high level water and the basal ground water in the Keauhou System. The interaction (if any) between these two water sources is essential to understanding the water supply in this region.

This study is [was] due September 30, 2014. **Done:** *Open File Report 2014-1173 posted online September 30, 2014.*

4. Three [3]-D ground water solute transport model (chlorides). The U.S. Geological Survey will take the Isotope study, the evapo-transpiration study, the recharge study, and other ongoing work to refine the ground water model for the Keauhou System. The modeling will be done after September 30, 2014. **Pending.** *Estimated date for draft report July 2017.*

A compilation of the history Commission meetings, actions, orders, presentations, testimony, information, and other related processing of the petition to date has been and is available on the Commission's website at <http://dlnr.hawaii.gov/cwrm/groundwater/activities/keauhou/>.

DESIGNATION PROCESS:

The process to designate a ground water management area is described in the State Water Code, Hawaii Revised Statutes (HRS) §§174C-41 to -46 and Hawaii Administrative Rules (HAR) §§13-171-3 to -9. A flow chart of the process and current status of the subject petition is shown in Exhibit 3. The Commission is presently at the stage of deciding to continue the process towards an actual designation and a more formal public hearing as described under Hawaii Revised Statutes (HRS) §174C-42 and Hawaii Administrative Rules (HAR) §13-171-5 pursuant to a recommendation from the Chairperson.

Staff is highlighting an update and clarification to the process described at various hearings and presentations since September 13, 2013 and throughout the historical processing of other petitions regarding the findings of fact. For the first time in a designation proceeding, the Commission on Water Resource

Management (CWRM) issued a draft findings of fact at the current stage of the proceedings (i.e. Chairperson's recommendation to continue the process towards designation). Upon further review of the statute and process for designation, staff understands that the findings of fact referenced in Hawaii Revised Statutes (HRS) §174C-46 and Hawaii Administrative Rules (HAR) §13-171-9 is not required at this stage of the process.

GROUND WATER MANAGEMENT AREA DESIGNATION - EIGHT (8) CRITERIA:

The Water Code, Hawaii Revised Statute (HRS) §174C-44 and Hawaii Administrative Rules (HAR) §13-171-7, lists eight (8) criteria that the Commission **shall consider** when deciding whether to designate an area for ground water management.

- (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 ground water management area;
- (2) There is actual or threatened water quality degradation as determined by the Department of Health;
- (3) Whether regulation is necessary to preserve the diminishing ground water supply for future needs, as evidenced by excessively declining ground water levels;
- (4) Whether 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;
- (5) Whether the chloride contents of existing wells are increasing to levels which materially reduce the value of their existing uses;
- (6) Whether excessive preventable waste of ground water is occurring;
- (7) Serious disputes respecting the use of ground water resources are occurring; 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.

The Commission is required to review all issues, studies, and testimony in the context of these criteria, not just the criteria presented in the petition.

ANALYSIS

- (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 ground water management area;*

Sustainable Yield

In 2008, the Commission's Water Resources Protection Plan (WRPP, 2008) set the sustainable yield for the *Keauhou Aquifer System Area* (KASA) at 38 million gallons per day (mgd), which covers all aquifers within the area (basal, high-level, and deep confined freshwater). This estimate is based on an annual average recharge of 86 mgd and the sustainable yield is roughly 44% for this recharge amount. Scientific studies since 2008 to the present have shown that the updated average recharge could be as high as 183 mgd (USGS Engott, 2011), which includes climate change considerations, and are considered in the Commission's upcoming 2017 Water Resource Protection Plan of the Hawaii Water Plan update.

The Commission uses a precautionary approach in setting sustainable yields. The sustainable yield of the *Keauhou Aquifer System Area* (KASA) is estimated by considering average annual recharge from scientific studies that result in a range of 86 mgd to 183 mgd estimates, then picking the minimum of that range. From that minimum, a factor of 44% is applied in the *Keauhou Aquifer System Area* (KASA) to arrive at the current sustainable yield of 38 mgd. This allows 56% of recharge to continue to discharge to the ocean. A more in-depth discussion on this can be found in the Commission's Water Resources Protection Plan (WRPP, 2008). A graphical representation of this is shown in Exhibit 4.

Also, the relationship of the area's high-level aquifer connection to the coastal basal aquifer is not well understood. Knowledge has been slightly improved through the Commission funded U.S. Geological Survey (USGS) Isotope Study (Open File Report 2014-1173) that estimates the high-level contributing between 30% to 70% of its recharge to the basal aquifer. Other testimonies from other local experts based on isotope and carbon-14 age analysis suggest the high-level contribution to the basal aquifer to be on the lower side of this 30% to 70 % range. The existence of the deep freshwater aquifer beneath the saltwater portions of the thin basal lens based on data from the Commission's Keopu Deep Basal Monitor Well (8-3858-001) and the Forest City Hawaii Kona LLC's Kamakana Well (8-3959-001) are also evidence of an alternative path high-level recharge can bypass the basal aquifer in the *Keauhou Aquifer System Area* (KASA). Lastly, staff does not believe the monitoring of the *Keauhou Aquifer System Area* (KASA) has a long enough track record nor are there numerical modeling analyses sufficient enough to move away from the established minimum sustainable yield despite more recent recharge estimate increases. The current 3-D solute transport modelling efforts of the U.S. Geological survey to predict potential changes in salinity and water levels around the Kaloko-Honokōhau National Historical Park may provide greater insight on the high-level basal connection. However, we understand results are still six (6) months away. For these reasons, the sustainable yield of the *Keauhou Aquifer System Area* (KASA) will remain at the reasonable minimum of 38 mgd.

Ultimately, sustainable yield is set at the discretion of the Commission through the Water Resources Protection Plan (WRPP) of the overall Hawaii Water Plan (HWP). The petitioner states that the current sustainable yield analysis does not consider the effects of coastal discharge, sea-level changes, drought, and climate change on the park's resources and ultimately how this affects traditional and customary practices. Staff believes these issues apply statewide and are more appropriately addressed in the Water Resources Protection Plan (WRPP) update. The petition itself notes that the 2008 Water Resources Protection Plan (WRPP) is explicit in that it does not directly consider coastal leakage impacts in setting sustainable yields but acknowledges that this is an emerging concern. Therefore, these issues disputing the Commission's approach to setting sustainable yield should be addressed within the context of the petition and criterion seven (7) concerning serious disputes.

Ground Water Use and Authorized Planned Use

Historical and current existing ground water pumpage is 15.013 mgd (as of November 2016) from 47 production wells out of 127 total existing wells in the *Keauhou Aquifer System Area* (KASA) (See Exhibit 5). Of this 15 mgd, approximately 9 mgd is developed from high-level sources and 6 mgd is pumped from basal sources. The 15.031 mgd constitutes 39% of the sustainable yield of 38 mgd. The 46-year trend and average increase in water use is approximately 0.334 mgd. If this trend continues it would take approximately 69 years from now before sustainable yield is reached.

For authorized planned use, the County came up with 3 scenarios in Phase 1 of their update to the *Keauhou Water Use and Development Plan* (KWUDP), in compliance with Commission guidance in the December 29, 2104 Commission Preliminary Order HA-WMA 2013-1, Preliminary Order C.2. and subsequent discussions at Commission meetings of:

Year	2015	2016
Month Day	Feb 18	Jan 28
	May 20	May 19
	August 17	Nov 15

The scenario called Anticipated Water Demand is what staff has considered to be authorized planned use where developments have received the proper state land use designation and county development plan/community plan approvals on current pumpage, zoning, and water agreements that figure is 28.07 mgd, which includes actual existing use of 14.86 mgd as of 2014 and the reservation for Department of Hawaiian Home Land (DHHL) of 3.398 mgd.

The 28.07 mgd authorized planned use demand is assumed to come from groundwater. However, Phase 1 of the *Keauhou Water Use and Development Plan* (KWUDP) specifies water conservation and initial plans for 1.0 mgd from R-1 wastewater reuse from the Kealakehe Wastewater Treatment Facility would help to reduce this future demand on the groundwater.

Therefore, the evidence shows that the reasonable foreseeable maximum rate of withdrawal from the *Keauhou Aquifer System Area* (KASA) may reach 74% of the 38 mgd sustainable yield, which is less than the 90% criteria. This figure is also less than the 80% figure mentioned under the designation section of the Hawaii Revised Statute (HRS) §174C-44 and Hawaii Administrative Rules (HAR) §13-171-7 that states when withdrawals reach the eighty per cent (80%) level of the sustainable yield, the Commission 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.

With respect to criterion one (1), the petition also states that:

“The 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 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.” (beginning on pg. 28)

Again, this issue is more appropriately discussed in analysis of criterion seven (7) of serious disputes.

(2) *There is actual or threatened water quality degradation as determined by the Department of Health;*

The State of Hawaii Department of Health (DOH) provided a written response (Exhibit 6) to staff inquiries on December 9, 2014 stating that in their opinion there has not been a deterioration of groundwater quality in the *Keauhou Aquifer System Area* (KASA). Further, DOH’s opinion of future impacts to groundwater due to wastewater disposal is going to be mitigated by current upgrades underway at the Kealakehe Wastewater Treatment Facility and proposed revisions to the Hawaii Wastewater Regulations (Hawaii Administrative Rules Title 11, Chapter 62) that ban new cesspools and require upgrades of cesspools within 750 feet of the shoreline at the time a property is sold.

- (3) *Whether regulation is necessary to preserve the diminishing ground water supply for future needs, as evidenced by excessively declining ground water levels;*

The petition only addresses declining ground water levels in and around the park and not the aquifer system area as a whole.

Historic water levels near the Park from (3) basal observation wells within the Park drilled in 1996 and eight (8) within the Kohanaiki Shores development drilled in 2008 are shown in Exhibit 7a. Despite the 12 month moving average pumpage of nearly 1.5 mgd from the Kohanaiki Shores seven (7) wells since 2009, the data shows no detrimental effect on water level trends. In fact, there is a rising trend in the Park's observation wells.

However, the petition also cites predicted water level declines by about 0.6 ft. around the Park at a pumpage near sixty (60) mgd from existing wells at the time between just north of the *Keauhou Aquifer System Area* (KASA) into the *Kiholo Aquifer System Area* (KIASA) to South Point. (Oki et al. 1999, *Ground-Water Resources in Kaloko-Honokōhau National Historical Park, Island of Hawaii, and Numerical Simulation of Effects of Ground-Water Withdrawals*, WRI 99-4070). Sixty (60) mgd is greater pumpage than the existing installed capacity (35.5 mgd) of all wells in the *Keauhou Aquifer System Area* (KASA). This is because the area of study was larger than just the *Keauhou Aquifer System Area* (KASA). This seems to indicate a somewhat limited impact given that daily tidal fluctuations are on the order of a couple feet.

Staff had stated it had concerns about high-level water declines (see Exhibit 7b) in the December 10, 2014 hearing. Staff recently went out to verify some of the hi-level sources and remain concerned, but recognize that high-level water fluctuations are larger than basal and less susceptible to saltwater intrusion. Further, high-level declines may be more related to pre-1997 Hawaii Well Construction and Pump Installation Standard issues of construction due to localized cross-connections between perched aquifer(s) than an aquifer wide threat to the resource for future needs. Thirteen (13) of the 17 high-level (dike or perched or combo depending on one's conceptual idea) wells were drilled before 1997, which was the first year of the Hawaii Well Construction and Pump Installation Standards (HWCPIS). Of all the wells, only the Palani (4158-003) and Komo (3957-002) show video evidence of perched water cascading down the current open casing. However, the steady water high-levels at the Keopu (3957-005) and formerly declining but now rising QLT Well (4057-001) water levels lessens staff's concerns.

- (4) *Whether 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;*

The petition combined this issue with criterion (5) and both are addressed herein.

In the southern portion of the *Keauhou Aquifer System Area* (KASA), the Kahaluu Shaft (3557-005) was constructed in 1976 with the anticipation of producing 6 mgd of potable water. Unfortunately, due to the very thin and sensitive nature of the basal aquifer and also possibly due to the lower connectivity between the high-level and basal aquifers, the chlorides gradually rose so that by 1990 chlorides in the "top" and "right" portions of the shaft started to exceed the EPA secondary guideline of 250 mg/l. Hence, pumpage has been cut back to address this upconing issue (See Exhibit 8). Since the discovery of the high-level aquifer the County has been shifting pumpage from and blending high-level water with the shaft water.

The petition claims saltwater encroachment in the Kahalu`u Shaft (3557-005) has affected the Park as this necessitated the development of high-level wells above the Park. However, staff rejects this analysis as: 1) evidence shows there has been no increase in the Park conductivity data at their observation wells away from the shore (see Exhibit 9) , and 2) this criterion with criterion (5) is related to affecting *the development* of the ground water.

In the effort to address the optimization of developing ground water, Draft Phase 2 of the County's update to the *Keauhou Water Use and Development Plan* (KWUDP) specifies that no new county wells are to be drilled in the basal portions of the *Keauhou Aquifer System Area* (KASA) and County pumpage from the basal aquifer will be reduced. Generally, all new County sources will be drilled between 1,500 foot and 1,800 foot ground elevations mauka of Māmalahoa Highway, between the QLT Deepwell (4057-001) in the and the Haleki`i Deepwell (3155-002, located south in the *Kealakekua Aquifer System Area*). However, private wells north of QLT Deepwell may be accepted for inclusion into the Hawaii Department of Water Supply (HDWS) infrastructure only after further vetting as described in the *Keauhou Water Use and Development Plan* (KWUDP) Phase 2.

The petition opines that the number of proposed desalting facilities around the Park (see Petition Appendix D) are alarming and may harm the Park. Staff shared these concerns when applications were submitted for seven (7) new wells at Kohanaiki Shores, LLC to pump and desalinate over 2 mgd just north and adjacent to the Park. As result, three (3) observation wells, including a deep monitor well were requested by staff and agreed upon by the applicant to provide evidence of no harm. If the applicant had refused to construct the monitor well and perform monitoring staff's plan was to reject the applications under Hawaii Revised Statutes (HRS) §174C-84 (f) and Hawaii Administrative Rules (HAR) §13-168-12(h) and take the wells to the Commission for a hearing.

Data since 2008 from the three (3) monitoring wells required by the production well construction permits, six (6) other monitoring wells at Kohanaiki Shores, LLC and the three (3) monitoring wells within the Park have shown little to no increases of chlorides (see Exhibit 9). In fact, the data indicates a freshening of water since 2008 in both areas most likely due to fresher return irrigation water for the golf course from the desalinated brackish basal ground water and the proper disposal of the reject water deep into saltwater below the thin basal lens. Nutrient increases had occurred due to the grow-in period of the golf course but seem to be returning to original conditions and proper course maintenance should control this.

The petition states that "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)." In terms of chlorides, the degradation from desalination at Kohanaiki Shores LLC is not apparent, and chloride concentrations in the observation wells have remained steady or improved (i.e. lessened).

However, there is evidence that the anchialine ponds conductivities have changed over time since the 1960's (see Exhibit 11). This is more relevant to ecosystem health and protection of traditional & customary practices than protecting the utility of the *Keauhou Aquifer System Area* (KASA). Again, this is analyzed under criterion (7) regarding serious disputes.

(5) *Whether the chloride contents of existing wells are increasing to levels which materially reduce the value of their existing uses;*

The petition combined this issue with criterion (4). See analysis of criterion (4).

(6) *Whether excessive preventable waste of ground water is occurring;*

Staff does not accept the petitioner's opinion that excessive preventable waste is occurring in the *Keauhou Aquifer System Area (KASA)*. The petition states that the County of Hawaii 2010 WUDP shows that water consumption in North Kona is 1000 gallons per day (GPD) per single-family residential unit – 2.5 times higher than other areas of the county (Fukunaga & Associates, Inc. 2010). However, the County of Hawaii 2010 WUDP section 809.4.3 in the Hualalai Aquifer Sector specifies 400 GPD/single or multi-family unit based on 1) the domestic consumption guidelines (Table 100-18) of the 2002 Water System Standards published by the county department of water supplies and 2) historical consumption data for the Hualalai Aquifer Sector Area. Further, the updated *Keauhou Water Use and Development Plan (KWUDP)* Phase I, preliminarily approved by the Commission on August 17, 2015, analyzed meter records between July 2013 and June 2014 and found single family residential with 5/8-inch meters used on average 430 GPD and concluded that the 400 GPD unit rate is reasonable for planning purposes (section 2.1.1.3).

It would be reasonable that some domestic users on larger lots or larger families in the drier part of the island use above the 400 gals/unit daily duty, but a robust conservation program can address and mitigate higher end users. For example, as presented by the Honolulu Board of Water Supply (HBWS) at the May 20, 2015 meeting in Kona, conservation efforts on the island of Oahu has been successful at reducing potable pumpage by 10% since conservation efforts began in 1990 (see Exhibit 10).

(7) *Serious disputes respecting the use of ground water resources are occurring; or*

The petitioner devotes more pages in its petition to this criterion than any of the other criteria. In summary, the petition cites three (3) major disputes with respect to the use of groundwater that and cannot be resolved through working groups and roundtables, or through the environmental review and land-use planning and permitting processes:

- (1) Cumulative impact assessments,
- (2) The significance of saltwater intrusion on ecosystems, and
- (3) The source(s) of recharge to the coastal groundwater system

Further, the petition states that the Commission itself is powerless to protect the public trusts and interests without designation. Earlier in this submittal, under the criterion (1) analysis, staff mentioned these planning and scientific disagreements all ultimately related to how the public trust and traditional and customary practices are affected and protected. These disputes are analyzed in two parts: 1) Protection of Public Trust Uses and 2) Scientific Opinions.

Protection of Public Trust Uses

Staff rejects the petition's notion that the Commission is powerless to protect the public trust uses and interests without designation. It would appear the Commission supported this by issuing Preliminary Order HA-WMA 2013-1 (Order) to get a better direction on the connection of water use to land-use planning, permitting, and development through the updates over the past (3) years to the *Keauhou Water Use and Development Plan (KWUDP)* Phases 1 & 2. Another part of the order was for the County and the petitioner to discuss alternatives to designation. The Commission also reserved groundwater to the Department of Hawaiian Home Lands (DHHL), which is also a public trust to be protected. The reservation also is counted as authorized planned use towards the 90% criterion trigger for designation that protects the resource and other the other public trust uses above, including domestic use.

Besides designation, the Commission seeks to protect public trust uses through its well construction and pump installation permitting processes under Hawaii Revised Statute (HRS) §174C-84 and Hawaii Administrative Rules (HAR) §13-168-11 to -16. These permits are to be issued only if the proposed construction complies with all applicable laws, rules, and standards. The assessment and mitigation of impacts, if found, to traditional and customary practices is a matter of law and applies to all permits issued by agencies. Further, well construction and or pump installation application can be referred to the Commission on Water Resource Management (CWRM) for decision making.

Traditional and customary practices (T&C) are typically more localized issues as opposed to the larger scale aquifer system area sustainable yield estimate, and staff agrees these should be assessed. The U.S. National Park Service (NPS) March 25, 2015 petition for declaratory ruling for designating a smaller portion of the *Keauhou Aquifer System Area* (KASA) as an alternative to designation of the entire Keauhou Aquifer System Area (KASA) was an attempt to address the more localized effects of pumpage near and around the Kaloko-Honokōhau National Historical Park (Park). On August 17, 2015 the Commission denied the petition for Declaratory Order.

Staff is proposing to address the more localized traditional and customary practices (T&C) issues in the *Keauhou Aquifer System Area* (KASA) by increasing the review of well construction and pump installation permits. Staff had minimally addressed this through reviews of the Office of Hawaiian Affairs (OHA) online Kipuka Database and Mapping Tool (<http://kipukadatabase.com/kipuka/>) and review by the State Historic Preservation Division (SHPD) of Department of Land Natural Resources (DLNR). Permits are not issued until compliance with the State Historic Preservation Division (SHPD) issues are met. However, the Office of Hawaiian Affairs (OHA) has informed the Commission that the online database should not be used to help determine traditional and customary practices. To increase review of traditional and customary practices (T&C), staff has met with and initiated review of well construction and pump installation permits within the *Keauhou Aquifer System Area* (KASA) with the Aha Moku Advisory Committee (AMAC) within the Department of Land Natural Resources (DLNR). Staff has met with the Kona Moku, Ms. Kawehi Ngueyn, and will be sending well construction and pump installation permits through her to facilitate review and comments from local practitioners to help with subsequent permit actions/conditions related to individual permits. In fact, the first well construction permit and pump installation permit application (Well 8-3257-004) for a private domestic well 10 miles south of the Park is going through this process as of the date of this submittal. Staff is hopeful this leads to positive collaboration with and protection of traditional and customary practices (T&C) surrounding individual well applications.

Sustainable Yield Calculation

The petition takes the position that sustainable yield is not comprehensive enough. This is similar to the petition for declaratory order requesting clarification that a smaller area around the Park within the *Keauhou Aquifer System Area* (KASA) hydrologic unit can be designated. Because of the statewide implications of the issues raised by these petitions, staff believes these disagreements are more appropriately addressed in the 2017 Water Resources Protection Plan (WRPP) update. The petitioner's comments thus far in the 2017 WRPP review highlight the protection of fish and wildlife as their number one big concern (see Exhibit 14).

However, since the petition raises these issues related to missing considerations for sustainable yield estimation, staff provides some initial analysis in the sections below:

Climate change considerations - The U.S. Geological Survey (USGS) Scientific Investigations Report 2011-5078 does consider climate change three (3) scenarios. The upper range of recharge considered is 183 mgd, which is based on the mean estimate of climate change scenarios assuming full urban development from the County of Hawaii's 2005 Land Use Pattern Allocation Guide (LUPAG). The 183 is considered the mean value from a climate change range of 128 mgd to 241 mgd, all higher than the current minimum of average recharge of 86 mgd upon which the current sustainable yield is based.

Drought considerations - Staff rejects the notion that drought scenarios should be used to determine sustainable yield. Drought scenarios are considered extreme events that are inappropriate to set long-term average hydrologic behavior. Drought can be handled more appropriately through drought mitigation planning and emergency provisions of Hawaii Revised Statutes (HRS) §174C-62 (g) and Hawaii Administrative Rules (HAR) §13-171-50 to -53, which apply to both designated and non-designated water management areas. Also, drought affects surface water components of the water cycle much more dramatically than groundwater due to the storage capacity of aquifers.

Sea-level rise considerations - Staff believes there is no nexus between sustainable yield and sea-level rise that may have significant impact on anchialine ponds and coastal areas. Long-term recharge should be insignificantly affected by sea-level rise. Instead, recharge would be more significantly affected by changes in rainfall and evapotranspiration due to related climate change events. The flux of recharge water to the coast will continue, albeit at a different elevation relative to *land* marks, such as anchialine ponds, that will be affected simply due to sea-level rise. The basal lens and coastal discharge would continue to float over the denser saltwater and relocate with the sea-level rise. This happens on a daily basis with the tides. Coastal discharge will maintain its quantity but relocate above or more inland of anchialine ponds that become more submerged due to sea-level rise.

Coastal discharge and impacts considerations - Coastal discharge is the greatest unknown in terms of specific location and amounts and impacts to the ecosystem and traditional and customary practices in a comprehensive aquifer-wide manner. The petition shows evidence of higher coastal leakage within the Park through infrared images showing cooler waters discharging along the coast into the ocean. However, the presence of the deep freshwater aquifer indicates that significant discharges may occur far offshore. The impacts of reduced aquifer leakage on coastal water quality and affects the ecosystem and potentially the exercise of traditional and customary practices along the coast. Again, sustainable yield accounts for 44% of the natural recharge to maintain and protect the integrity and utility of the aquifer, while 56% continues to coastal discharge in the *Keauhou Aquifer System Area (KASA)*.

The petitioner quantified the coastal leakage flow necessary to maintain ecosystem health and protection of traditional and customary practices simply as no additional pumpage above 2014 values (max reported 12-month moving average = 14.161 mgd). The relative percentages of pumpages and coastal leakage requested by the petition are summarized in the Table 1 below:

Table 1

WRPP Minimum	mgd	Maximum 2014 12-MAV	Pumpage	Coastal leakage
Sustainable Yield	38	14.161	37%	63%
Recharge	86	14.161	16%	84%

The petition also provided evidence of increases in two (2) anchialine and the Aimakapa pond salinity since 1963 (see Exhibit 11) and has listed a number of species that are sensitive to increases in chlorides due to reduced coastal leakage affecting anchialine, fishponds, and near shore waters.

Through the testimony and presentations to date, it appears the euryhaline species (i.e. opae`ula (*Halocaridina rubra*) & mullet `ama `ama (*Mugil cephalus*) have adapted to the wide range of salinities typically found in tidal zones. The Division of Aquatic Resources (DAR) of the Department of Land and Natural Resources (DLNR), opined that:

“The majority of the aquatic flora and fauna found in the anchialine pools and fish ponds within the boundaries of Kaloko-Honokohau National Historical Park can tolerate fluctuations in salinities within a wide range. In addition, aquatic flora and fauna found within the nearshore environment of the Kaloko-Honokohau National Historic Park are mostly marine species with only a few that can tolerate and acclimate to a brackish water environment. As long as there is some source of freshwater, whether it be from rainfall, surface runoff, or groundwater flow, the biological and ecological integrity of aquatic resources within this area will not be compromised.” – Exhibit 12

Historical data available from the three (3) observation wells within the Park show evidence of no significant rise in conductivity since 2009. Unfortunately, no data between the original date of construction in 1996 and 2009 were reported or have been produced to date. It is important to note that these wells are also inland from the pond areas with kiawe trees and the shoreline tidal zones that affect chloride concentrations.

Again, data since 2008 from the three (3) monitoring wells required by the production well construction permits, six (6) other monitoring wells at Kohanaiki Shores, LLC and the three (3) monitoring wells within the Park have shown little to no increases of chlorides (see Exhibit 9). In fact, the data indicates a freshening of water since 2008 in both areas most likely due to fresher return irrigation water for the golf course from the desalinized brackish basal ground water and the proper disposal of the reject water deep into saltwater below the thin basal lens. Nutrient increases had occurred due to the grow-in period of the golf course but seem to be returning to original conditions and proper course maintenance should control this.

However, of all the listed biota and salinities in the Parks ponds, it would appear the native orange-black Hawaiian damselfly (*Megalagrion xanthomelas*) is the critical species regarding salinity. This is summarized in the following bullets:

- The petition references “The effect of salinity and temperature on survival of the orange-black Hawaiian damselfly, *Megalagrion xanthomelas*”, University of Hawai`i and U.S. Geological Survey researchers found that “naiads [larva] also displayed a threshold response to salinity above 15 ppt with no naiads surviving at 20 ppt despite successful hatch observed at this salinity” (Tango 2010) (see Exhibit 13). One of the anchialine pools in the Park where the candidate-endangered orange-black Hawaiian damselfly has been observed (HA_Kaloko_007) was sampled 15 times between 2004 and 2009. Salinity averaged 13.77 ppt with a minimum of 11.84 ppt and a maximum of 15.33 ppt. While it is important to be cautious about extrapolating thresholds derived from laboratory experiments to field conditions, it is also important to recognize that this pool is near the published threshold for the damselfly larva and that increased pumping, if not optimally located, may increase salinity beyond this threshold.

- Though not brought up in the original petition, but later in response to the Commission's Preliminary Order HA-WMA 2013-1 (Order)(C.3.b&c), the petitioner reported on quantities needed for traditional and customary practices that the damselfly was used in spiritual offerings and rituals (pg. 20 - <http://files.hawaii.gov/dlnr/cwrm/activity/keauhou/20150529TraditionalCustomaryPracticesReport.pdf>).
- As of October 31, 2016, the U.S. Fish & Wildlife Service (USFWS) has now listed the native orange-black Hawaiian damselfly as an endangered species. However, no critical habitat rules or conservation plans have been published to date. Also, no evidence has been presented that show the damselfly is important to traditional and customary practices.

Staff is taking the position that the petitions proposed percentages in Table 1 limit the utility of the aquifer for other beneficial and public trust uses (i.e. domestic) besides the public trust use of traditional and customary practices. Ultimately, it is up to the Commission to decide on the balance between public trust uses and, again, this should be done through the larger discussion within the Commission's 2017 Water Resource Protection Plan (WRPP) update.

(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.*

Staff does not accept the petitioner's opinion that this criterion is met. Criterion 8 speaks to water developments, such as wells or stream diversions that may result in the previous 7 groundwater designation criteria being met. Instead, the petition has an Appendix C that lists an additional 19 mgd of future demands based on Environmental Impact Statements and other State and County land use approvals since 1990. This is looking at end uses rather than source developments.

Though not mentioned in the petition, the installed capacity of all wells in the *Keauhou Aquifer System Area* (KASA) is approximately 35.5 mgd. This constitutes 93% of the sustainable yield. However, wells are almost never pumped on a 24-hour basis and most pumps are sized to accommodate peak demand and fire flow needs. Therefore, staff's opinion is that the installed capacity is highly unlikely to result in meeting the criterion (1). So far, the installed capacity has shown no evidence of the other criteria being met with the exception of the localized upconing at the Kahaluu Shaft analyzed earlier in this submittal.

Further, for the sake for argument, these end use demands also do not appear to result in any of the previous seven (7) criteria. For criterion (1), the difficulty is assessing how much groundwater for these projects is already accounted within the current *Keauhou Water Use and Development Plan* (KWUDP) Phase I. The Keauhuolu and Kealakehe projects are already accounted for under the State Department of Hawaiian Home Lands (DHHL) reservation and are a part of the authorized planned use figures in the criterion (1) analysis. Even if all these estimates are in addition to current pumpage of 15 mgd, the total would be 34 mgd, which would constitute 89% of the sustainable yield of 38 mgd.

Staff's opinion is that these projects listed in the petition are already accounted for the authorized planned use under *Keauhou Water Use and Development Plan* (KWUDP) Phase I. Phase 2 of the KWUDP address well location optimization and staff processing of the well construction permits by incorporating Aha Moku review will to prevent any of the above conditions occurring.

CONCLUSION:

In staff's opinion, none of the eight (8) criteria analyzed meet the designation criteria as specified in the Water Code and its rules.

However, there is a need to protect the public trust needs and resource of both the Park and larger community of the *Keauhou Aquifer System Area* (KASA). Staff has described in this submittal and further proposes the following actions as alternatives to designation:

1. The Commission will refer all well permit applications to the Aha Moku system for review for recommendations to protect traditional and customary practices that are exercised and may be affected by the proposed application. If traditional and customary practices are found in the proposed

permit area that may be affected by the proposed action, special conditions will be suggested to mitigate impacts of the proposed well. If the well operator and land owner do not agree to the special conditions, then staff will present the applications to the Commission for decision making pursuant to Hawaii Revised Statutes (HRS) §174C-84 (f) and Hawaii Administrative Rules (HAR) §13-168-12(h).

2. For new private production wells within the Ahupua`a of Kaloko, Honokohau 1-3, or Kealakehe, as defined in the GIS coverages by State of Hawaii Office of Planning and the Office of Hawaiian Affairs (OHA) Kipuka Database, staff will encourage the applicant to install a deep monitor well beneath the thin basal lens into salt water between the new well and the Kaloko-Honokōhau National Historical Park (Park) if such a monitor well does not already exist.
3. Staff will complete the remediation of Keopu Deep Monitor Well (Well No. 3858-001) and the construction of the new Keopu 2 Deep Monitor Well (Well No. 3858-002) to further explore the deep freshwater aquifer.
4. Staff will provide for the conversion of the Kaloko Irrigation Well 1 (Well No. 4160-001) to a deep monitor well located due east and upgradient of the Kaloko-Honokōhau National Historical Park (Park). This well will be deepened to further explore the existence of the deep freshwater aquifer similar to the deep monitor wells of: 1) Kalaoa Keopu (Well No. 3858-001), and 2) Kamakana (Well No. 3959-001) and monitor changes due to pumpage in the area above the Park.
5. Staff will continue to monitor pumpage, water levels, and chlorides through the monthly reporting program. Reporters who are delinquent in reporting will be brought to the Commission for enforcement and sanctions at the discretion of the Chairperson.
6. If authorized planned use reaches eighty percent (80%) of the Keauhou Aquifer System Area (KASA) sustainable yield (which currently equates to 30.4 mgd of 38 mgd), then the Commission will commence public informational meetings in the Keauhou Aquifer System Area (KASA) in accordance with Hawaii Revised Statutes (HRS) §174C-44 & Hawaii Administrative Rules (HAR) §13-171-7.
7. If alternative water sources or future potable high-level sources in the southern portion of the Keauhou Aquifer System Area (KASA) as defined in the Keauhou Water Use and Development Plan (KWDUP) for the Keauhou Region fail to materialize and actual rate of withdrawal based on a 12-month moving average reaches forty-five percent (45%) of the sustainable yield (which currently equates to 17.1 mgd of 38 mgd), the Commission will commence public informational meetings. The forty-five percent (45%) figure is one-half ½ of the ninety percent (90%) criteria to be considered in designation proceedings and relates to the current well infrastructure that relies on the northern half of the Keauhou Aquifer System Area (KASA) to meet water demands. It is prudent to spread pumping uniformly throughout an aquifer when data and analysis do not show otherwise. This encourages the implementation of the Keauhou Water Use and Development Plan (KWDUP).
8. Staff will continue to work with and track the status of the U.S. Geological Survey 3-D solute transport modelling efforts. Staff will organize a briefing to the Commission when results are published.

RECOMMENDATION:

Based on the above and studies and records cited herein, staff recommends that the Chairperson recommends that the Commission deny the petition to designate the Keauhou Aquifer System Area as a groundwater management area and directs staff to further investigate the science of coastal leakage impacts for consideration in setting or adjusting sustainable yields in the upcoming Water Resource Protection Plan update. The Commission will continue to closely monitor the Keauhou Aquifer System Area to protect and ensure the health of the aquifer and all public trust uses therein in accordance with the eight (8) actions described in the conclusion section of this submittal.

Respectfully submitted,



JEFFERY T. PEARSON, P.E.
Deputy Director

APPROVED FOR SUBMITTAL:



SUZANNE D. CASE
Chairperson

- Exhibit(s):
1. Petition
 2. Keauhou Aquifer System Area maps
 3. Designation Process
 4. Profile of Keauhou Aquifer System Area sustainable yield estimate.
 5. Keauhou Aquifer System Area Historical Pumpage to November 2016
 6. State Department of Health quality degradation position, December 9, 2014
 7. (a.) Basal water levels near Park (b.) High-level water levels
 8. Kahaluu Shaft (3557-005) historical chlorides and pumpage
 9. National Park Service & Kohanaiki Shores, LLC observation well conductivity
 10. Honolulu Board of Water Supply conservation program effects on pumpage
 11. Increases in salinity at National Park Service anchialine ponds, pg. 29 of petition
 12. October 20, 2014 DAR memo on Nation Park Service biota
 13. Orange-black Hawaiian damselfly (*Megalagrion xanthomelas*) salinity tolerances
 14. National Park Service comments on 2017 WRPP update, January 15, 2014

Exhibit 1. Petition (attach in final) – see
<http://files.hawaii.gov/dlnr/cwrn/activity/keauhou/20130913gwmap.pdf>

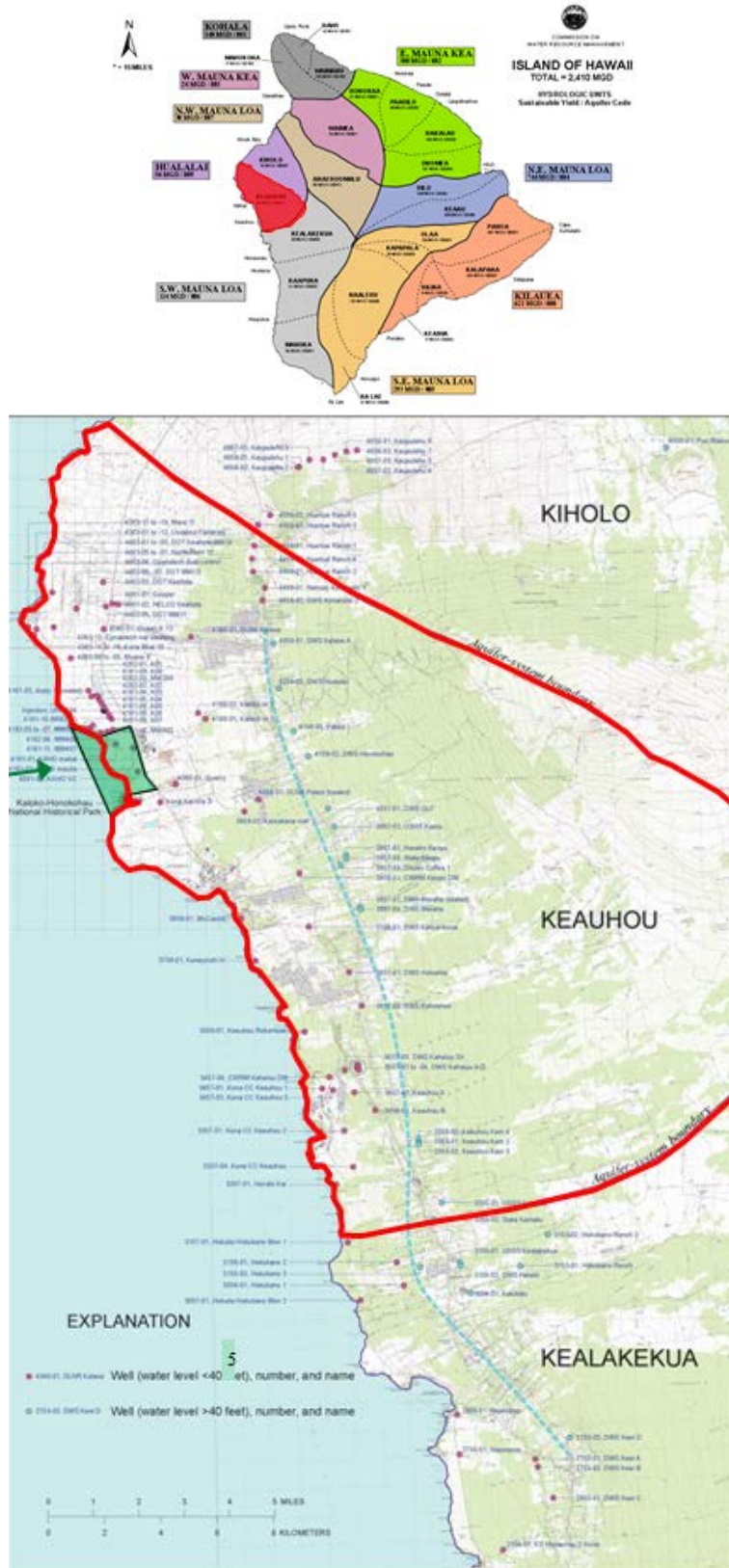


Exhibit 2. Keauhou Aquifer System Area maps

11x17 enlargement of second map

Designation Process

(HRS §174C-41 to 46, HAR §13-171-3 to 9)

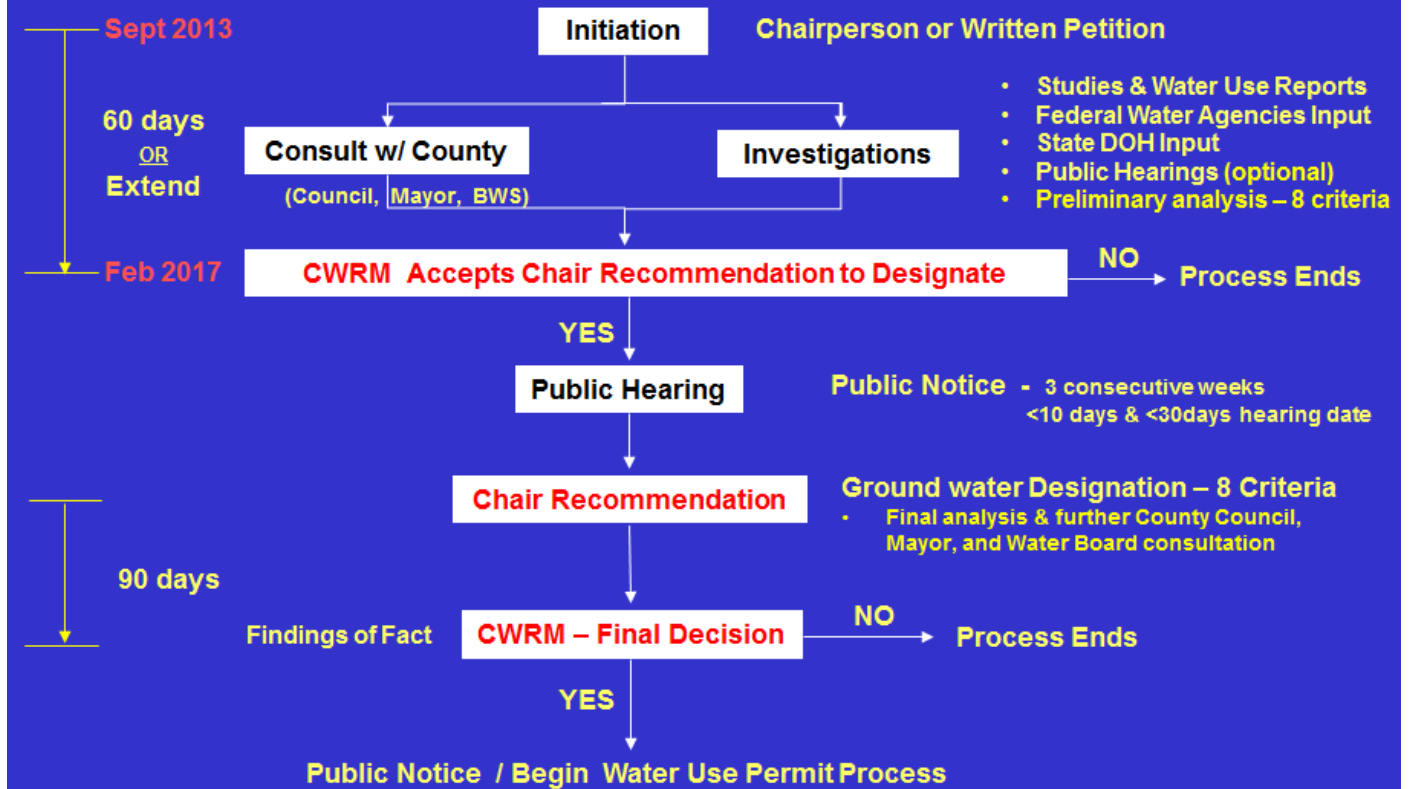


Exhibit 3. Designation Process

Ground Water

Resource Assessment – Keauhou Aquifer System Area Sustainable Yield

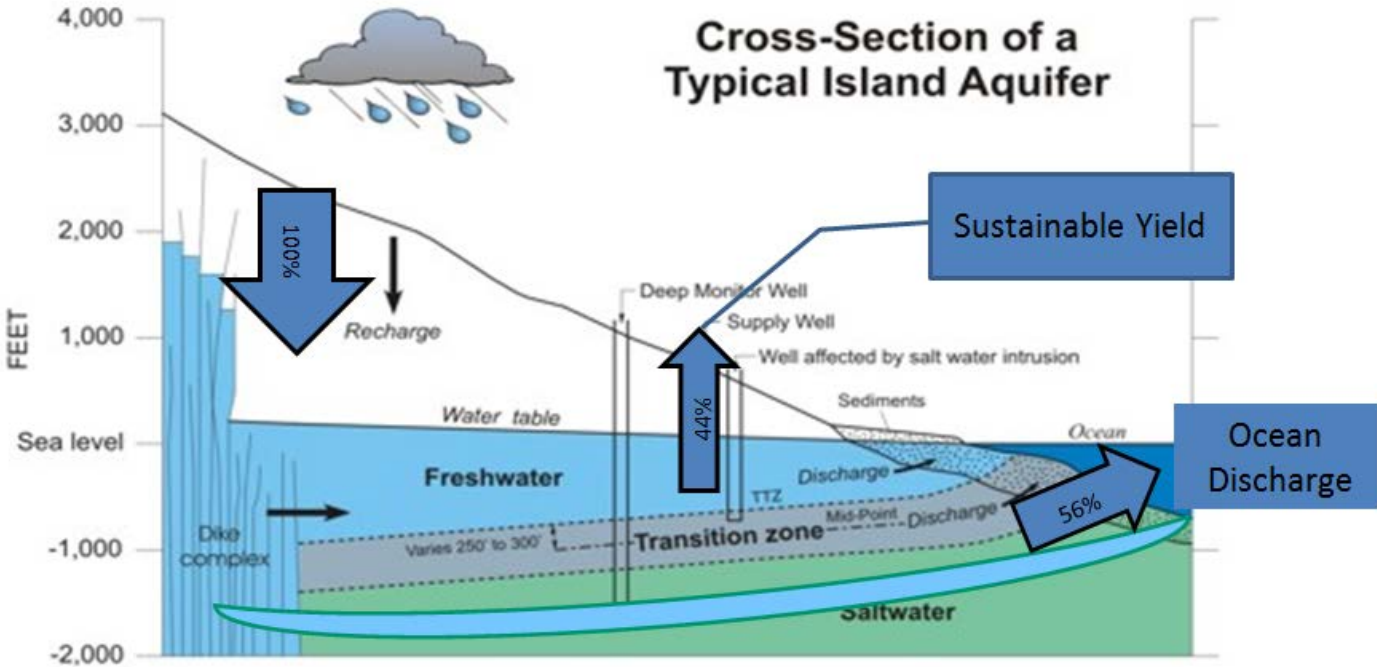


Exhibit 4. Profile of Keauhou Aquifer System Area sustainable yield estimate.

Monthly Pumpage Chart
12 Month Moving Average

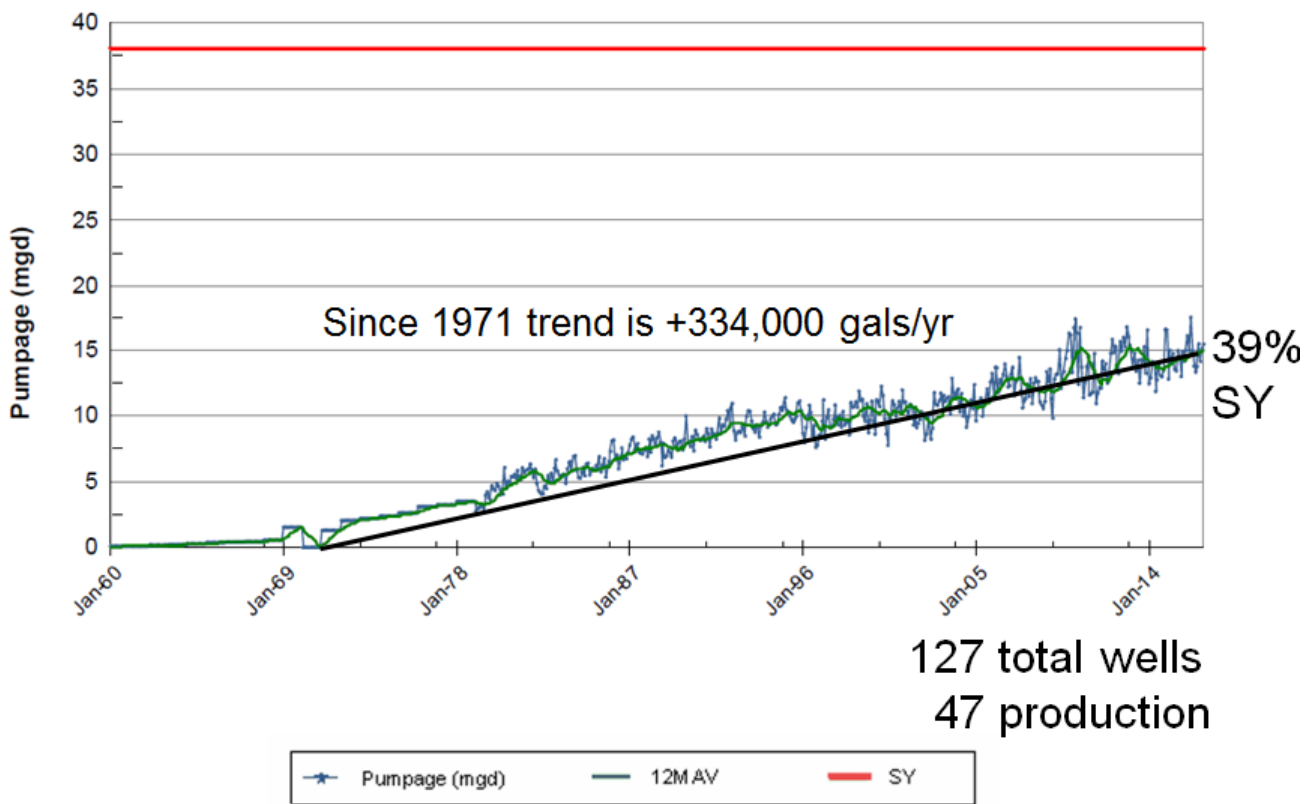


Exhibit 5. Keauhou Aquifer System Area historical pumpage

DAVID Y. IGE
GOVERNOR OF HAWAII



KEITH YAMAMOTO
ACTING DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. BOX 3378
HONOLULU, HAWAII 96801-3378

In reply, please refer to:
File: SDWB
Tam01.docx

December 9, 2014

Mr. William M. Tam
Deputy Director
Commission on Water Resource Management
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Attention: Mr. Roy Hardy

Dear Mr. Tam:

SUBJECT: PETITION TO DESIGNATE KEAUKOU AQUIFER SYSTEM AREA, NORTH KONA, HAWAII AS A GROUND WATER MANAGEMENT AREA

As requested by the Department of Land and Natural Resources, Commission on Water Resource Management (DLNR-CWRM), the Department of Health (DOH) has evaluated the subject petition to designate the Keauhou Aquifer System Area as a Ground Water Management Area.

Based on the enclosed document, the DOH position is that "there is not a deterioration of groundwater quality in the Keauhou Aquifer System Area."

If you have any questions, please contact Ms. Joanna L. Seto, P.E., Safe Drinking Water Branch Chief, at 586-4258.

Sincerely,

A handwritten signature in blue ink, appearing to read "G. Gill".

GARY GILL, DEPUTY DIRECTOR
Environmental Health Administration

JS:mc

Enclosure: Current and Future Water-Quality in the Keauhou Aquifer Sector

- c: Mr. Roy Hardy, DLNR-CWRM (w/ encl.) [via Roy.Hardy@hawaii.gov only]
- Ms. Lenore Ohye, DLNR-CWRM (w/ encl.) [via Lenore.N.Ohye@hawaii.gov only]
- Mr. Neal Fujii, DLNR-CWRM (w/ encl.) [via Neal.D.Fujii@hawaii.gov only]
- Clean Water Branch (w/ encl.) [via email only]
- Wastewater Branch (w/ encl.) [via email only]
- Solid and Hazardous Waste Branch (w/ encl.) [via email only]
- Hazard Evaluation and Emergency Response Office (w/ encl.) [via email only]

Exhibit 6. DOH Determination of Water Quality Degradation

Mr. William M. Tam
December 9, 2014
Enclosure Page 1

Current and Future Water-Quality in the Keauhou Aquifer Sector

The Hawaii Department of Health (DOH) submits this document on the petition submitted by the National Park Service on September 13, 2013 to designate the Keauhou Aquifer Sector a Water Management Area (WMA). Hawaii Revised Statutes (HRS) Chapter 174C, State Water Code, tasks the Department of Land and Natural Resources (DLNR), Commission on Water Resources Management (CWRM) with designating an aquifer as a WMA if scientific investigations and research determine that the water resources may be threatened by existing or proposed withdrawals. A WMA designation allows CWRM to establish administrative control over the withdrawals in the aquifer sector to ensure reasonable beneficial use of the water resources in the public interest.

The Hawaii Water Code, HRS §174C-44 sets out eight (8) criteria to be considered in designating a groundwater management area. Criteria No. 2 provides a declaration whether or not "[t]here is an actual or threatened water quality degradation as determined by the department of health." This letter addresses that requirement.

Activities that could degrade water quality in the Keauhou Aquifer include:

1. Over-withdrawal of groundwater resulting in increasing salinity of the aquifer;
2. Chemical contamination resulting from industrial activities;
3. Chemical and nutrient contamination resulting from agricultural activities;
4. Chemical and nutrient contamination resulting from residential and resort development; and
5. Chemical and nutrient contamination resulting from wastewater disposal.

Of the five (5) activities stated above, over-withdrawal of groundwater resulting in increasing salinity in the aquifer and wastewater disposal are the most likely activities to degrade the water quality of the Keauhou Aquifer.

Over-withdrawal of groundwater can cause increasing salinity due to saltwater intrusion. Current pumpage appears to be having little adverse effect on the salinity of the Keauhou Aquifer. Past higher pumpage from the Kahaluu Shaft resulted in a significant increase in salinity, elevating the chloride concentration in the extracted groundwater. However, by shifting groundwater withdrawals from the Kahaluu Shaft to new wells drilled in the high water level areas of the Keauhou Aquifer, the increasing chloride concentration trend has been reversed. The chloride concentration at the Kahaluu Shaft decreased from a high of about 450 mg/L to the current concentration of 150 to 300 mg/L (<http://hi.water.usgs.gov/recent/westhawaii/chloride.html>).

Shifting pumpage to the high level aquifers is being done to relieve stress on the basal aquifer. Data presented by the major water resource engineering firms and the National Park Service show no increase in the salinity of the basal aquifer that corresponds to increasing pumpage of the high level aquifer (Bowles, 2014; Cutillo and Beaver, 2014; and Nance, 2014). However, there are two major considerations when evaluating the impact of high level pumpage on basal water quality: 1) Due to the barriers that retard the flow of high level groundwater to the basal aquifer, it could take decades for the full impact of pumping the high level aquifers to be felt at the basal aquifer; and 2) the nature of the barriers that constrain the groundwater to the high elevations and the connectivity between high level and basal water are poorly understood. Thus there is insufficient data at this time to make any definitive assessments regarding the impact of pumping the high level aquifer on water quality in the basal aquifer. However, it is

Mr. William M. Tam
December 9, 2014
Enclosure Page 2

important to note the sustainable yield of 38 million gallons per day (mgd) established for the Keauhou Aquifer by CWRM is 25 percent of the 152 mgd recharge to this aquifer estimated by the USGS (Engott, 2011). Stated another way, increasing the pumpage from the current 15 mgd in the Keauhou Aquifer to the sustainable yield would result in about a 17 percent reduction in coastal discharge. This calculation assumes that all recharge to the Keauhou Aquifer that is not captured by wells discharges near the coast. The actual impact of high level aquifer pumpage on the amount and distribution of coastal groundwater discharge is dependent on the degree connectivity to the basal aquifer and the location of the high level pumpage. Since the connectivity between the high level aquifers is poorly understood the impact on the Kaloko-Honokohau National Historical Park cannot be determined at this time.

Anthropogenic activities at or just beneath the ground surface can adversely impact groundwater quality. There are no current groundwater quality problems in the Keauhou Aquifer. A review of the drinking water contamination database found no detections of regulated drinking water contaminants. Reviewing other groundwater quality data also showed no significant deterioration of groundwater quality. A USGS study in 1999 (Oki, 1999) found only a low concentration of Phenol and relatively low levels of nutrients in the groundwater near the Kaloko-Honokohau National Historic Park. The nitrate concentrations in the Keauhou Aquifer are generally less 1.5 mg/L, a nitrate concentration that is fairly common in Hawaii. When compared to normal background concentration of about 0.5 mg/L for Hawaii Island or the background nitrate concentration of 1 mg/L for Oahu (Hunt, 2004), a nitrate concentration of 1.5 mg/L does indicate some anthropogenic impact to groundwater quality. However, the Hawaii Island background concentration of 0.5 mg/L is only a general benchmark. In the neighboring Kiholo Aquifer, some drinking water wells have nitrate concentrations of up to 4 mg/L with no apparent anthropogenic source (Fackrell, 2014).

With development, both residential and resort, comes the need to dispose of wastewater. There are estimated to be up to 7,400 cesspools, and about 1,550 other on-site sewage disposal systems in the Keauhou Aquifer (data taken from Whittier and El-Kadi, 2014). There are also 12 wastewater injection wells. The Kealakehe Wastewater Treatment Plant discharges treated wastewater into a pit near the coast. To date there is not an indication of a significant deterioration of groundwater quality due to wastewater disposal. However, wastewater chemical and isotopic indicators have been detected near or along the Keauhou coastline by Dailer et al. (2013), Hunt (2008), and Fackrell. (2014). Elevated concentrations of nitrogen in the groundwater is an indicator of groundwater quality degradation due to wastewater. In the basal aquifer, nitrogen concentrations vary from about 1 to 2 mg/L (Oki, 1999; Knee et al., 2008; Brock, 2014) concentrations above background, but not unusual for Hawaii groundwater. Also, with the exception of short periods when turf grass for golf courses was being established, these groundwater nitrogen concentrations have not changed significantly since the 1999 USGS study of groundwater in west Hawaii Island (Brock, 2014; Oki, 1999). Current upgrades underway at the Kealakehe Wastewater Treatment Facility and proposed revisions to the Hawaii Wastewater Regulations (Hawaii Administrative Rules Title 11, Chapter 62) that ban new cesspools and require upgrades of cesspools within 750 feet of the shoreline at the time a property is sold will mitigate future impacts to groundwater due to wastewater disposal.

To date and relative to other non-designated aquifers, there is not a deterioration of groundwater quality in the Keauhou Aquifer System Area.

Exhibit 6. DOH Determination of Water Quality Degradation

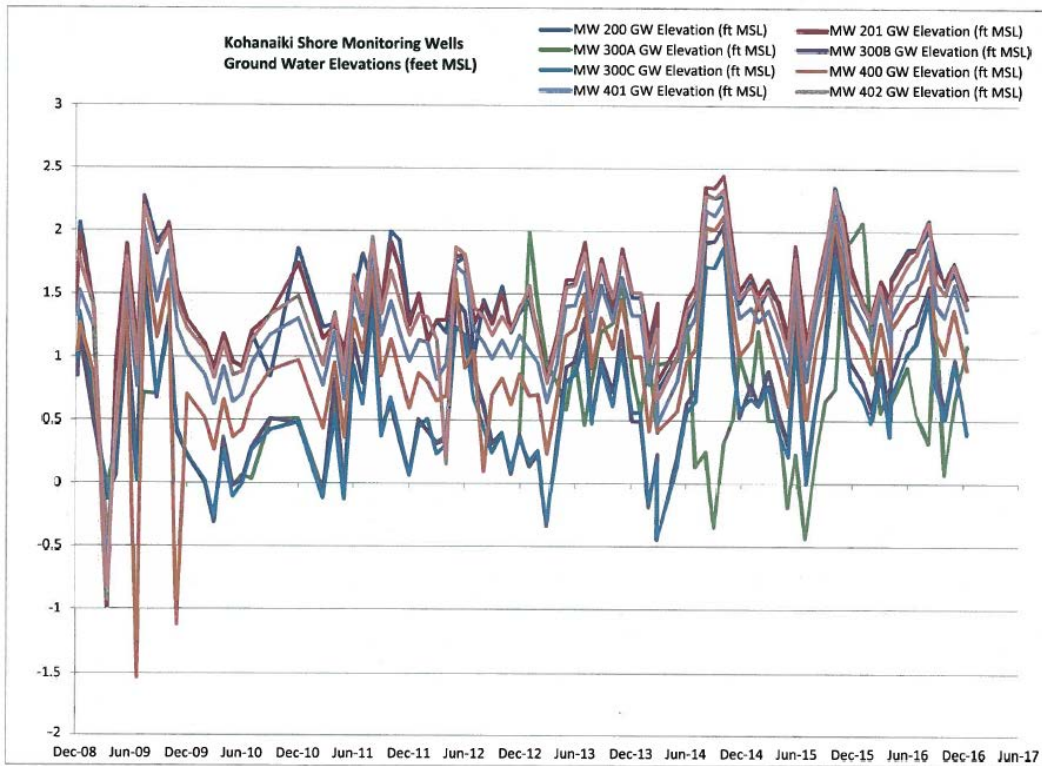
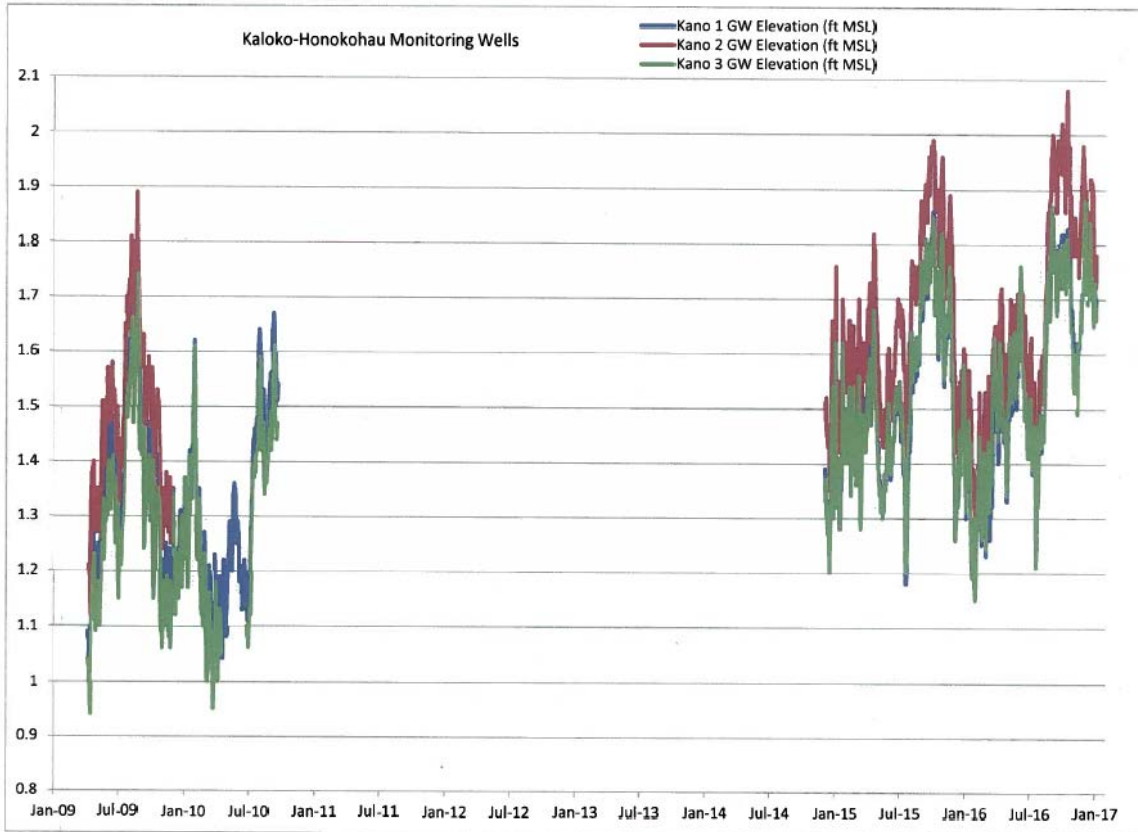
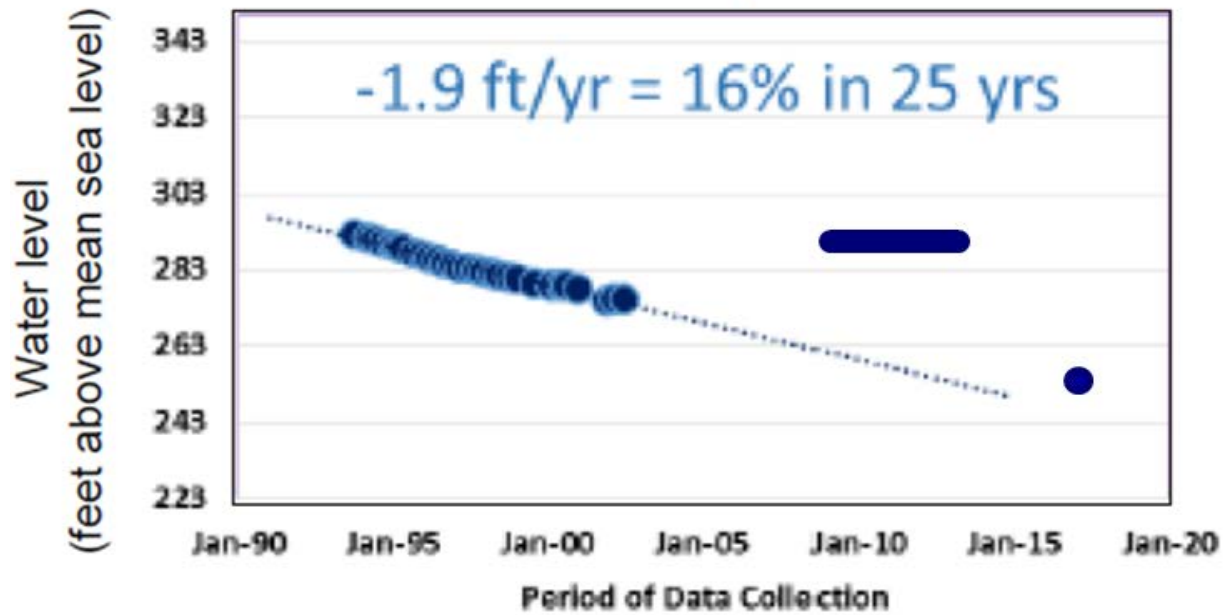
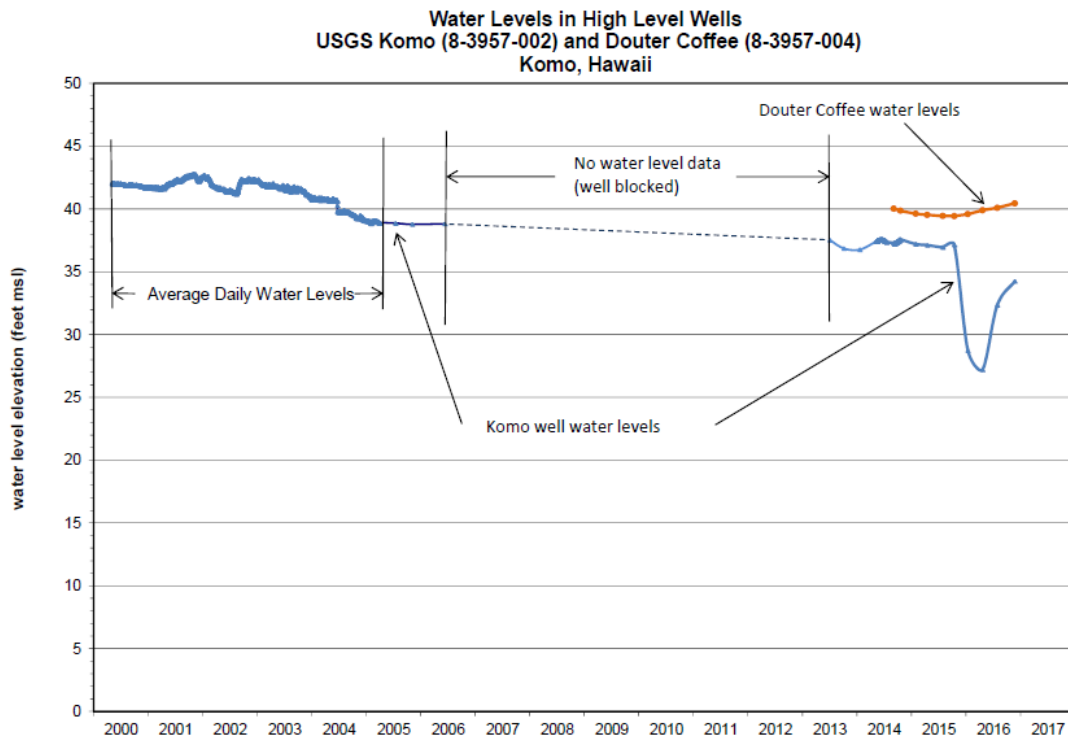


Exhibit 7a. Basal level water levels near Park

Hualalai Deepwell



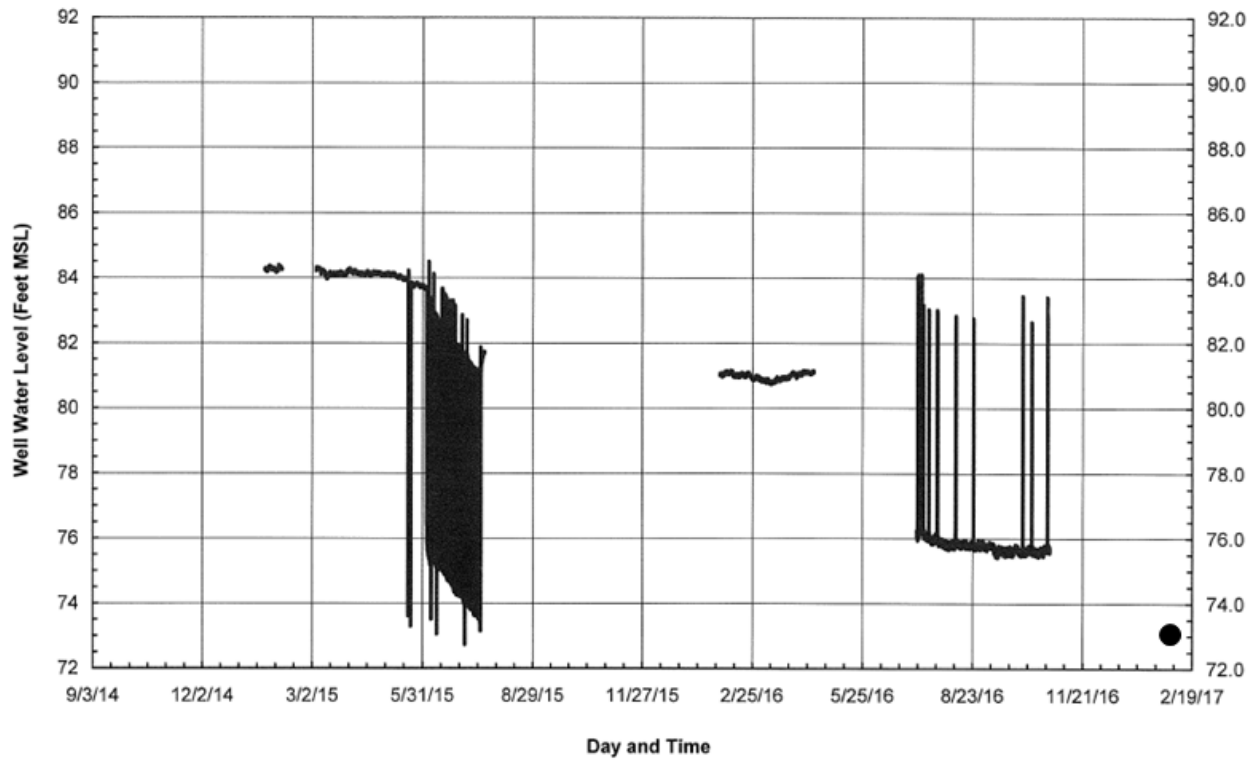
(Draft Findings of Fact, CWRM, 2014)



last updated 1/30/2017

Exhibit 7b. High-level water levels

Figure 8. Water Level in the Honokohau Well from January 2015 through October 25, 2016



Water Level in the Keopu Well from October 2014 through October 25, 2016

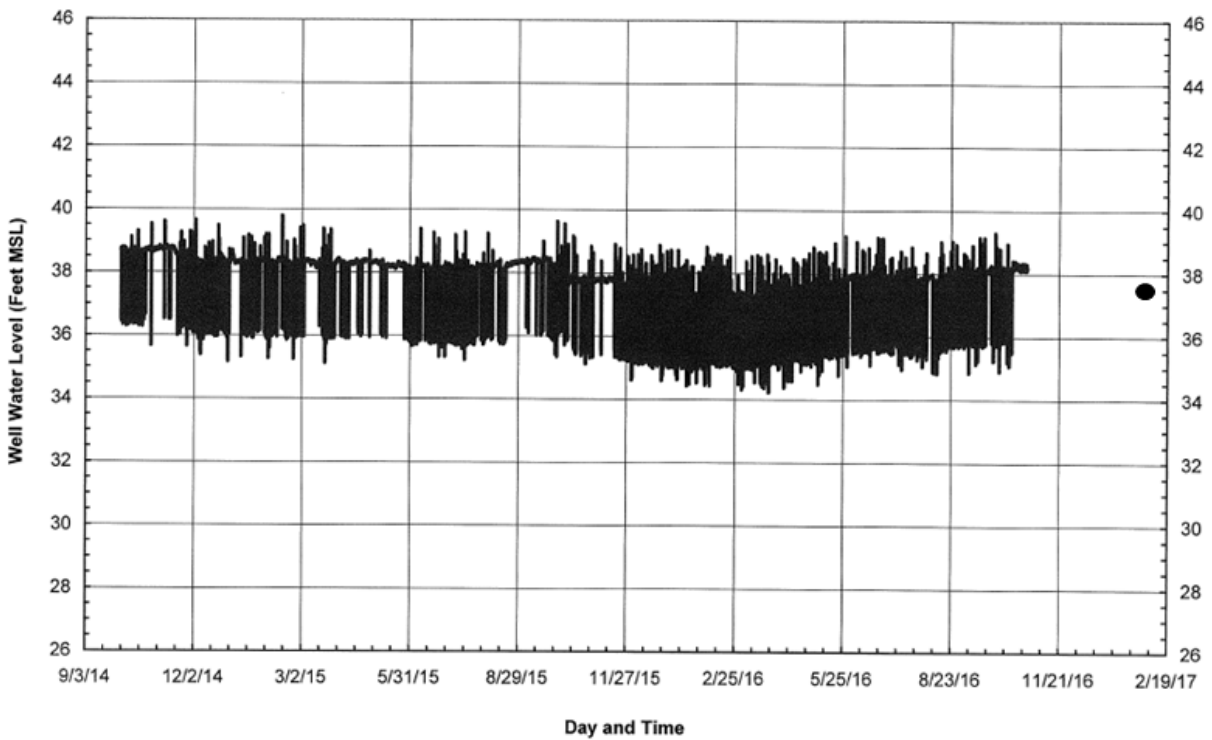


Exhibit 7b. High-level water levels

Water Level in the QLT Well from October 2, 2014 through October 25, 2016

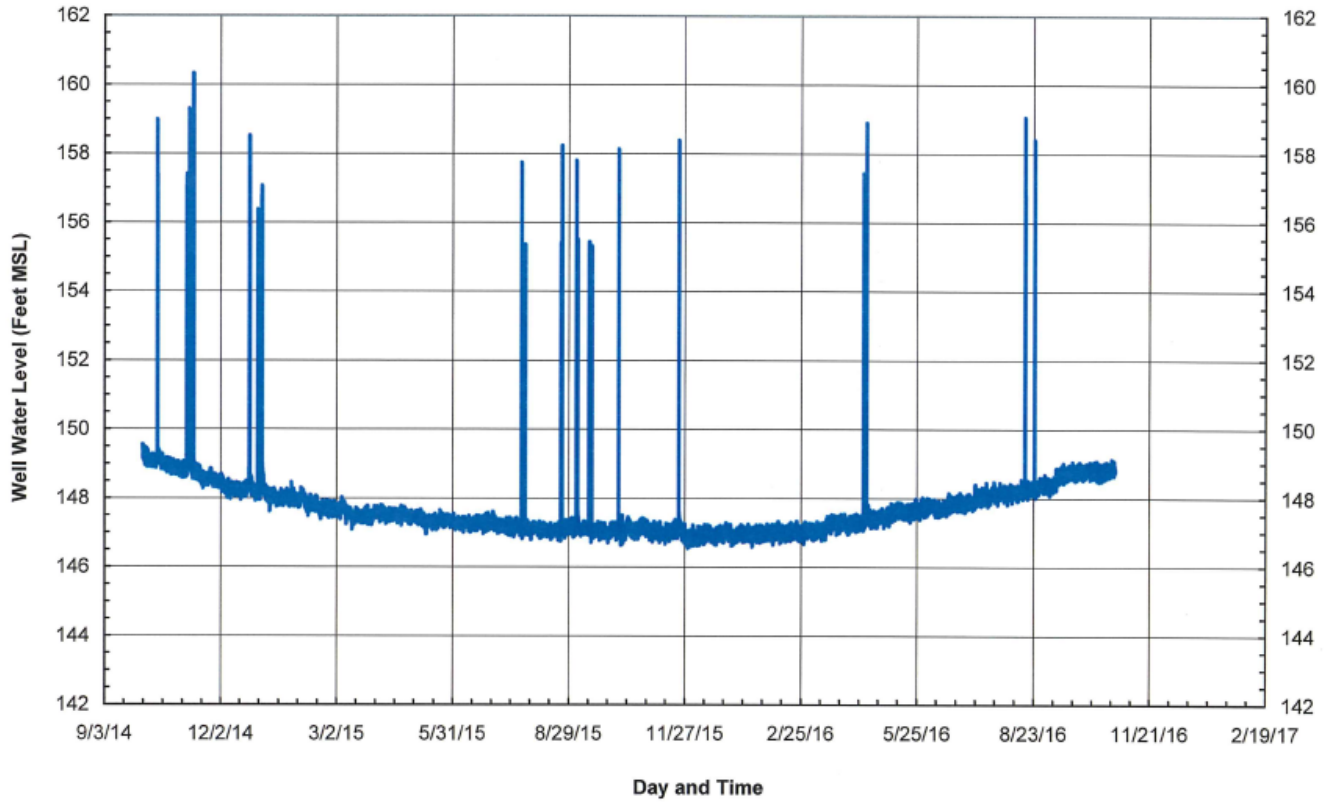
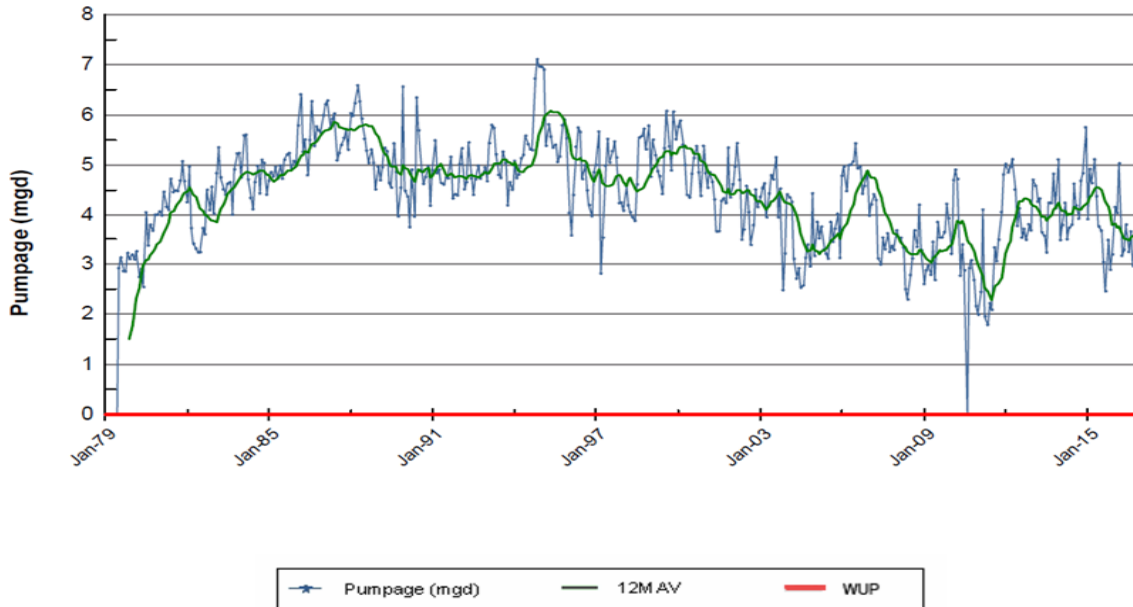


Exhibit 7b. High-level water levels

**Monthly Pumpage Chart
12 Month Moving Average
Kahaluu Shaft 3557-005**



Chloride Concentrations in Kahalu'u Shaft from 1980 through January 2017 in mg/L (ppm)

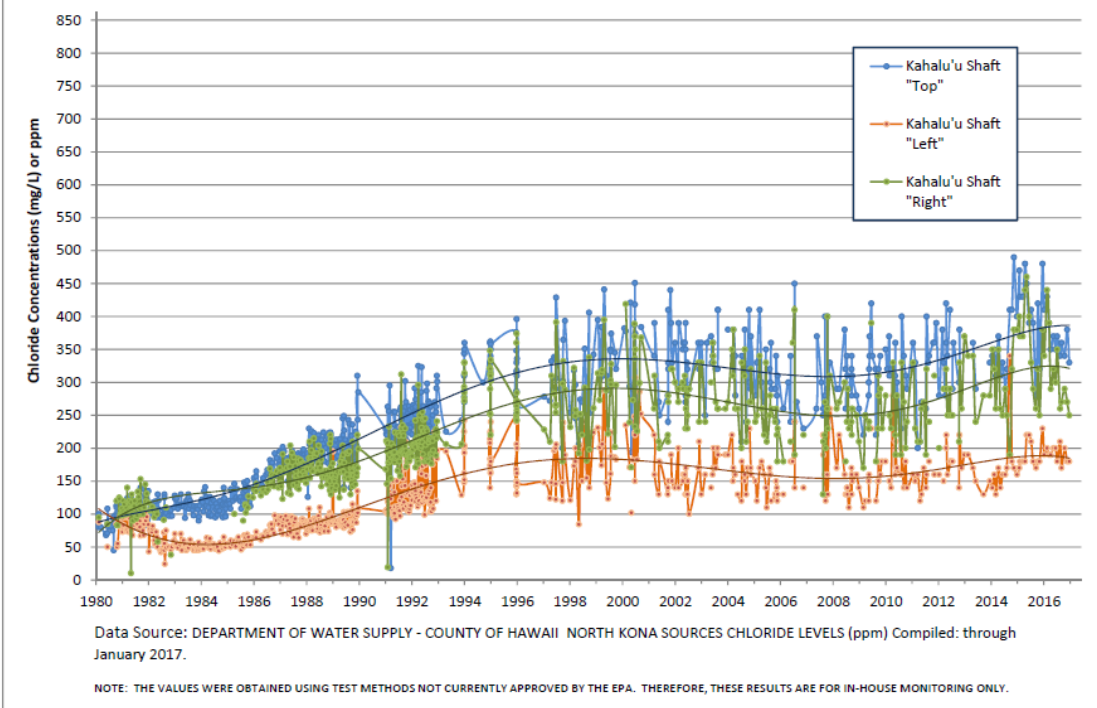


Exhibit 8. Kahaluu Shaft (3557-005) historical chlorides and pumpage

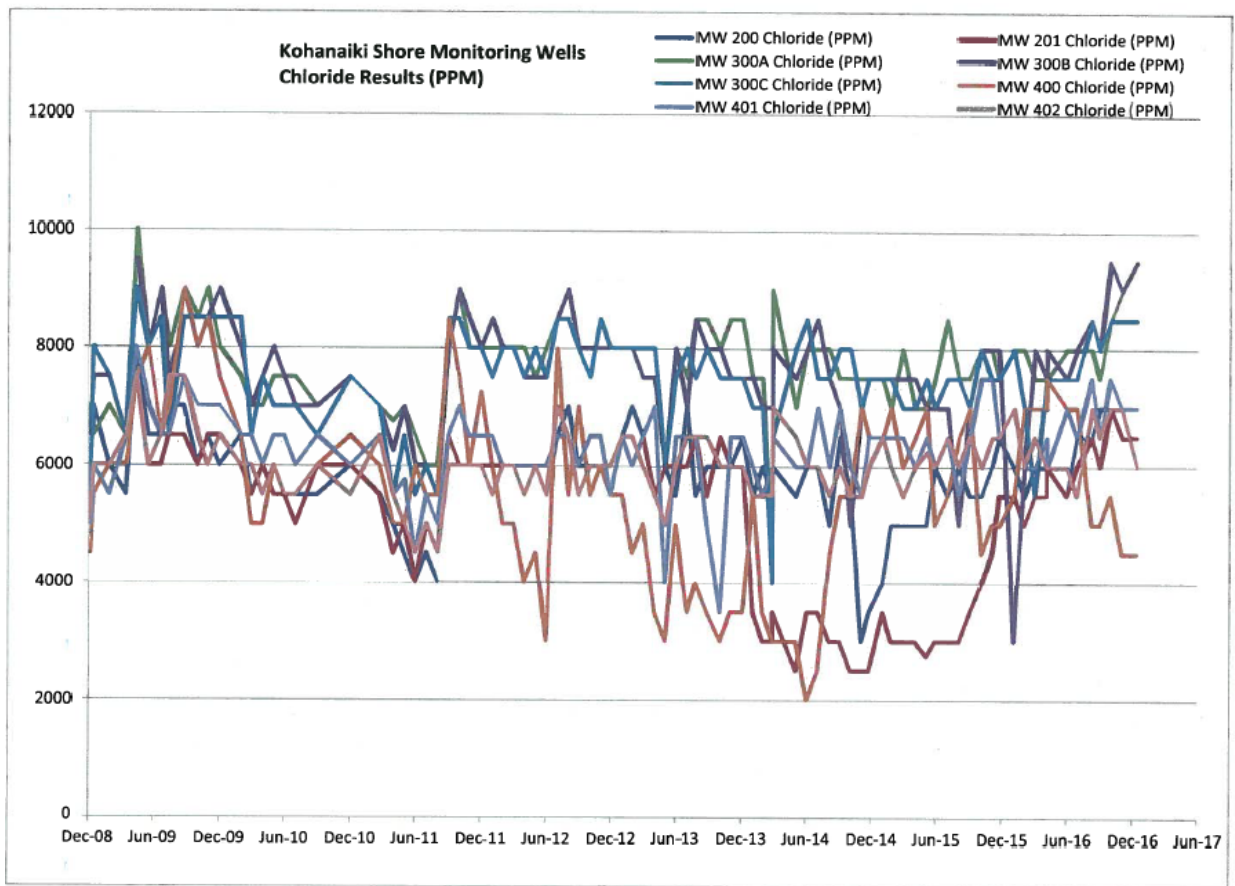
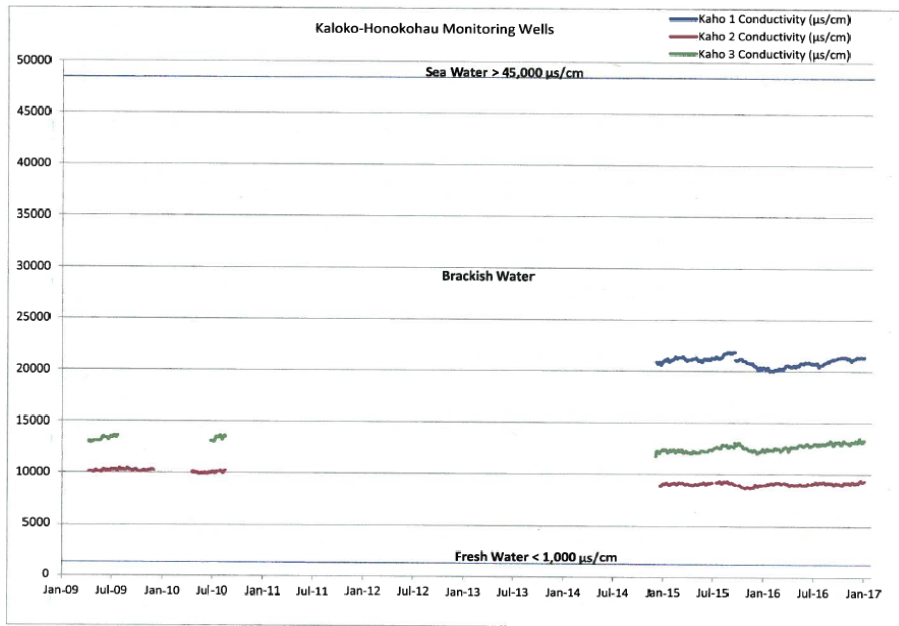


Exhibit 9. NPS & Kohanaiki Shores, LLC observation well conductivity

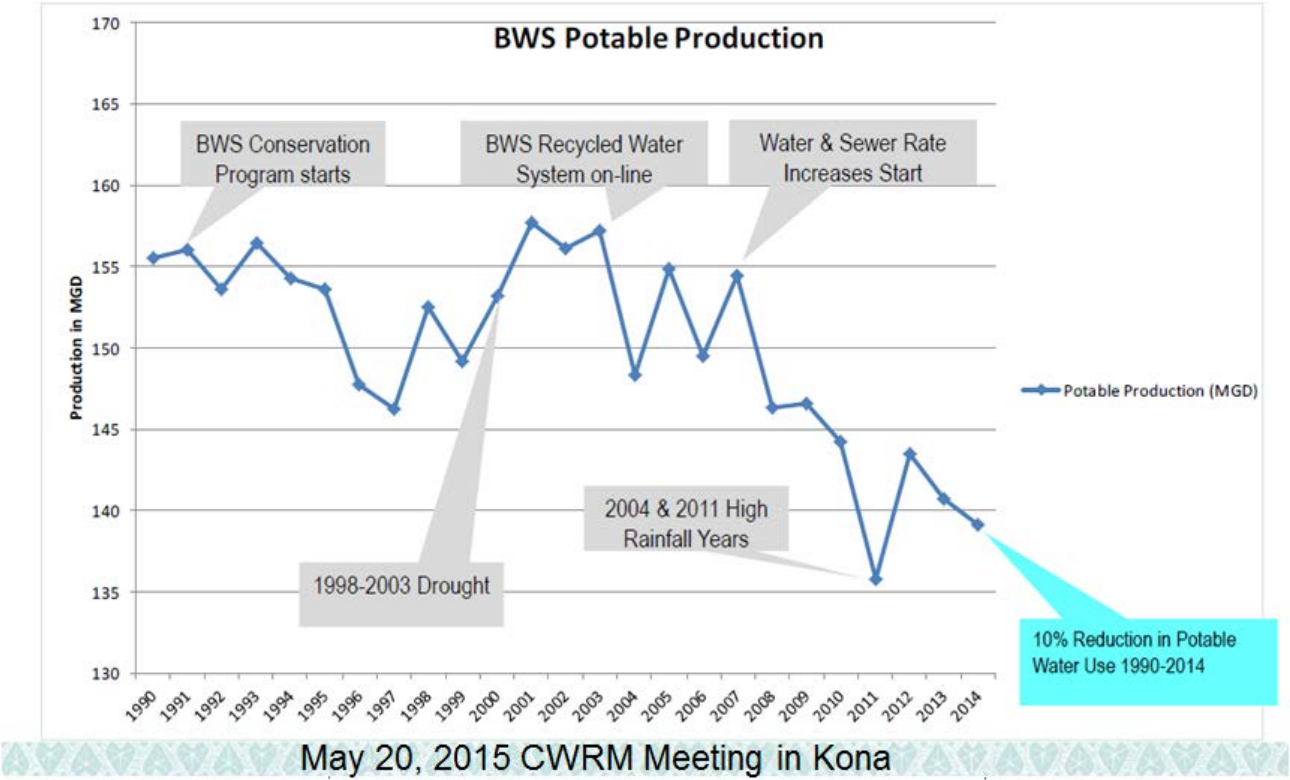


Exhibit 10. Honolulu BWS Supply conservation program effects on pumpage

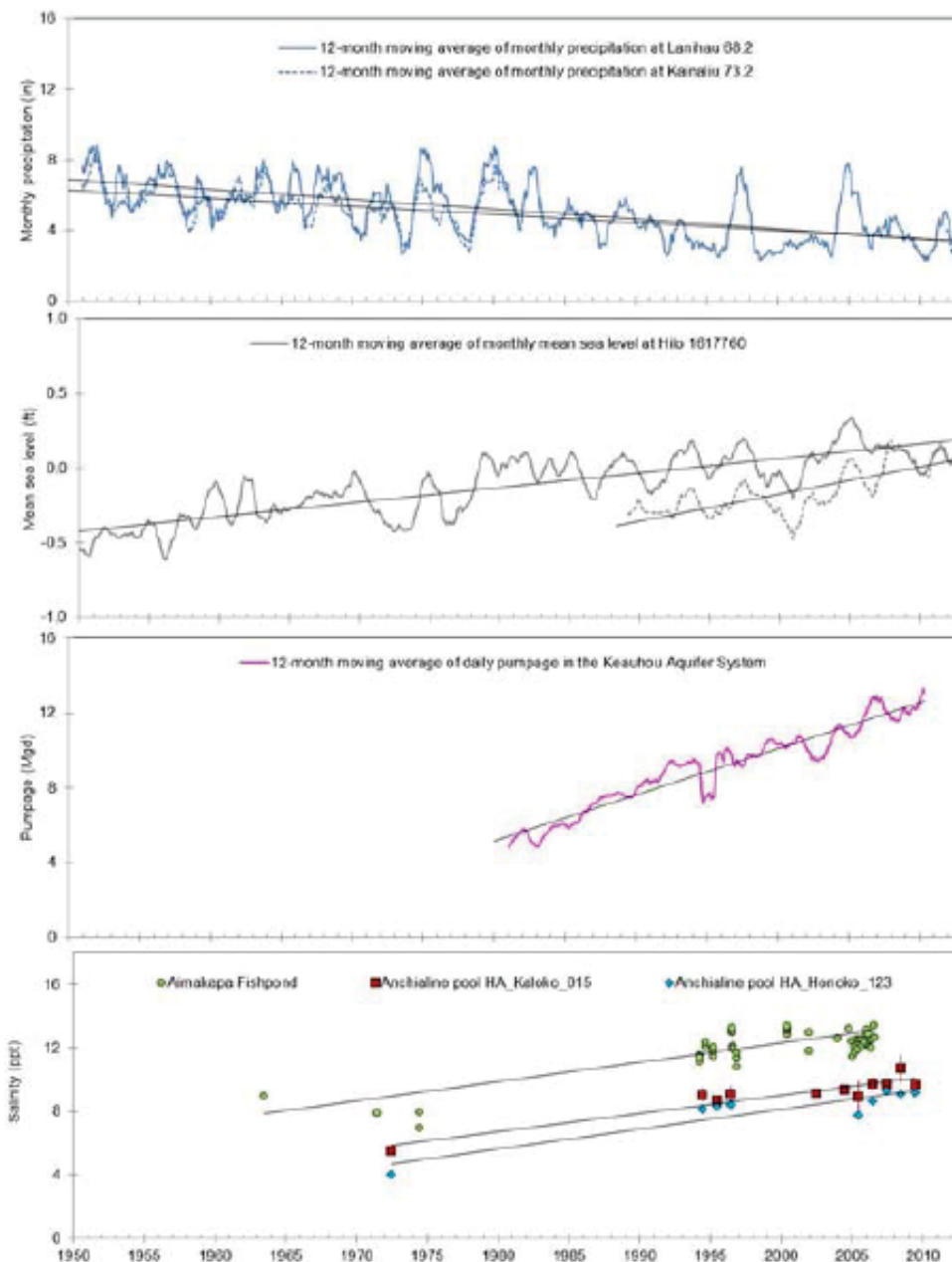


Figure 16. Twelve-month moving average and linear fits of monthly rainfall at two rain gauges in the Keauhou Aquifer System (<http://www.wrcc.dri.edu>), monthly mean sea level at two tide gauges in Hawaii (<http://tidesandcurrents.noaa.gov/index.shtml>), and reported average daily pumpage in the Keauhou 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).

Exhibit 11. Increases in salinity at KAHO anchialine ponds, pg. 29 of petition

NEIL ABERCROMBIE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF AQUATIC RESOURCES
1151 PUNCHBOWL STREET, ROOM 330
HONOLULU, HAWAII 96813
Telephone: 587-0100

WILLIAM J. AHA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

JESSE K. SOUKI
FIRST DEPUTY

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

October 20, 2014

MEMORANDUM

TO: William Tam, Deputy Director - Water
Frazer McGilvray, Administrator

FROM: Annette Tagawa, Aquatic Biologist

SUBJECT: Per CWRM Request - Comments Regarding the Petition to Designate the Keauhou Aquifer System a Water Management Area

The Kaloko-Honokohau National Historic Park provides a wide variety of aquatic resource habitats ranging from anchialine pools and fish ponds along the shoreline to nearshore coral reefs. Some of the animals that inhabit these areas may prefer brackish water environments, but they are by no means restricted to a narrow salinity range.

The National Park Service states that Kaloko-Honokohau contains more than 185 anchialine pools. The aquatic animals found to inhabit these pools include 3 anchialine pool shrimp: *Halocaridina rubra*, *Metabetaeus lohena*, and *Palaemonella burnsi*. All 3 shrimp species are considered to be true anchialine pool species where they are dependent upon the anchialine pool habitat for survival. The salinity in the anchialine pools at Kaloko-Honokohau averages approximately 15 ppt. *H. rubra* and *M. lohena* have been found to inhabit anchialine pools throughout Hawaii with salinities ranging from as low as 2 ppt. to >30 ppt. which demonstrates that they are adept in inhabiting a wide salinity range and are not limited (restricted) to live within a salinity of 15 ppt. *P. burnsi* are found in anchialine pools on Maui and the Big Island with salinities ranging from 9 to 27 ppt. In fact, specimens of *P. burnsi* were collected from Kaloko Fish Pond on August 26, 1972 where salinities were measured to be between 24 to 27 ppt. (Holthuis 1973).

The remaining species of concern by the National Park Service that utilizes the Park's anchialine pools is the orange-black damselfly, *Megalagrion xanthomelas*. The orange-black damselfly is not considered a true anchialine pool species as it is not dependent solely upon the anchialine pool environment for survival. Considered a coastal wetland species, this damselfly occupies a wide range of habitats from perennial streams to springs and seeps as well as reservoirs and ponds including, but not limited to, lower salinity anchialine pools (< 15 ppt.).

Two historical fish ponds are located within Kaloko-Honokohau: Kaloko Fish Pond and Aimakapa Fish Pond. Both fishponds are spring-fed producing brackish water with a salinity of 12 ppt. Brackish water environments are important for the juvenile stages of marine fishes such as aholehole, mullet and awa providing specific food sources for these species as juveniles as well as protection from predators. However, these species are not limited to salinities of 12 ppt. These fish as juveniles have also been known to inhabit and thrive in brackish water areas that have higher

Exhibit 12. October 20, 2014 DAR memo on KAHO biota

salinity at >25 ppt. In some of these areas, the higher end salinities are more conducive for the growth of diatoms providing more nutritional value for some juvenile species such as the pua or baby mullet.

Limu manaua, *Gracilariia coronopifolia*, is an endemic marine species of red algae that occurs in a wide variety of habitats. It is found on reef flats and eroded limestone, from mid-intertidal tidepools to shallow subtidal, up to 4 meters deep. Like any marine plant, high productivity occurs in areas with enhanced nutrient content of its surrounding waters. Freshwater entering the marine environment in the form of groundwater seepage or terrestrial runoff from rainfall and streams provides a good source of nutrients for the growth of edible algae like limu manaua. Other non-point sources of nutrients for edible limu have been attributed to freshwater surface runoff, groundwater seepage from cesspools, sewage treatment effluent, as well as agricultural runoff from agricultural crops such as sugar cane. However, with improved sewage treatment procedures and government regulatory effluent discharge requirements, and the decline of the sugar cane industry, reef areas that previously produced a high abundance of limu are no longer as productive. Prevailing ocean currents can also carry nutrients into surrounding areas increasing algae productivity as well. Limu manaua has also been cultured at the Anuenue Fisheries Research Center with seawater without the need of brackish water for growth. As long as the source of water used to produce limu manaua contains the proper nutrients it needs (regardless of salinity), this limu will continue to be productive wherever it is found in the marine environment.

The majority of the aquatic flora and fauna found in the anchialine pools and fish ponds within the boundaries of Kaloko-Honokohau National Historical Park can tolerate fluctuations in salinities within a wide range. In addition, aquatic flora and fauna found within the nearshore environment of the Kaloko-Honokohau National Historic Park are mostly marine species with only a few that can tolerate and acclimate to a brackish water environment. As long as there is some source of freshwater, whether it be from rainfall, surface runoff, or groundwater flow, the biological and ecological integrity of aquatic resources within this area will not be compromised.

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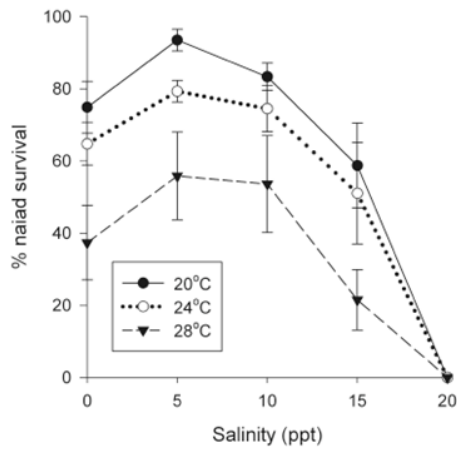
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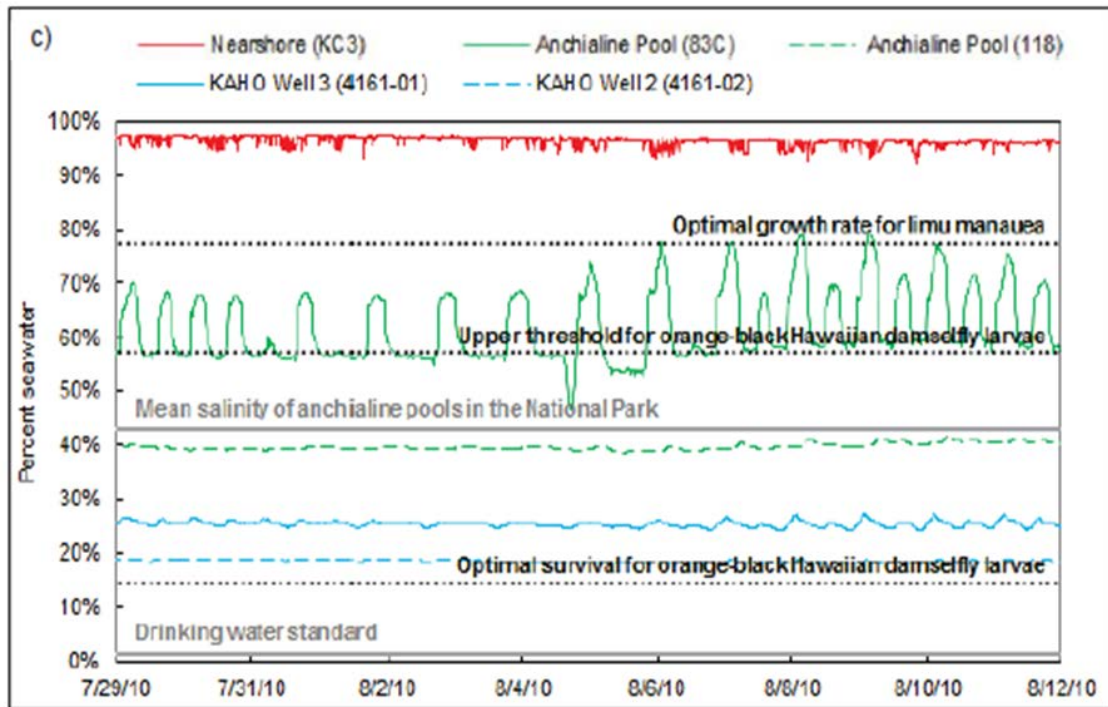
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Damselfly Larval Survival



(Tango 2010)



NPS Petition page 14

Exhibit 13. Orange-black Hawaiian damselfly (*Megalagrion xanthomelas*) salinity tolerances



United States Department of the Interior

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Pacific West Region
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IN REPLY REFER TO
N1619 (PWRH)

January 15, 2014

William M. Tam, Deputy Director
Commission on Water Resource Management
P.O. Box 621
Honolulu, Hawai'i 96809

Re: Agency Stakeholder Input on the Update to the Hawai'i Water Resource Protection Plan

Dear Mr. Tam:

Thank you for inviting me, as a representative of the National Park Service, to participate in the October 28, 2013 agency stakeholder meeting for the update to the Water Resource Protection Plan (WRPP). As part of the discussion at this meeting, your staff posed the following four questions to better understand the jurisdictions and responsibilities of various agency stakeholders and how the WRPP may be of use to them:

- *What is your one big water resource issue?*
- *What water issues are you currently dealing with that are outside of your jurisdiction?*
- *How can the WRPP better serve your agency?*
- *Who else should we be talking to?*

In a follow-up meeting on December 16, 2013, I and other representatives of the National Park Service and the U.S. Fish & Wildlife Service discussed these issues in more detail with your staff and Townscape, Inc. We greatly appreciate this opportunity to provide input as the Commission on Water Resource Management updates the WRPP.

Please find attached our written responses to the above questions. We look forward to continued collaboration with you and your staff in the stewardship of Hawai'i's water resources. Please contact me at (808)541-2693 x729 if you have any questions.

Sincerely,

M. Melia Lane-Kamahele
Pacific Islands Office Manager

Attachment: NPS Input on update to the Hawai'i WRPP

cc: J. Kimura (email), CWRM
Superintendent (email), Kaloko-Honokohau NHP
Superintendent (email), Kalaupapa NHP



National Park Service Input on Update to the Hawai'i Water Resource Protection Plan (WRPP)

- *What is your one big water resource issue?*

The big water resource issue for the National Park Service is conserving clean fresh water for fish and wildlife in parks. National Parks in Hawai'i encompass streams, estuaries, wetlands, wet forest, fishponds, anchialine pools, tidepools, and coral reefs. These resources support public health and the environment, the economy, and Hawai'i's cultural heritage by providing clean fresh water for aquatic species and water users.

Surface water diversions and groundwater withdrawals for drinking water, irrigation, and industrial processes, however, can interfere with the life cycles and habitat of aquatic species including culturally important and rare native plants and animals. Nonpoint-source pollution and wastewater disposal from adjacent developed lands also threaten the health and integrity of aquatic resources in parks.

The National Park Service is required by the Organic Act to prevent impairment of the cultural and natural resources for which each park unit was established. When there is a conflict between resource protection and use, we must ensure that conservation will be predominant so that we can pass the resources entrusted to our care unimpaired to future generations.

Some aquatic species in national parks are listed as endangered under the Endangered Species Act and some are candidates for listing as endangered or threatened. As a federal agency, the National Park Service is required under this law to use all necessary methods and procedures to conserve listed species and to insure that any actions authorized, funded, or carried out by the National Park Service are not likely to jeopardize either the survival or recovery of a listed species by reducing its reproduction, numbers, or distribution.

In addition to human activities, climate change further threatens the supply of fresh water for aquatic ecosystems in parks. Rainfall and base flow to streams in Hawai'i have been steadily declining over the past century and sea level is rising. Preserving the flow of fresh clean water to the culturally and nationally significant water-dependent resources in Hawai'i's national parks is a critical natural defense against these changes.

- *What water issues are you currently dealing with that are outside of your jurisdiction?*

The quantity and quality of water that flows into national parks is influenced by adjacent land and water uses. In Hawai'i, water use is managed by the Department of Natural Resources and water quality is managed by the Department of Health. The Hawai'i Department of Agriculture also manages irrigation systems on Oahu, Moloka'i and the Island of Hawai'i.

The State Water Code requires that such water management agencies take into account public trust uses of water such as the maintenance of waters in their natural state and traditional and customary Native Hawaiian practices. Collaboration with these water management agencies is therefore critical to preserving and protecting water resources in our parks.

- *How can the WRPP better serve your agency?*

The WRPP could better serve agency stakeholders if it provided guidance to the state's political subdivisions about their legal obligations to safeguard public trust resources including the maintenance of waters in their natural state and traditional and customary Native Hawaiian practices. For example, in non-designated water management areas, the responsibility for evaluating the effects of groundwater withdrawals on public trust resources such as native aquatic species and traditional and customary practices lies with the counties because there is no process requiring the Commission on Water Resource Management to consider the potential adverse effects to these resources in the approval of a well construction/pump installation permit.

However, there appears to be a large discrepancy in the level of consideration that county agencies give to these responsibilities when allocating water for different uses – the 2012 Honolulu Board of Water Supply Koʻolau Poko Watershed Management Plan explicitly identifies preserving native species and protecting Native Hawaiian rights and traditional and customary practices as objectives of the plan, whereas these public trust uses are not mentioned at all in the County of Hawaiʻi 2010 Water Use and Development Plan Update.

It would be helpful if the WRPP described the tools that are available to agency stakeholders to conserve water for public trust uses. For instance, can an agency seek a water reservation for public trust uses? Can the state reserve water for such uses outside of a designated water management area? Addressing these issues would make the WRPP a useful tool for the stewardship of water resources.

- *Who else should we be talking to?*

Office of Hawaiian Affairs
Department of Hawaiian Homelands
State of Hawaiʻi Department of Health
State of Hawaiʻi Department of Agriculture
U.S. Fish & Wildlife Service
The Nature Conservancy on Molokaʻi
Aha Moku Council for the Island of Molokaʻi
Cultural practitioners