J Yoshimoto
Chair & Presiding Officer
Council District 2

Telephone: (808)961-8272
Facsimile: (808) 961-8912
Email: jyoshimoto@co.hawaii.hi.us

HAWAI'I COUNTY COUNCIL

Office of the County Clerk
County of Hawai'i
25 Aupuni Street
Hilo, Hawaii 96720

October 2, 2013

William J. Aila, Jr., Chairperson
Commission on Water Resource Management
P.O. Box 621
Honolulu, HI 96809

Re: Request for County Consultation on the Kaloko-Honokōhau National Park Service Petition to Designate Keauhou Aquifer System Area (North Kona), Hawai'i as a Ground Water Management Area

Dear Chairperson Aila:

I am in receipt of your transmittal regarding the Commission's request for review and comment on the above-referenced Petition.

The Hawai'i County Council appreciates the opportunity to provide comment in this matter. However, the timing is not practicable. Our next noticed meeting is October 16, 2013, and the deadline for matters to be placed on that agenda has passed. I respectfully request that we be granted an extension of time in order for our Council to review the petition and to discuss this matter. A review of our upcoming meetings indicates that we will be able to allot sufficient time at the November 19, 2013 Committee day.

Also, given the complexity of this matter, may we request the presence of one of your staff members at the meeting to provide information and other guidance in order that our Council may make properly informed comment?

Again, we appreciate the opportunity to comment in this matter, and for honoring our request for an extension of time to fully participate. Please feel free to call me if you would like to discuss this matter further, or you may contact my legislative assistant, Amy Miwa (808-961-8015 or email at amiwa@co.hawaii.hi.us).

Very truly yours,

J Yoshimoto, Chair
Hawai'i County Council

Cc: Mayor William P. Kenoi
Quirino Antonio, DWS
Arthur Taniguchi, Chair BWS

DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAI'I
345 KEKŪANAŌ'A STREET, SUITE 20 • HILO, HAWAI'I 96720
TELEPHONE (808) 961-8050 • FAX (808) 961-8657

October 4, 2013

Mr. William J. Aila, Jr., Chairperson
Commission on Water Resource Management
P.O. Box 621
Honolulu, HI 96809

REQUEST FOR COUNTY CONSULTATION ON THE KALOKO-HONOKŌHAU NATIONAL PARK SERVICE PETITION TO DESIGNATE KEAUHOU AQUIFER SYSTEM AREA (NORTH KONA), HAWAI'I AS A GROUND WATER MANAGEMENT AREA

We received your letter of September 20, 2013, requesting the Water Board's review and comments on the petition referenced in the subject heading.

Unfortunately, the submittal was received too late to be agendized for the September 24, 2013, Water Board meeting. The next meeting is scheduled for October 22, 2013. We understand your 60-day deadline to make a recommendation for or against the petition's request is November 12, 2013. You requested review and comments on the petition prior to the Commission on Water Resource Management's (CWRM) next meeting of October 16, 2013. Because the Water Board will not meet again until after the CWRM's next meeting, the Water Board does not have sufficient time to submit its recommendation.

Therefore, on behalf of the Water Board and the Department of Water Supply, it is requested that a time extension to submit comments to a date after October 22, 2013 be granted.

Please respond to this request for additional time as our review of the petition is extremely important to the County of Hawai'i.

Should there be any questions, please do not hesitate to contact me by phone at (808) 961-8050 or email, qantonio@hawaiidws.org.

Sincerely yours,

Quirino Antonio, Jr., P.E.
Manager-Chief Engineer

QA:jms

copy – Honorable William P. Kenoi, Mayor, Hawai'i County
Honorable J Yoshimoto, Chairman, Hawai'i County Council
Honorable Arthur Taniguchi, Chairperson, Water Board

RECEIVED
COMMISSION ON WATER
RESOURCE MANAGEMENT
2013 OCT -7 PM 12: 14

William P. Kenoi
Mayor

Duane Kanuha
Director

Bobby Command
Deputy Director

West Hawai'i Office
74-5044 Ane Keohokalole Hwy
Kailua-Kona, Hawai'i 96740
Phone (808) 323-4770
Fax (808) 327-3563

County of Hawai'i
PLANNING DEPARTMENT

East Hawai'i Office
101 Pauahi Street, Suite 3
Hilo, Hawai'i 96720
Phone (808) 961-8288
Fax (808) 961-8742

October 8, 2013

2013 OCT 10 P 3:37

Mr. William J. Aila, Jr., Chairperson
Commission on Water Resource Management
Department of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

Dear Mr. Aila:

SUBJECT: Review of Petition to Designate the Keauhou Aquifer System as a Ground Water Management Area; North Kona, Hawai'i

Thank you for your letter dated September 24, 2013 requesting comments from this office regarding the subject Petition. We understand that the National Park Service (NPS), through the Superintendent of Kaloko-Honokōhau National Park, has filed the Petition to designate the Keauhou Aquifer System Area in North Kona as a Ground Water Management Area.

The Kona Community Development Plan (KCDP) was adopted by Ordinance No. 08-131, effective as of September 25, 2008. As requested, a copy of the KCPD has been enclosed for your convenience. The Kona Urban Area, an area designated for future growth in the KCDP, is located entirely within the subject Keauhou Aquifer System. Within the Kona Urban Area, growth will be directed to compact villages located along proposed transit routes or to infill areas within, or adjacent to, existing development. The general locations of these villages are within the Transit-Oriented Developments (TODs).

In addition, please note that one of the relevant policies of the KCDP is to support TOD development with water infrastructure: (PUB-4.1) *A priority shall be to provide an appropriately sized water transmission line within the Keohokalole Highway Corridor, and to flexibly enable water allocation policies to support the Kona CDP land use policy to concentrate growth within TODs, in lieu of sprawl.*

Due to the large area of the Keauhou Aquifer System, it will require more time for our office to research and provide the additional information requested by your agency, including the list of planned or proposed developments and the status of approvals for those developments.

Please extend the investigation and consultation period for an additional 30-day period to allow us sufficient time to prepare the requested information and finalize our comments on the petition.

In the meantime, if you have additional questions or if you need further assistance, please feel free to contact Bethany Morrison of this office at (808) 961-8138.

Sincerely,

DUANE KANUHA
Planning Director

BJM:cs
P:\wpwin60\Bethany\General Zoning Inquiries\CWRM-Petition to designate Keauhou Aquifer.doc

Enclosure: Kona Community Development Plan (KCDP) CD

cc ltr. only: Planning Department- Kona Office

Mr. William P. Kenoi, Mayor
Mr. Wally Lau, Managing Director
Mr. Randall M. Kurohara, Deputy Managing Director
Mr. Quirino Antonio, Jr., P.E., Manager-Chief Engineer,
Department of Water Supply

DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAI'I
345 KEKŪANAŌ'A STREET, SUITE 20 • HILO, HAWAI'I 96720
TELEPHONE (808) 961-8050 • FAX (808) 961-8657

October 16, 2013

Mr. William J. Aila, Jr., Chairperson
Commission on Water Resource Management
P.O. Box 621
Honolulu, HI 96809

U.S. DEPARTMENT OF INTERIOR – NATIONAL PARK SERVICE – KALOKO-HONOKOHAU NATIONAL HISTORIC PARK
PETITION FOR GROUNDWATER MANAGEMENT AREA DESIGNATION - KEAUHOU AQUIFER SYSTEM AREA (NORTH KONA), HAWAI'I

Dear Mr. Chairman and Members of the Commission:

Thank you for the opportunity to provide testimony on the subject matter, Item F, on your agenda today.

I am Quirino Antonio, Jr., Manager-Chief Engineer of the Department of Water Supply of the County of Hawai'i.

First of all, I would like to note that on behalf of the Water Board of the County of Hawai'i, our letter of October 4, 2013, requests additional time to submit comments to the subject petition. The Commission received similar requests from J Yoshimoto, Chair of the Hawai'i County Council, William P. Kenoi, Mayor of the County of Hawai'i, and Duane Kanuha, Planning Director of the County of Hawai'i Planning Department. The matter is of utmost importance to the County of Hawai'i and affected stakeholders, including landowners, residents, and any individual or entity that rely on the area's groundwater resource. Any information that will or will not support the petition should be submitted in a timely and orderly manner that will allow the Commission and its staff the diligent consideration the matter and its stakeholders deserve. The current time constraints do not allow this.

Secondly, the Commission's staff submittal noted four (4) important studies that are due to be completed within a year's time. The studies include an "Evapo-transpiration Study" by Tom Giambelluca, "Ground-Water Recharge Update" by USGS, "Isotope Study," and "Three-D Groundwater Modeling." These studies will assist the Commission in formulating an informed decision on the matter.

Thirdly, over the past several years, through the Kona Water Round Table, Hawai'i Water Works Association, and American Water Works Association – Hawai'i Section Conferences, and other meetings attended by stakeholders and interested parties, numerous data and information were

presented that indicates the Keauhou Aquifer is far from meeting the criteria set by the State Water Code for designation of an aquifer as a groundwater management area.

Therefore, on behalf of the Water Board and the Department of Water Supply, it is requested that the subject petition be denied at this time. We sincerely believe that the State Water Code is clear in the designation requirements; and to consider approving the petition, or even deferring a decision at this time, would be inconsistent with the statute.

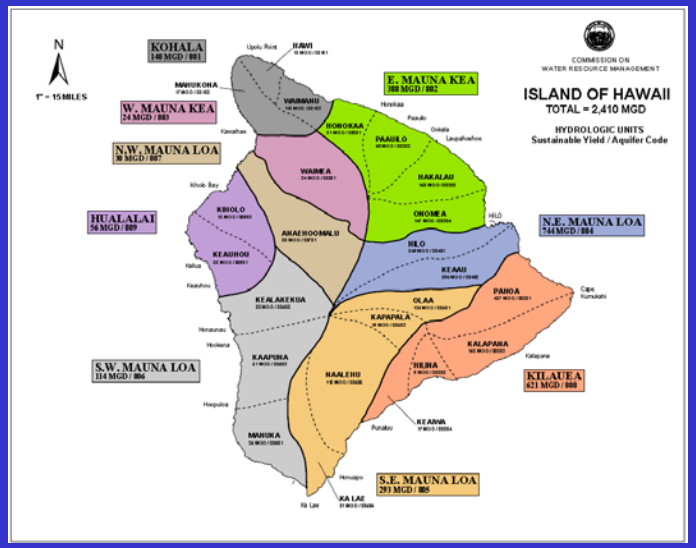
Thank you for your time. I will be happy to respond to any questions that you may have.

Sincerely yours,

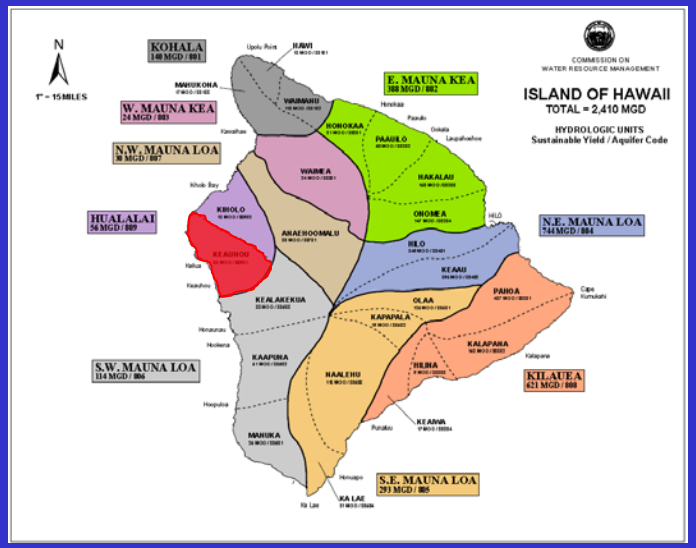
Quirino Antonio, Jr., P.E.
Manager-Chief Engineer

QA:dmj

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



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

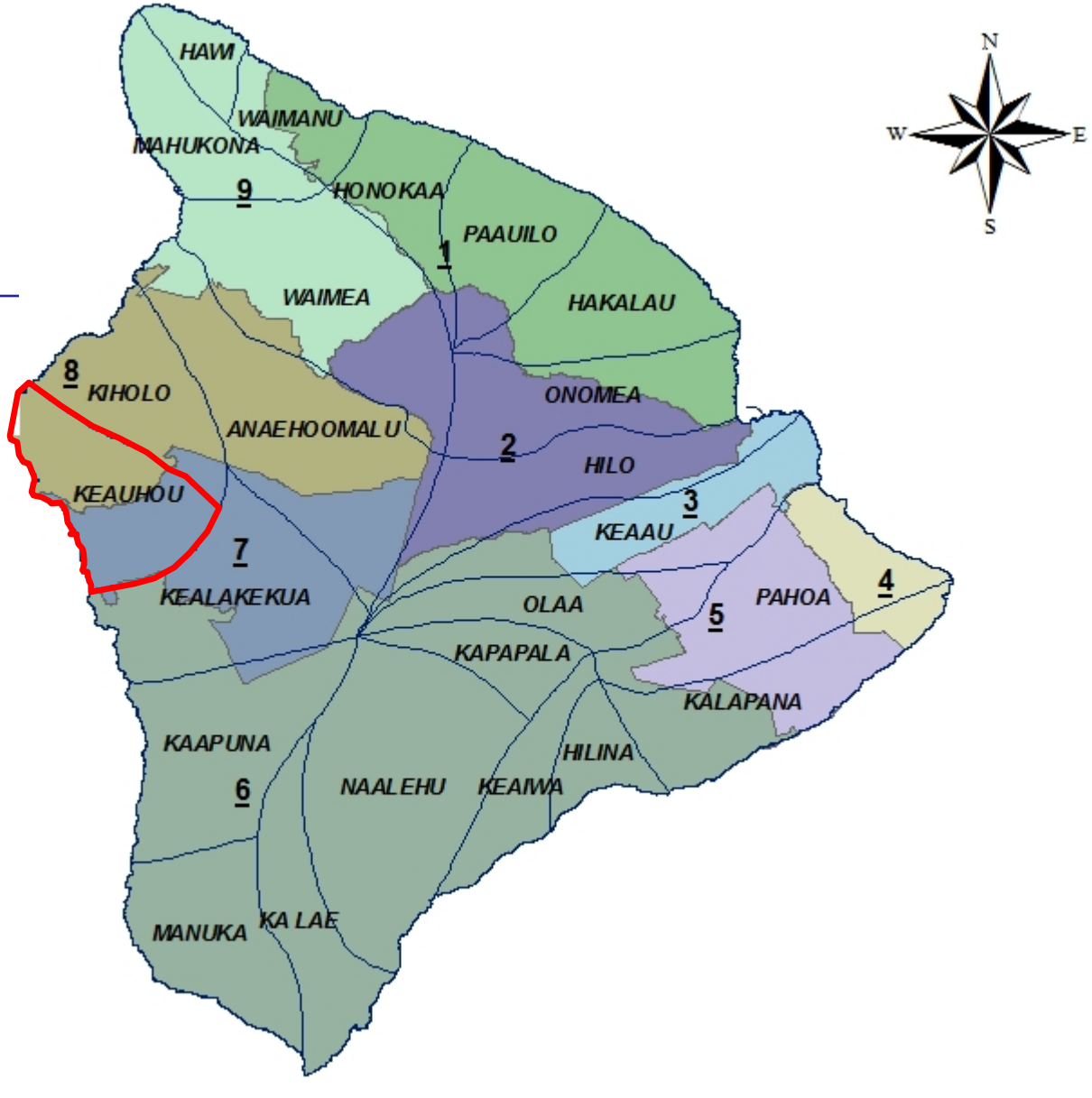


CWRM Aquifer System Area Boundaries

vs.

HAWAII COUNCIL DISTRICTS

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9



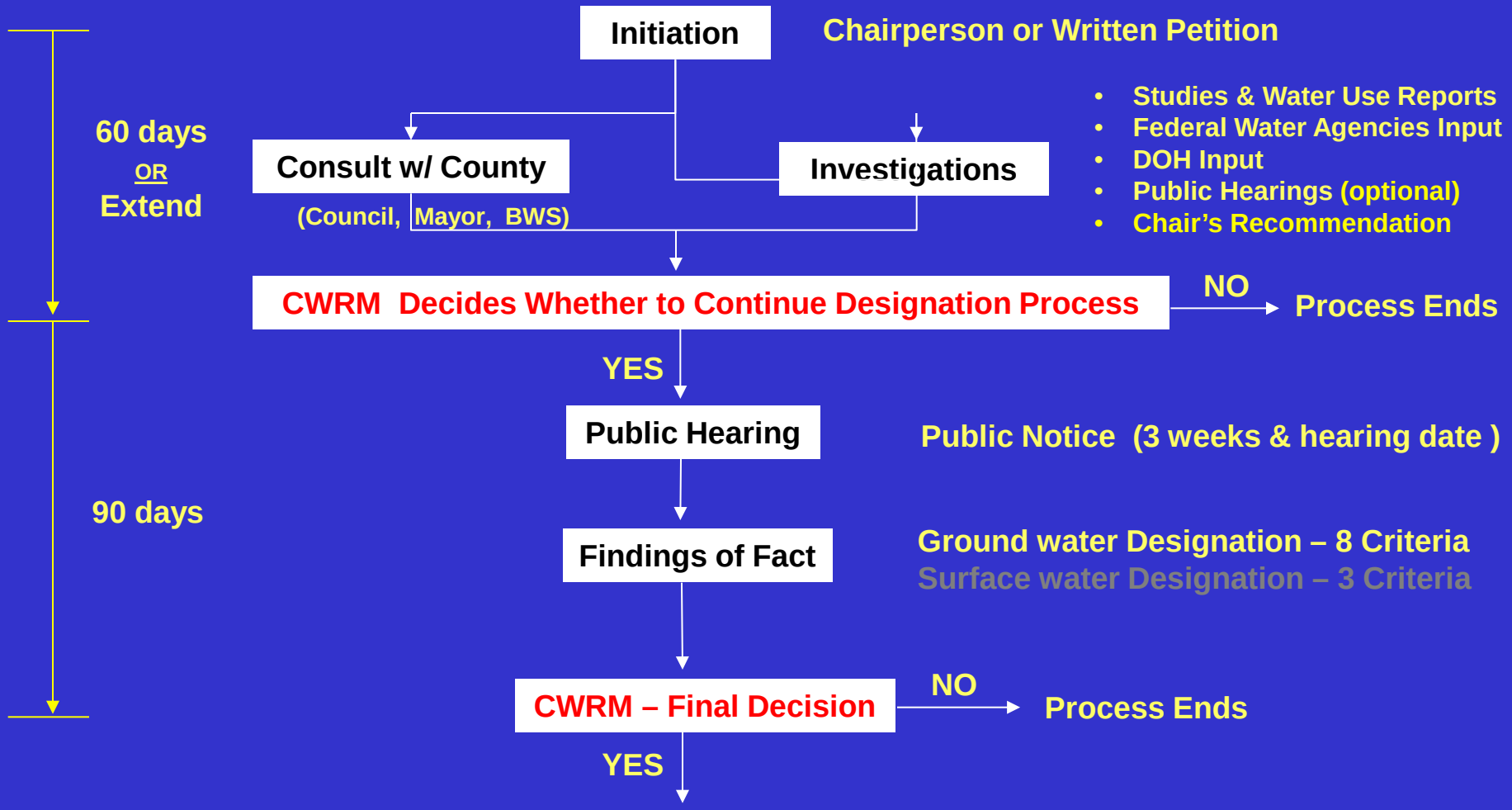
Kaloko-Honokōhau National Park

On September 13, 2013, the National Park Service at the Kaloko-Honokōhau National Historical Park submitted a petition to the Commission requesting that the Keauhou Aquifer System Area be designated as a Ground Water Management Area.

Ground Water Management Areas require additional regulation through Commission-approved ground water use permits.

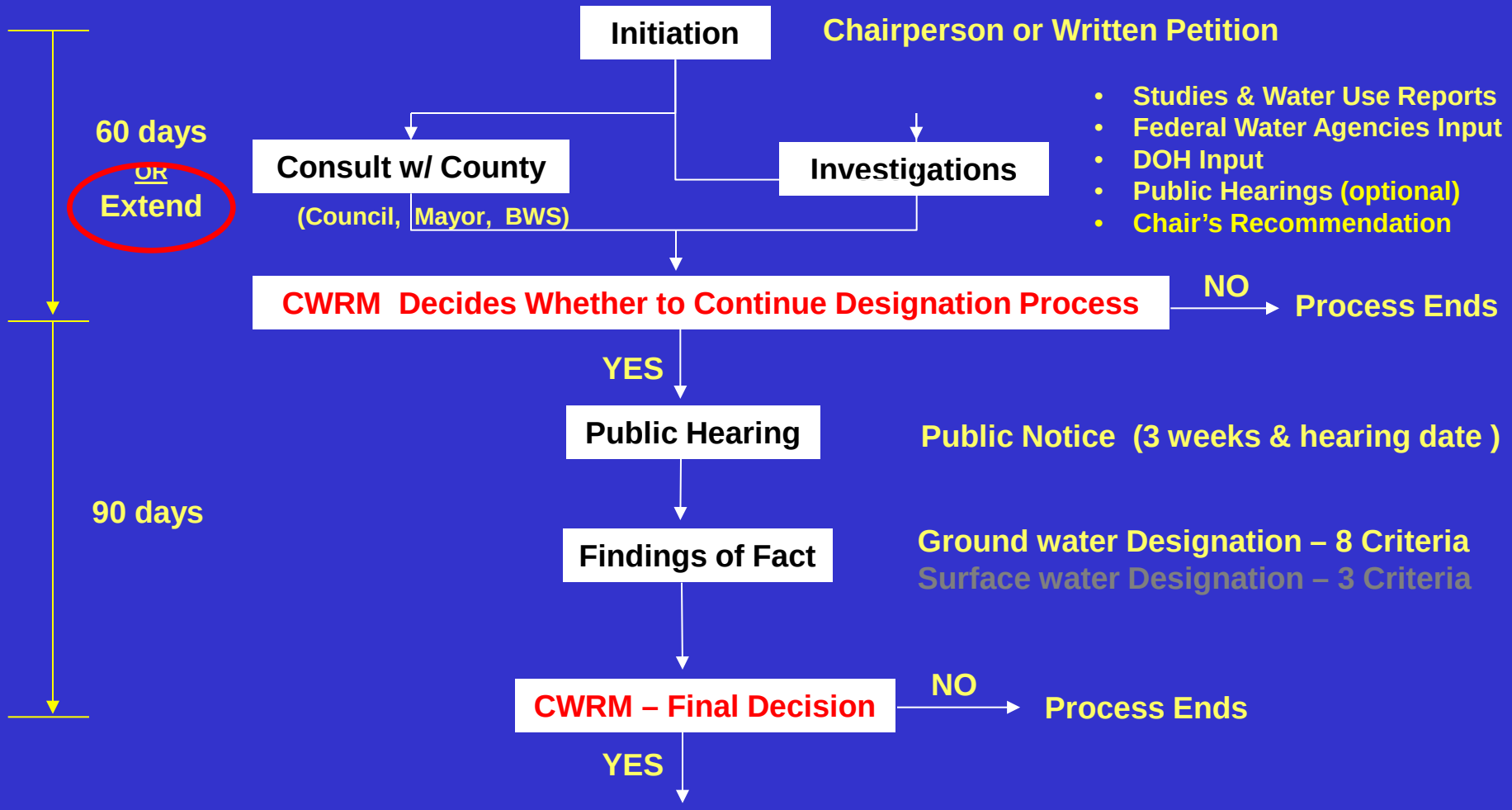
Designation Process

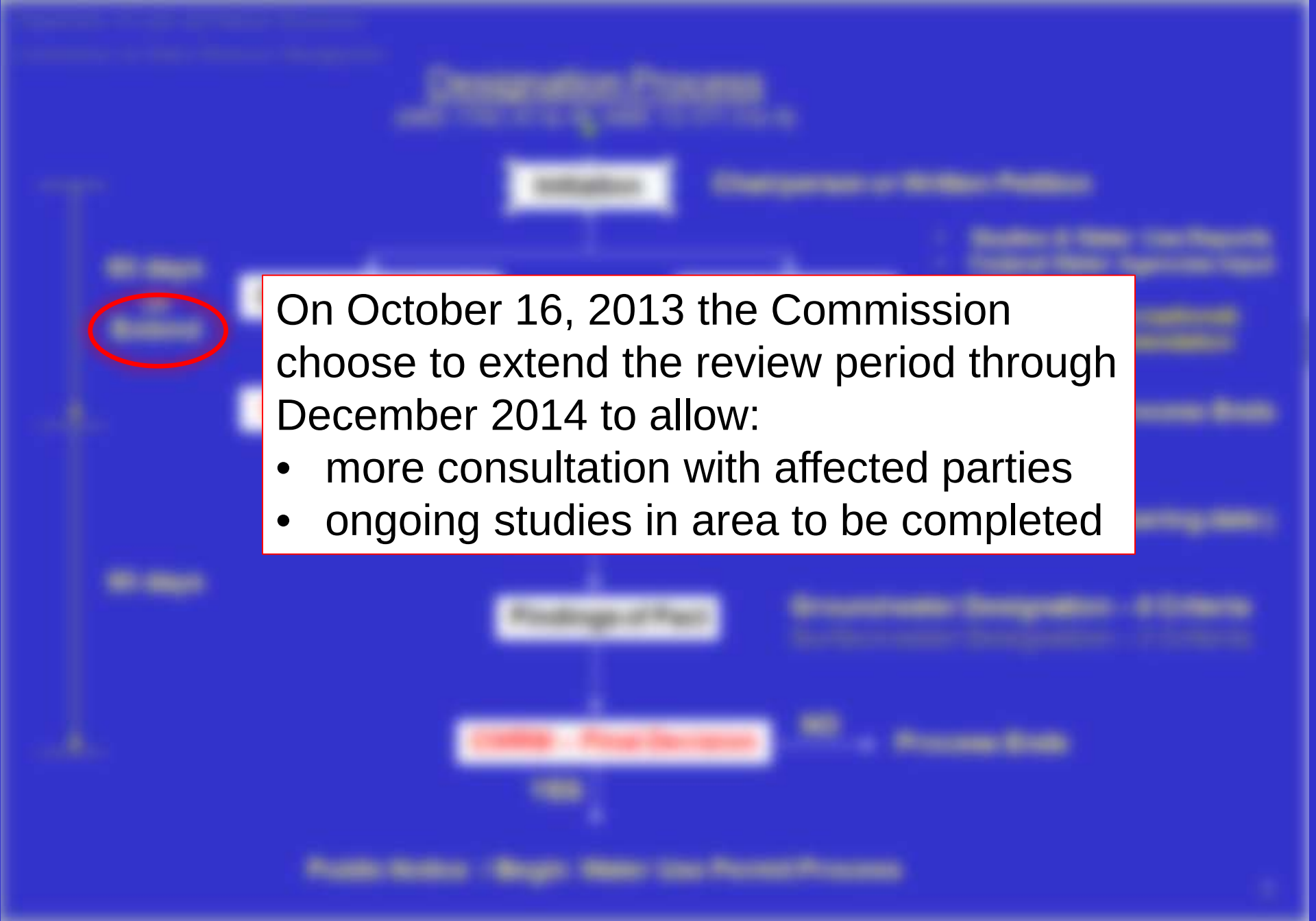
(HRS 174C-41 to 46, HAR 13-171-3 to 9)



Designation Process

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



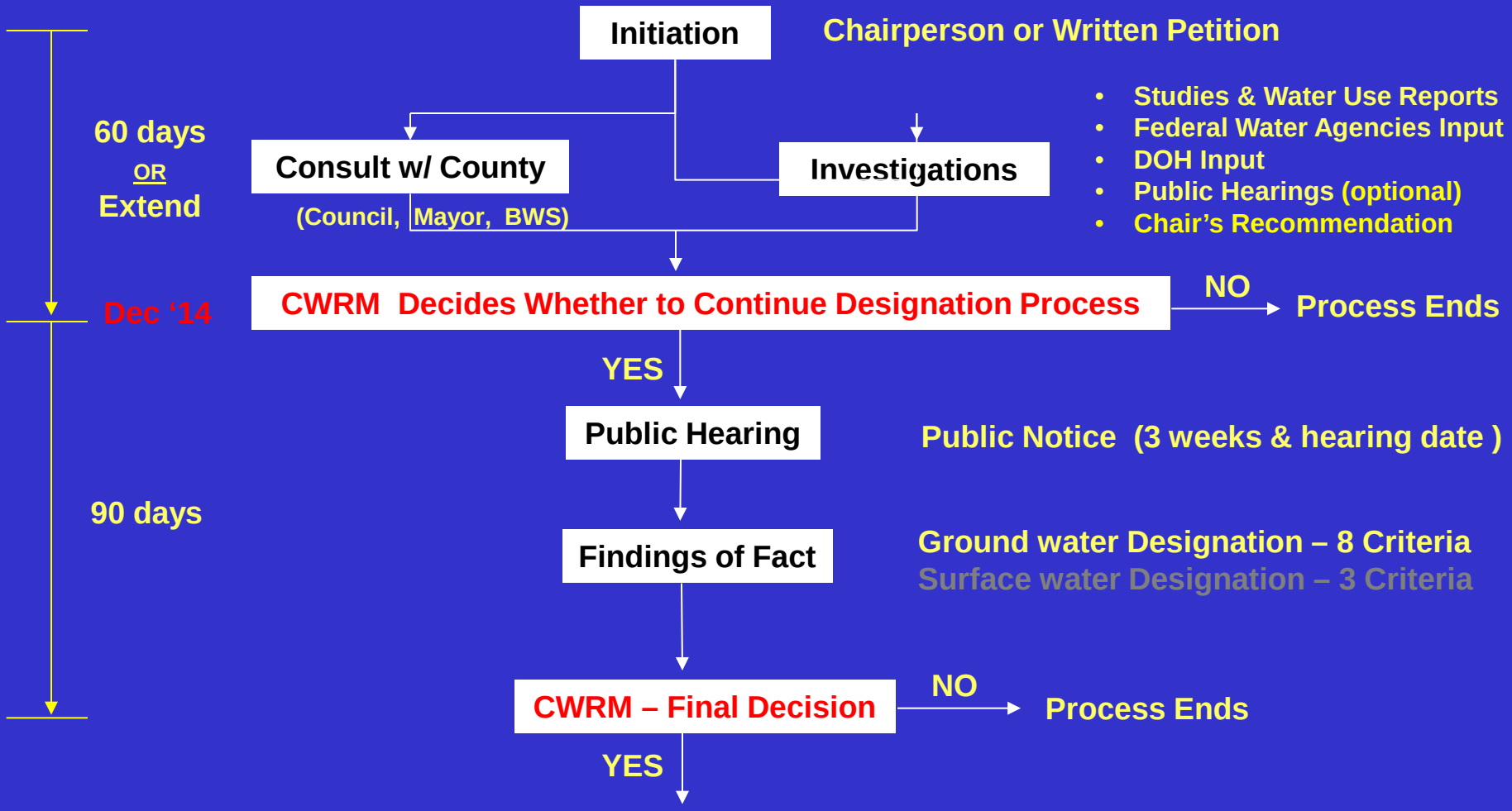


On October 16, 2013 the Commission choose to extend the review period through December 2014 to allow:

- more consultation with affected parties
- ongoing studies in area to be completed

Designation Process

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



Ground Water Criteria Commission shall Consider (§174C-44):

(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 90% of the sustainable yield;

(2) There is an actual or threatened water quality degradation as determined by DOH;

(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;

Ground Water Criteria Commission shall Consider (§174C-44):

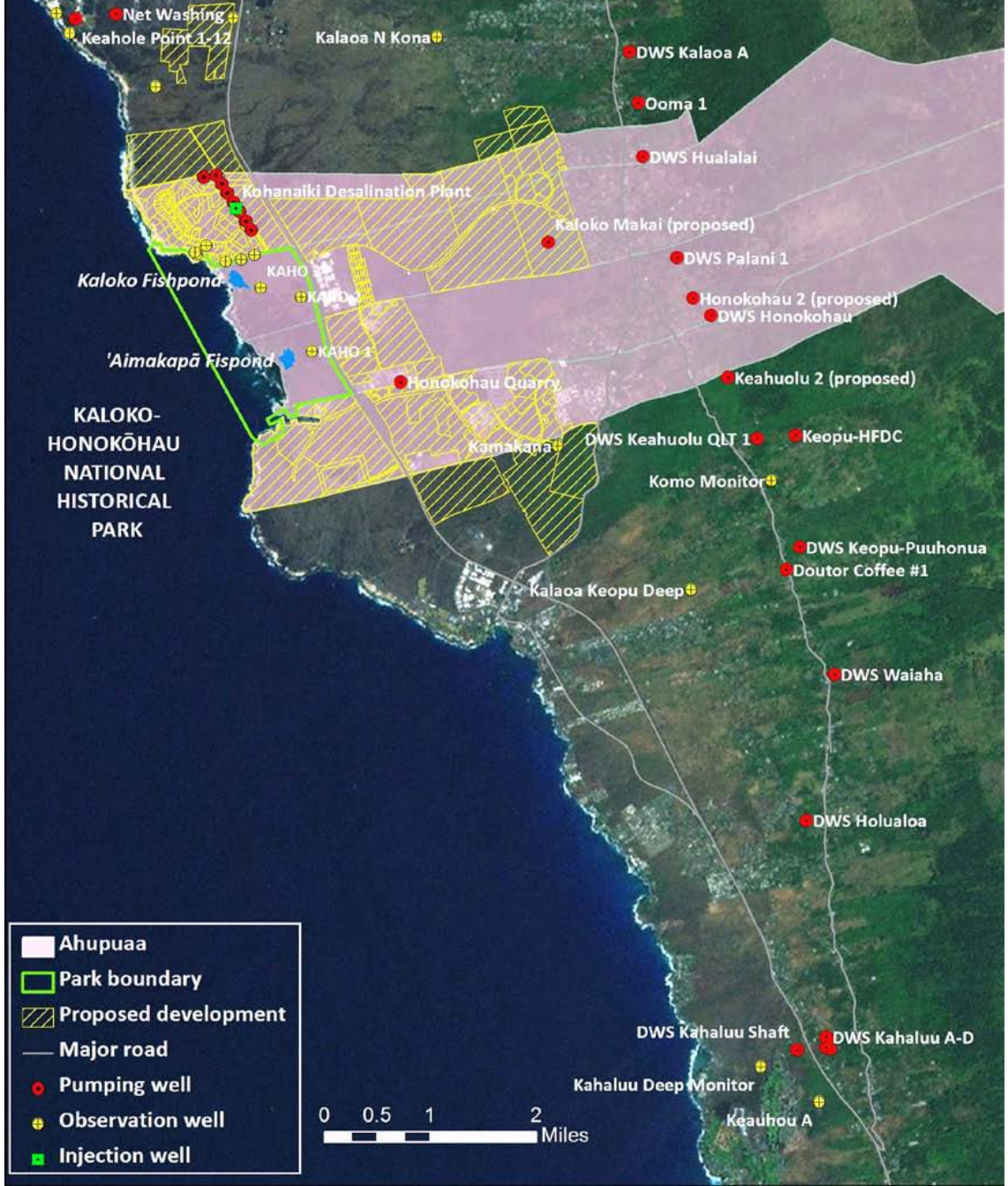
(5) Whether the chloride contents of existing wells are increasing to levels which materially reduce the value of their existing uses;

(6) Excessive preventable waste of ground water is occurring;

(7) Serious disputes respecting the use of ground water; 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.

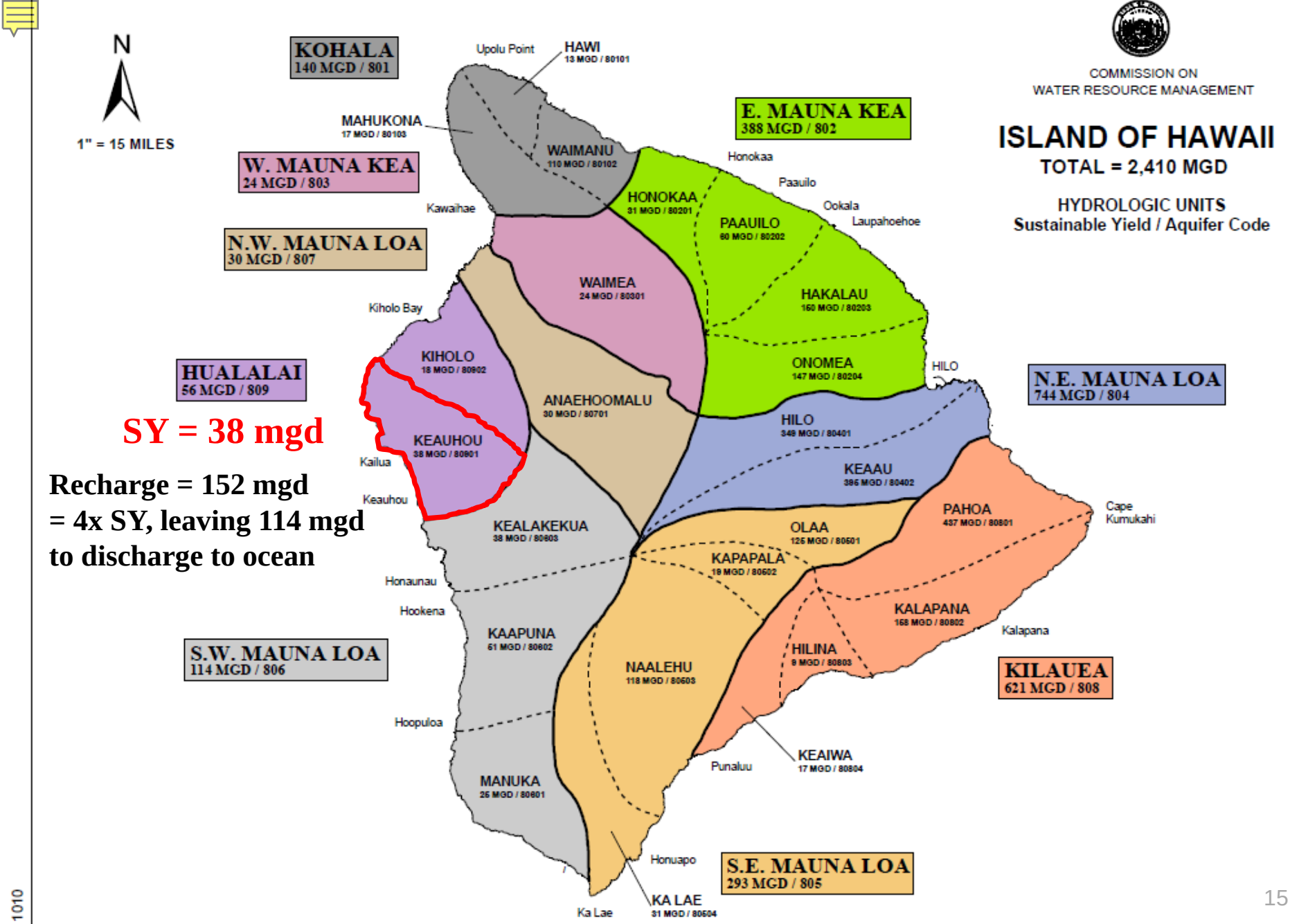
NPS Petition Details



2013 Petition from National Parks Service to designate the Keauhou Aquifer System Area (ASA)

5 of 8 criteria the Commission shall consider were raised:

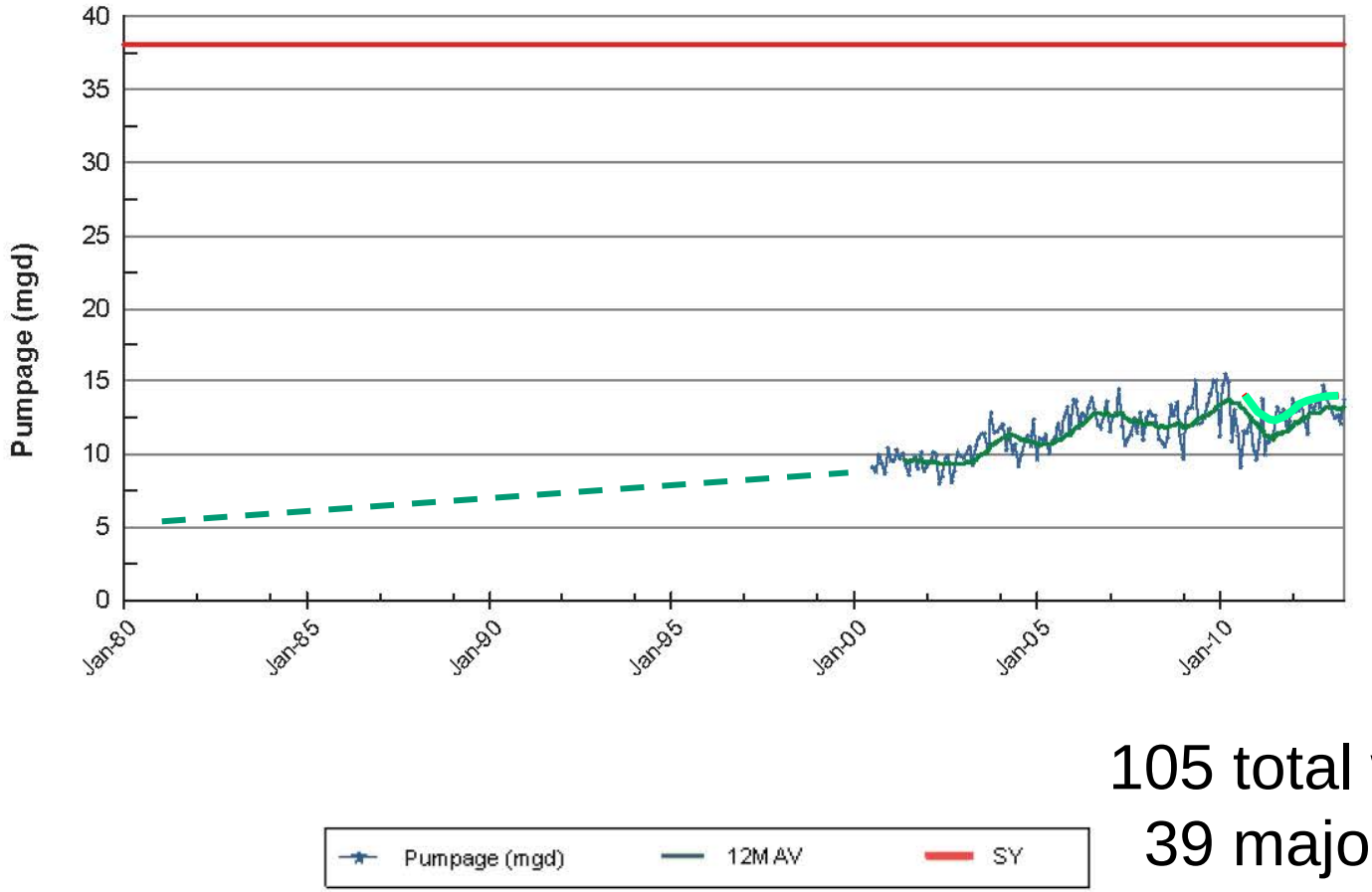
- Sustainable Yield approach to groundwater management is not adequate to address 1) potential harm to the biota and potential for limiting the practice of Traditional and Customary Rights caused by the reduction of shoreline discharge from pumping, 2) projected water demands that will exceed SY, or 3) rising sea-level and declining rainfall
- Documented Saltwater Encroachment: Kahaluu Area
- Waste: Kona water use is “2.5 higher than other areas of the county”
- Serious Disputes: 1) effects of cumulative future pumping on NPS resources, 2) conceptual models of the hydrogeologic structure of the Keauhou ASA
- Potential development projects will contribute to cumulative withdrawals that will exceed the Keauhou Aquifer System Area sustainable yield



SY = 38 mgd

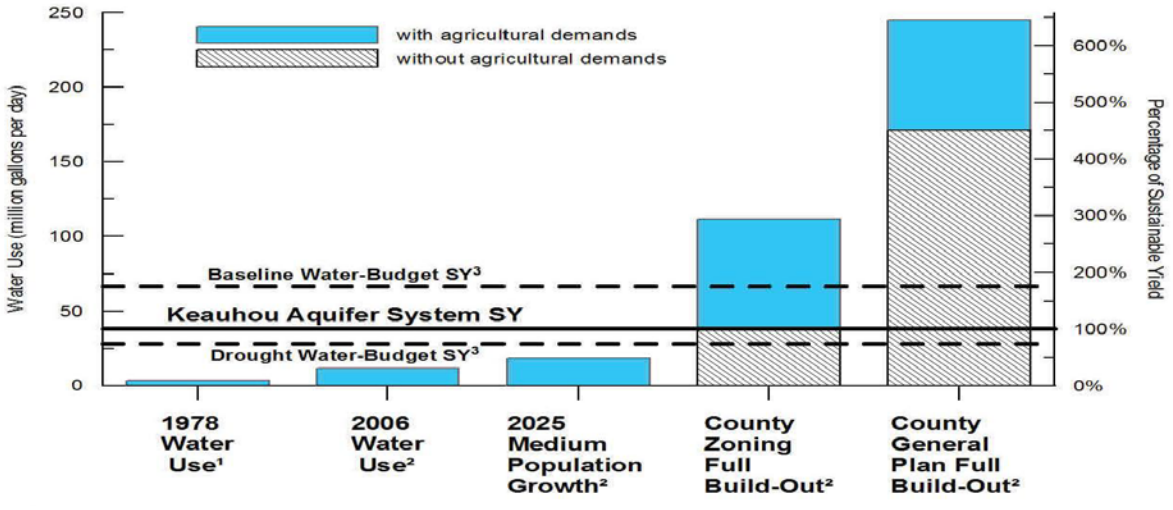
Recharge = 152 mgd
= 4x SY, leaving 114 mgd
to discharge to ocean

Monthly Pumpage Chart
12 Month Moving Average



105 total wells
39 major pumping

Report Parameters
Date: 1/1/1980 - 06/30/2013



§174C-41 Designation of water management area. (a) When it can be reasonably determined, after conducting scientific investigations and research, that the water resources in an area may be threatened by existing or proposed withdrawals or diversions of water, the commission shall designate the area for the purpose of establishing administrative control over the withdrawals and diversions of ground and surface waters in the area to ensure reasonable-beneficial use of the water resources in the public interest.

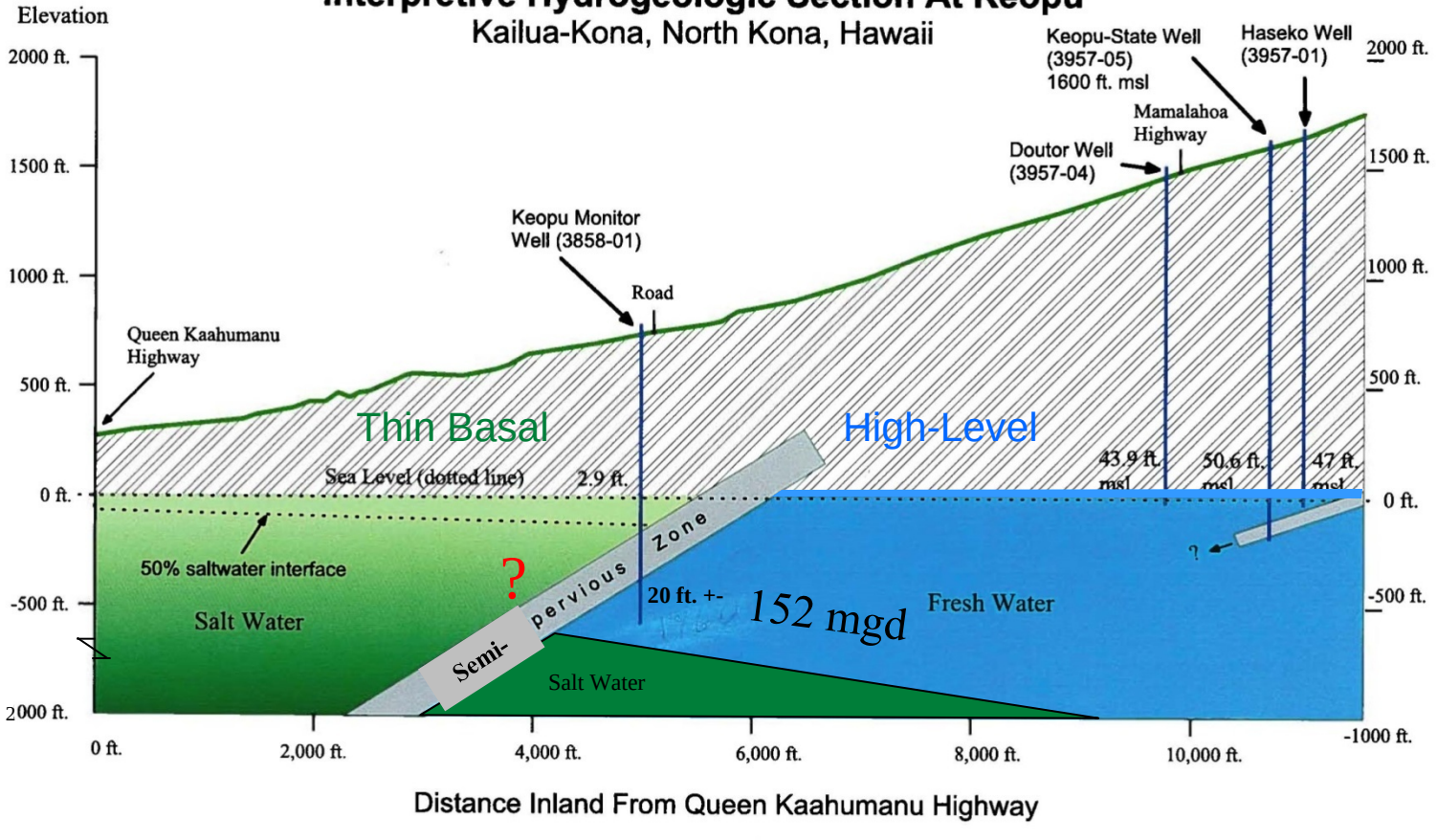
Pumpage of 175 Mgal/d will serve > 1 million people.

Kaloko-Honokōhau National Park

Figure 9

Interpretive Hydrogeologic Section At Keopu

Kailua-Kona, North Kona, Hawaii



Water Resource Associates 2006
067 Hydrogeologic Section

Significant collaboration since 2007:

- Working group (NPS)
- Round Table (HDWS)
- Professionals Group – 2008 WRPP (CWRM)

Outcomes of these collaborations:

- Increased monitoring (increase to quarterly monitoring, 2013 online water use reporting, additional monitor wells: Komo, Kainaliu, Kamakana, Keopu, Kohanaiki, etc.)
- Current ongoing studies (WRPP, Evapotranspiration, Recharge, & data trends updates; USGS-High-Level/Basal Isotope Study & 3D Numerical Model)
- Extensive bibliographies of completed studies (2011 Big Island Recharge, 2012 Rainfall Atlas, NELHA, NPS, others)

Summary of Petition from NPS to designate the Keauhou Aquifer System Area (ASA)

Major Concerns:

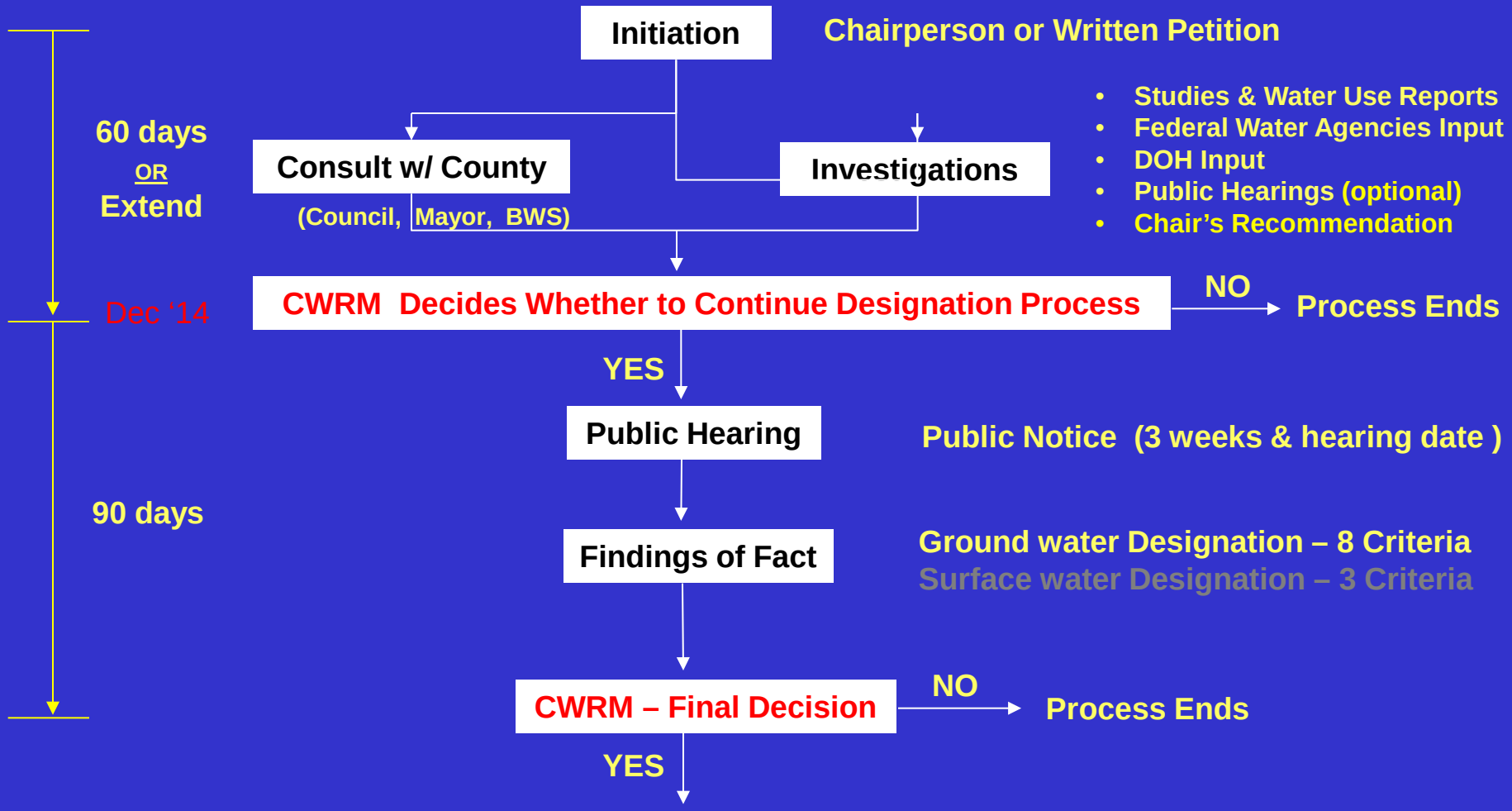
- Sustainable Yield approach to groundwater management is not adequate to address 1) potential harm to the biota and potential for limiting the practice of Traditional and Customary Rights caused by the reduction of shoreline discharge from pumping, 2) projected water demands that exceed SY, or 3) rising sea-level and declining rainfall
- Documented Saltwater Encroachment: Kahaluu Area
- Serious Disputes: 1) effects of cumulative future pumping on NPS resources, 2) conceptual models of hydrogeologic structure of the Keauhou ASA

Preliminary Conclusions

- NPS case rests on potential harm to near shore biology and harm to the practice of Traditional and Customary Rights & future pumpage demands.
- Commission needs help from the County to determine what constitutes future authorized planned ground water use for Keauhou ASA.
- Increased studies and monitoring of the Keauhou ASA have improved and will continue to improve our understanding of the resource.
- Ongoing studies will better quantify the hydrology of the area. These studies will be completed in late 2014.
- October 16, 2013 Commission approved extending investigation phase of initial designation proceedings through December 2014 to allow:
    - - more consultation with affected parties
    - - ongoing studies in area to be completed

Designation Process

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

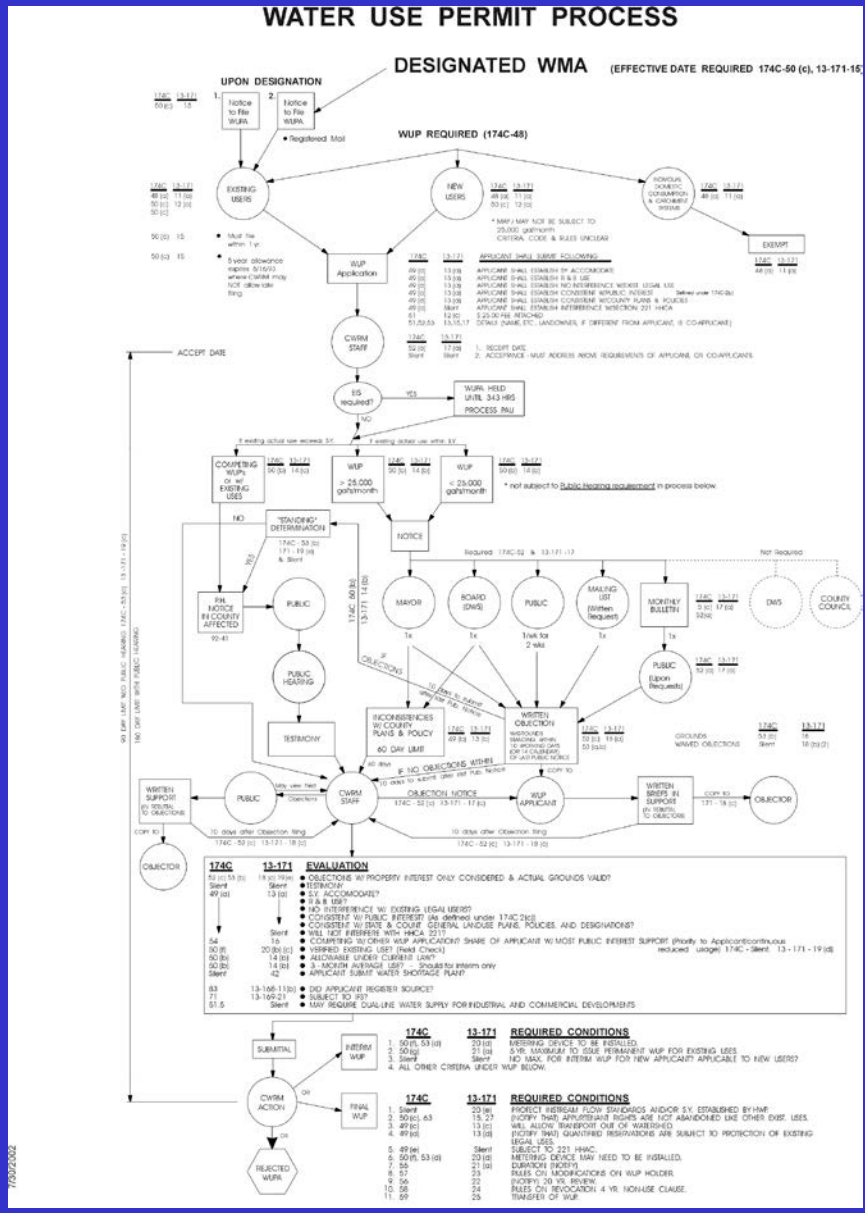


If Keauhou ASA is Designated:

- Public Notice. All owners of wells that use ground water have 1 year to apply for existing ground water use permit from published notice date.
- Existing uses at the time of designation are determined before future uses are considered.
- Public & agency review of all ground water use permit applications (GWUPA) that includes Mayor, Board of Water Supply, Public, registered mailing list & HDWS and County Council comments.
- Individual domestic users and catchment systems are exempted.

If Keauhou ASA is Designated:

Flow diagram of GWUPA Process



If Keauhou ASA is Designated:

- **GWUPA**: Existing Use & New Use forms. $25 application fee (government agencies are exempted). Applications available on website: http://www.state.hi.us/dlnr/cwrm/forms.htm

  - Well operator and well landowner must sign.
  - 8 criteria applicant must address:
    a) Can be accommodated with the available water source.
    b) Is a reasonable-beneficial use.
    c) Will not interfere with any existing legal use.
    d) Is consistent with the public interest.
    e) Is consistent with state and county general plans and land use designations.
    f) Is consistent with county land use plans and general policies.
    g) Will not interfere with the rights of the Department of Hawaiian Home Lands.

County

If Keauhou ASA is Designated:

- **GWUPA (continued)**
- Completed application timelines
  - 90-day decision deadline for action on applications with no objections
  - 180-day decision deadline for action on applications with objections (public hearings required to be held in management area. Uses <25,000 gals/month do not require public hearings even if objections)
  - Unknown case-by-case: All applications subject to contested case hearings if requested at the appropriate time.

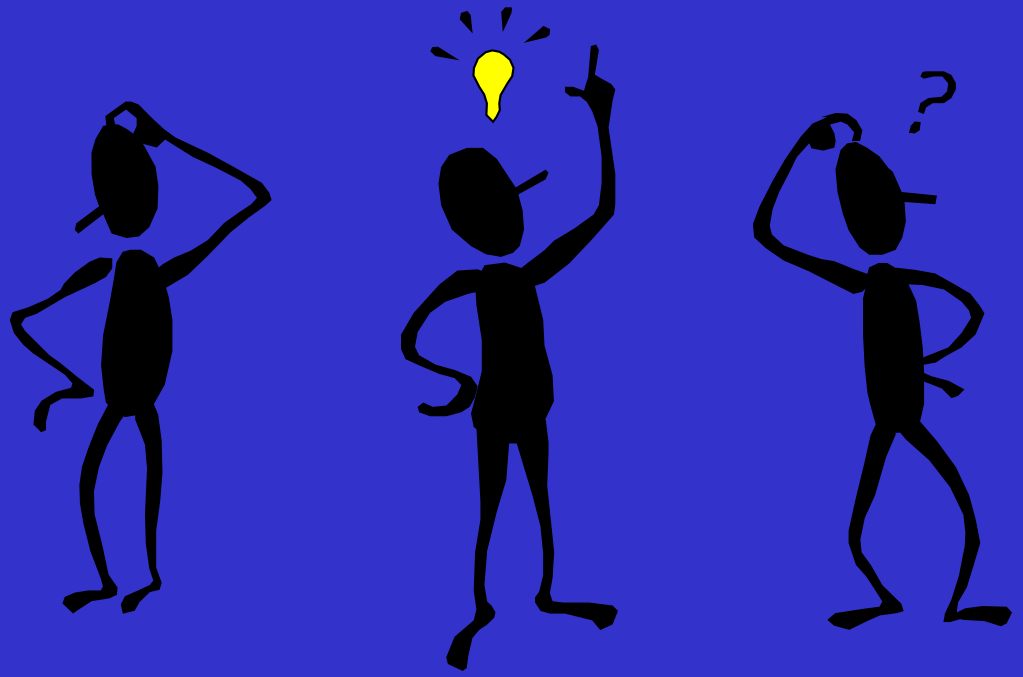
If Keauhou ASA is Designated:

- **GWUPA (continued)**

  The Commission:

  - Relies heavily on the County Water Use and Development Plan (part of Hawaii Water Plan) for guidance
  - Uses County Water System Standards to estimate daily demand
  - Uses an irrigation model (IWREDSS - ver 2.0) to estimate average daily demands for 5-year drought.

- **QUESTIONS? / THOUGHTS?**



William P. Kenoi
Mayor

Duane Kanuha
Director

Bobby Command
Deputy Director

West Hawai'i Office
74-5044 Ane Keohokalole Hwy
Kailua-Kona, Hawai'i 96740
Phone (808) 323-4770
Fax (808) 327-3563

County of Hawai'i
PLANNING DEPARTMENT

East Hawai'i Office
101 Pauahi Street, Suite 3
Hilo, Hawai'i 96720
Phone (808) 961-8288
Fax (808) 961-8742

May 21, 2014

William J. Aila, Jr., Chairperson
Commission on Water Resource Management
Department of Land & Natural Resources
Kalanimoku Building
1151 Punchbowl Street, Room 227
Honolulu, Hawai'i 96813

Dear Mr. Aila:

SUBJECT: **TRANSMITTAL OF AN APPROVED MOTION BY THE KONA COMMUNITY DEVELOPMENT PLAN (KDCP) ACTION COMMITTEE TO OPPOSE THE PETITION BY THE NATIONAL PARK SERVICE (NPS) FOR DESIGNATION OF THE KEAUHOU AQUIFER SYSTEM AS A CRITICAL WATER MANAGEMENT AREA**

Transmitted herewith is a transmittal letter dated May 6, 2014 and attached motion by the KCDP Action Committee taken at their meeting of April 30, 2014 held at the West Hawai'i Civic Center. Copies of the fourteen (14) testimonies submitted to the Action Committee are also attached for your reference.

The Community Development Plan (CDP) Action Committees were established through Chapter 16, Planning, Article 3, CDP Action Committees, Sections 16-4 to 6 of the Hawai'i County Code, and therefore are also governed by the Hawai'i County Charter. The purpose of the CDP action committee is to be a proactive, community-based steward of the plan's implementation and update. The members are appointed by the Mayor and approved by the County Council.

The KCDP was adopted by Ordinance No. 08-131 effective September 25, 2008.

The Planning Department is in full support of the KCDP action committee and will be providing more detailed and structured response to the proposed designation prior to or in conjunction with the commission's decision making proceedings.

Please feel free to contact me or my staff if there are any further questions.

Sincerely,

DUANE KANUHA
Planning Director

Attachments

cc: Greg Ogin, Chairperson, KCDP AC
Bobby Command, Deputy Planning Director
Wally Lau, Managing Director
Quirino Antonio Jr., Manager, Department of Water Supply
Keith Okamoto, Deputy Manager, Department of Water Supply

William P. Kenoi
Mayor

PLANNING DEPARTMENT
COUNTY OF HAWAII
2014 MAY -6 AM 11: 24

Duane Kanuha
Director

Bobby Command
Deputy Director

West Hawai'i Office
74-5044 Ane Keohokalole Hwy
Kailua-Kona, Hawai'i 96740
Phone (808) 323-4770
Fax (808) 327-3563

County of Hawai'i
PLANNING DEPARTMENT

East Hawai'i Office
101 Pauahi Street, Suite 3
Hilo, Hawai'i 96720
Phone (808) 961-8288
Fax (808) 961-8742

KONA COMMUNITY DEVELOPMENT PLAN ACTION COMMITTEE

May 6, 2014

Mr. Duane Kanuha
Planning Director
County of Hawai'i
101 Pauahi Street, Suite 3
Hilo, Hawai'i 96720

Reference: Approved motion by the Kona Community Development Action Committee (KCDP) to oppose the petition by the National Park Service (NPS) for designation of the Keauhou Aquifer System.

Dear Mr. Kanuha,

Thank you for taking the time to join the KCDP Action Committee at our last meeting on April 30, 2014 where the Action Committee entertained and unanimously approved a motion to oppose the petition by the NPS for designation of the Keauhou Aquifer System.

Approximately 14 testimonies were submitted to the Action Committee where a majority of submissions agreed with the position taken by the Action Committee. Copies of those submitted testimonies were submitted to you by Terry Dunlap, Planning.

A copy of the approved motion is attached for your review.

Respectfully Submitted

Greg Ogin
Chairman
KCDP Action Committee

KCDP AC Members are in support and Agreement regarding this motion: Ken Melrose, Keoki Schattauer, Hiram Rivera, Elaine Fukushima and Douglas Payne.

CC: Bill Brilhante, Deputy Corporation Counsel
AC members
Attachment: approved motion

091543

Preamble:

Mr. Chairman, if I may.

As the sole remaining original member, I feel compelled to continue to help keep the flame alive of the Kona CDP, as has been our charge. I would like to share that in the 8 years I have had the privilege of serving here remarkable things have happened for and within Kona. Most import among them is the unity with which the community embraced the shared Vision and Guiding Principles of the Kona CDP. The positive outlook for our shared future together has endured a challenging economic phase and those constraints are slowly yielding to a more prosperous time for many families in our community. Recent events threaten to thwart our path to a desired outcome, where future growth is directed within the Urban designated area of Kona and a new style of community evolves where work is closer to homes and the automobile isn't our only choice to get around.

The Kaloko Honokohau NHP was established after the urban boundary was determined and the resulting settlement pattern began to evolve. The NPS now seeks to usurp our ability to direct and manage ourselves as we move forward by prematurely mandating draconian practices, created for crisis situations, well ahead of any of the criteria being met and when no impacts, by their own data and admissions, yet exist today.

However, they, and the others who support them, have pointed out shortcomings in our full implementation of the Kona CDP. The precautionary principles they espouse as necessary are intrinsically embedded in the fabric of the Vision, Guiding Principles, Policies and Actions proposed in the Kona CDP. We as an Action Committee must defend our right and obligation to implement the Kona CDP. There is a way to address the potential impacts of future growth, but the NPS petition for designation of the Keauhou Aquifer System isn't it. As such I propose:

Motions:

The Action Committee (AC) for the Kona CDP finds that our CDP pre-emptively anticipated and includes strategies for mitigation measures to address future growth. The AC embraces the Overall Strategies for Land Use (in 4.2.2) and Environment (in 4.3.2) to proactively implement public policy through a regional framework for growth. As such, the AC opposes and asks the Planning Dept. and the County Administration to oppose the petition by the NPS for designation of the Keauhou Aquifer System.

The AC further asks that the County establish, consistent with Environmental Policies 1.5, 1.10, 1.11 & 1.12, an integrated regional Water Resource Management Plan (WRMP) spanning the coastal areas of the Urban area from Keauhou to Keahole that includes information from the potable wells, brackish and monitoring wells, Anchialine pools, fishponds (including Aimakapa and Kaloko within the KHNHP) and near shore waters that is transparent and cooperative. Projects within the Urban Area would participate in the plan providing data as part of new entitlements being granted. Perhaps involvement of University and High School students can be encouraged as part of curriculum projects. The WRMP could be administered by Planning while integrating DWS and DEM projects and private projects. Monitoring could be part of purveying water or treated wastewater re-use and some of the costs recovered through water or sewer rates.

The upgrading of wastewater treatment to provide re-use as irrigation and measures to minimize impacts of surface drainage injection should become part of the WRMP as well. Emphasis is needed on the geology which underlies the region and influences the flow of groundwater.

Finally, that the Chair designate a representative or sub-committee of the AC to work with the Administration to structure, advocate for and implement such a program.

The AC respectfully requests that the NPS withdraw its petition for designation and invites the NPS to lend its scientific resources and data openly in conjunction with the above mentioned WRMP to manage the impacts of growth on all the coastal resources of Kona in a collaborative effort.

Respectfully Submitted,

Ken Melrose

TOD Sub-committee, Chair

Charles Flaherty

Kauai Springs pp 85-87 of slip opinion; notes and citations omitted.

To assist agencies in the application of the public trust doctrine, we distill from our prior cases the following principles:

a. The agency's duty and authority is to maintain the purity and flow of our waters for future generations and to assure that the waters of our land are put to reasonable and beneficial use.
b. The agency must determine whether the proposed use is consistent with the trust purposes:

i. the maintenance of waters in their natural state;
ii. the protection of domestic water use;
iii. the protection of water in the exercise of Native Hawaiian and traditional and customary rights; and
iv. the reservation of water enumerated by the State Water Code.

c. The agency is to apply a presumption in favor of public use, access, enjoyment, and resource protection.
d. The agency should evaluate each proposal for use on a case-by-case basis, recognizing that there can be no vested rights in the use of public water.
e. If the requested use is private or commercial, the agency should apply a high level of scrutiny.
f. The agency should evaluate the proposed use under a "reasonable and beneficial use" standard, which requires examination of the proposed use in relation to other public and private uses.

Applicants have the burden to justify the proposed water use in light of the trust purposes.

a. Permit applicants must demonstrate their actual needs and the propriety of draining water from public streams to satisfy those needs.
b. The applicant must demonstrate the absence of a practicable alternative water source.
c. If there is a reasonable allegation of harm to public trust purposes, then the applicant must demonstrate that there is no harm in fact or that the requested use is nevertheless reasonable and beneficial.
d. If the impact is found to be reasonable and beneficial, the applicant must implement reasonable measures to mitigate the cumulative impact of existing and proposed diversions on trust purposes, if the proposed use is to be approved.

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Volume 24, Number 10 -- April 2014

HAWAII SUPREME COURT DECISION REAFFIRMS GOVERNMENT DUTY TO PROTECT PUBLIC TRUST

"We ended up on the short end of this opinion.... Minds immeasurably superior to ours will have to do the analysis on this one, at least for now," wrote Honolulu attorney Robert Thomas in a recent post on his blog, inversecondemnation.com.

After a decade of bottling mountain spring water in Koloa, Thomas' client, Kaua`i Springs, Inc., lost its fight for the Use, Special, and Class IV Zoning permits it needs to operate.

On February 28, in a 107-page decision, the Hawai`i Supreme Court found that the Kaua`i Planning Commission had properly denied the permits in January 2007. However, the court directed the commission to clarify the findings and conclusions of its Decision and Order so they are consistent with the court's decisions regarding the protection of public trust resources.

Like its 2006 decision in *Kelly v. 1250 Oceanside Partners,* which involved marine pollution caused by excessive grading, the court's Kaua`i Springs decision reaffirms that the public trust doctrine requires state and county agencies – not just the Commission on Water Resource Management – to "take the initiative in considering, protecting, and advancing public rights in [trust resources] at every stage of the planning and decision-making process."

Furthermore, the court found, agencies must determine whether proposed water uses are reasonable and beneficial, and applicants carry the burden to prove the proposed use won't affect a protected use. (Protected uses include the traditional and customary Hawaiian practices, the maintenance of waters in their natural state, and municipal drinking water, among other things.)

How does the ruling affect future decisions by government agencies that deal, even in small, tangential ways, with water?

For now, Thomas is mum on the subject, and with regard to how it affects his client, he also has little to say.

"In cases that aren't finally resolved, I try not to say too much. If the court resolved it, I might have more to say," he says. "Obviously, we're disappointed. ... It was not to be."

Whether or not he agrees with the decision, it's the law now, he says.

Throughout the appeals process, Kaua`i Springs has continued to bottle water under an injunction against the county ordered by 5th Circuit Judge Kathleen Watanabe.

How the Supreme Court's decision affects the operation is unclear.

"We'll have to figure that out with the Planning Commission," Thomas says. "This has gone on so long now ... a lot of people who were on the county side may not be there."

In an email, Kaua`i County public information officer Beth Tokioka states that the Kaua`i Planning Department is still reviewing how the decision affects the continued operation of Kaua`i Springs.

She adds, however, that the Supreme Court's decision "makes it clear that all state and county agencies that make decisions that affect water and its uses must proceed through a public trust analysis so as to ensure that such uses protect the public trust resource and are reasonable and beneficial.

"As outlined in the [decision], the county took its public trust duties very seriously in this case as it does in all cases. The county is highly aware of its public trust duties and obligations under the law and ... remains committed to ensure that any decision it makes regarding water and its uses complies with its obligation under the public trust."

Water Commission director William Tam predicts that the Supreme Court's decision may lead to some "difficult procedural issues."

With counties now apparently having to analyze things like alternative soruces of water and determining what reasonable and beneficial uses are when reviewing things like zoning permits, counties may start asking the Water Commission for advice, he says.

"It will heighten the water-land relationship," he says.

The Water Commission was scheduled to discuss the Kaua`i Springs case at its March 21 meeting.

Background

In 2003, Kaua`i Springs obtained building and zoning permits from the county for a 1,600-square-foot "watershed." A year later, the state Department of Health granted it a permit to bottle water. *The Garden Island* newspaper shortly thereafter ran a feature story on Kaua`i Springs, a new entry in the local water bottling market that until then had been dominated by O`ahu-based water bottlers.

Under a licensing agreement with the EAK Knudsen Trust, Kaua`i Springs takes water from a spring in Kahili mountain that has been diverted miles away to a tank owned by Grove Farm Company. The trust owns the land surrounding the spring as well as the transmission system that delivers the water. Grove Farm operates the system, and its water tank serves Kaua`i Springs as well as dozens of residences.

Water that is not used overflows the tank into Waihohonu Stream.

Spurred by a complaint, allegedly from an employee of an O`ahu water bottler, the Kaua`i Planning Department in 2006 issued a cease and desist letter to Kaua`i Springs' landlord, Makana Properties, charging that industrial processing and packaging were occurring on the property, which lies in the state Agricultural District, without the necessary permits.

After some initial resistance, Kaua`i Springs applied to the county for a Use permit, a Special permit, and a Class IV zoning permit.

During the commission's hearings on the permits, Kaua`i Springs owner Jim Satterfield testified that he planned to increase production from 2,500 gallons a week to 35,000 gallons a week. He went on to say that there was no limit on how much water he could extract.

The Planning Commission asked the state Water Commission and the Public Utilities Commission whether either of those agencies would require Kaua`i Springs to apply for permits for its operation. The Water Commission said it might require permits under certain circumstances, such as if the source of the water had been modified (as it apparently had been). The PUC said Grove Farm might be required to obtain authorization to sell water as a public utility, but Kaua`i Springs would probably not.

As the Planning Commission continued to seek more information from Kaua`i Springs, the deadlines to decide on the Use permit and the Class IV Zoning permit passed. The commission planned to decide on all three permits by the Special permit's approval deadline, January 31, 2007.

Given the PUC's and Water Commission's advice, and the limited information provided by Kaua`i Springs, the Planning Commission denied the permits on January 23 of that year.

In its Decision and Order, the commission wrote that the land use permit process should "insure that all applicable requirements and regulatory processes relating to water rights, usage, and sale are satisfactorily complied with prior to taking action on the subject permits. The applicant ... should also carry the burden of proof that the proposed use and sale of the water does not violate any applicable law administered by CWRM, the PUC or any other applicable regulatory agency."

The Planning Commission found that Kaua`i Springs failed to provide any substantive evidence that it had the authority to extract and sell the water.

Satterfield appealed to the 5th Circuit Court, which on April 30, 2007, found in his favor and granted him a preliminary injunction against the county. Circuit Judge Watanabe ordered the Planning Commission to issue the permits.

A year ago, the Intermediate Court of Appeals vacated Watanabe's decision, but still found that the Planning Commission's decision was "arbitrary and capricious." The ICA remanded the case with instructions on how to better review the permits in light of the Planning Commission's duty to protect public trust resources.

"[T]he Planning Commission's public trust duty under [the state Constitution], coupled with the state's power to create and delegate duties to the counties, establishes that the Planning Commission had a duty to conserve and protect water resources in considering whether to issue the special permit to Kaua`i Springs," the ICA found.

Despite standards set forth in the Kaua`i General Plan, zoning ordinances and the state's land use law requiring the protection of water, however, the Planning Commission failed to apply them, the ICA found. The Planning Commission merely focused on whether Kaua`i Springs' water use was "legal and met all potentially applicable regulatory requirements," it stated in its decision.

Automatic Approvals

Last November, the Supreme Court heard oral arguments in the case. In its final decision, the majority of the Supreme Court supported some of the ICA's findings and disagreed with others.

The court's decision first addressed whether the Use and Class IV Zoning permits had been automatically approved when the Planning Commission failed to decide on them in time. Kaua`i Springs argued that they had been approved. The ICA and the Supreme Court, however, found that Kaua`i Springs had, by its actions and behavior, assented to a time extension.

The ICA had focused on the fact that the company and its representatives had continued to negotiate on permit terms, and that Kaua`i Springs had even amended its permit application, then retracted the amendment, after approval deadlines had passed. The Supreme Court, however, found that the ICA erred when it used Kaua`i Springs' post-deadline behavior as evidence of assent.

Assent must occur *before* an automatic approval deadline, and in this case, Kaua`i Springs had assented to an extension before the deadlines for the Use and Class IV Zoning permits, the court found.

"[B]oth Kaua`i Springs and the Planning Commission treated the application for the three permits as comprising a consolidated application request. In accordance with this understanding, the parties agreed, as repeatedly evidenced by their conduct, that the Planning Commission would be required to render a decision on the consolidated application by January 31, 2007, which was the latest deadline possible for the Special Permit," wrote Justice Richard Pollack in the majority decision.

Kaua`i Springs needed both the Special permit and the Use permit to operate in the Agriculture District. Thus, "[f]rom the Planning Commission's position, it would have been illogical and impractical to decide separately upon the Use Permit and Special Permit, given the similarity of the permits' requirements," he wrote.

Arbitrary and Capricious

The Supreme Court majority also disagreed with the ICA's conclusion that the Planning Commission's decision was arbitrary and capricious. In the ICA's view, the Planning Commission's requirement that Kaua`i Springs prove that its proposed use complies with all applicable laws administered by the Water Commission, the PUC, or other applicable regulatory agencies created "an obscure and indefinite burden of proof."

Kaua`i Springs had similarly argued that the public trust doctrine doesn't empower agencies to deny applications based on a simple lack of information that is "within its [the agency's] power to obtain, thus shifting the burden to the applicant."

However, the Supreme Court found, "a lack of information from the applicant is exactly the reason an agency is empowered to deny a proposed use of a public trust resource." And in this case, it stated, Kaua`i Springs failed to prove it had the legal authority to put to commercial use a public trust water resource.

"There is also no indication in the record of the substance of any water purchase agreement, nor of the water supplier's right to make the public trust resource commercially available," the decision states.

The Planning Commission had identified specific permits or authorizations Kaua`i Springs might need from the Water Commission and the PUC, the decision continues.

"The Planning Commission correctly imposed on Kaua`i Springs the burden to demonstrate the propriety of its proposed use of the public trust resource, which, under the circumstances of this case, required Kaua`i Springs to demonstrate that any necessary permits and applicable regulations from the Water Commission and PUC were complied with," the decision states.

Thus, the court concluded, the Planning Commission's decision was neither arbitrary nor capricious.

Those seeking a commercial use of water use can't simply say a use is grandfathered or get some sort of perfunctory response from agencies and that's the end of it, says Earthjustice attorney Isaac Moriwake.

Arguments Moriwake raised in an amicus brief in the case, filed on behalf of Hawai`i's Thousand Friends and Malama Kaua`i, closely track those made by the Hawai`i Supreme Court.

"In so many cases in land development, despite questions, [agencies] just punt, issue a permit subject to conditions that never get enforced and are practically meaningless," he says.

In the Kaua`i Springs case, the responses the PUC and Water Commission gave to the Planning Commission were inconclusive, Moriwake says.

"At that point do they sweep it under the rug and keep it hanging? ... To the Kaua`i Planning Commission's great credit, they didn't just try to sweep this under the rug."

In backing the Planning Commission's denial of Kaua`i Springs' permits, the Supreme Court's opinion clarifies that under a trust fiduciary duty, that kidh of business as usual is unacceptable, he says.

Dissent and a Rebuttal

The Supreme Court's decision was not unanimous. Chief Justice Mark Recktenwald issued a 13-page dissent in the case.

"This case requires us to address how [the public trust doctrine] should be applied by governmental entities other than the Commission on Water Resource Management, in light of our decision in *Kelly*," Recktenwald wrote.

He pointed out that the ICA had considered the role of the Kaua`i Planning Commission first, then assessed additional duties imposed by the public trust doctrine.

The ICA decision directed the Planning Commission to simply make "appropriate assessments and require reasonable measures to protect water resources."

"In contrast," Recktenwald wrote, "the majority's approach requires that the applicant prove that all potentially applicable regulatory requirements, including those applicable to third parties not under the applicant's control, have been satisfied."

The majority's decision would require Grove Farm "to seek a declaration from the PUC on its status as a utility," he continued. "It is unclear ... how that additional regulatory review will further the purposes of the public trust doctrine. And, if Grove Farm decides not to pursue it, Kaua`i Springs' application will be at an end."

Recktenwald also pointed out that the Planning Commission did not seek a decision supporting its denial of the permits. Rather, the commission had agreed with the ICA's decision to remand the matter, and with the court's directions on how to evaluate the permits.

"[T]he majority is crafting an outcome that neither party sought," he wrote.

To Recktenwald, the majority's decision went too far.

"There are a large and diverse array of agencies that might issue permits or approvals that could in some way affect a water resource. Would the Kaua`i building division, in considering a request by Kaua`i Springs for a permit to expand its facility, be obligated to consider Kaua`i Springs' use of the water that would be processed in the expanded facility? What if Kaua`i Springs sought to add a second floor to its processing facility, and wanted to install an elevator to access it – would the Boiler and Elevator Inspection Branch of the Department of Occupational Safety and Health be required to consider the impact of granting an elevator installation permit on water use issues? The answers presumably would depend on the extent to which those agencies had a regulatory interest in water use. Thus, starting the analysis with an examination of the agency's regulatory mandate, as suggested by the ICA, makes sense," he wrote.

The seemingly extreme examples Recktenwald posed don't seem to concern Moriwake.

"That's the job of dissents .... You throw out the parade of horribles [to try to illustrate] that this rule, left to its ultimate conclusion, is going to result in disaster," he says.

But the majority opinion simply clarifies what the public trust requires of private companies that wish to use public resources for profit, he argues.

The Supreme Court concluded that the standards laid out by the ICA incorrectly inverted the public trust doctrine by mandating the evaluation of "appropriate assessments" and "reasonable measures" *before* the propriety of the proposed use has been assessed.

"[T]he ICA's proposed test is deficient because it does not provide the degree of protection of the public trust required by the law that our prior holdings recognize," the majority decision states.

Moriwake notes that the standard to make "appropriate assessments" and impose "reasonable meaures" – terms drawn from the *Kelly* case – comes into play late in the planning process. Had the Supreme Court agreed with the ICA, it would have set a "diluted and superficial standard," he says.

WMA Designation

Designation all of Hawai`i as a water management area (WMA), which is what was originally proposed when the state Water Code was created, would give the Water Commission more authority over water issues statewide. Designation might "make it clear that there's a primary agency where the buck stops," Moriwake suggests. Currently, only Moloka`i, most of O`ahu, and as small part of Maui have been designated.

But in the absence of statewide designation, "we're not going to say it's a water free for all. The state has a trust duty," he adds.

While designation might help centralize decision making with regard to water, it comes with its own problems, according to the Water Commission's Tam. Once an area is designated, the work required to simply process water use permits is enormous, he says.

He also warned against letting isolated conflicts drive designation.

"In areas not under stress, you don't need to permit everything right now because of a conflict. There's always the danger of the tail wagging the dog, of using a water conflict to get the zoning," he says.

"We've got a lot on our plate," he says, referring to three contested case hearings on Maui, management of Central O`ahu water use, a petition to designate an aquifer in Kona, and stream issues on Kaua`i.

(For more background on this case, see the story published in our June 2013 edition, "Kaua`i Water Bottler's Permit is Vacated by Appellate Court.")

Teresa Dawson

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FOREST CITY
HAWAII KONA, LLC

April 29, 2014

Mr. Greg Ogin, Chairperson
Kona Community Development Plan Action Committee
Via email: oginhi@hawaiiantel.net

Re: Testimony in support of the KCDPAC Motion to Oppose Designation of the Keauhou Aquifer System Area

Dear Mr. Ogin,

Thank you for this opportunity to provide testimony in support of the motion before your Kona CDP Action Committee, which would take a stand against the National Park Service's petition to designate the Keauhou Aquifer as a Water Management Area.

Forest City Hawaii Kona, LLC, in partnership with the State of Hawaii, Hawaii Housing Finance and Development Corporation, is developing a mixed-use housing project in the urban area of Kona, to include up to 2,330 residential units, more than 50% of which will be sold or rented to Hawaii households who earn140% or less of the HUD area median income. The Kamakana Villages will also include neighborhood commercial sites, numerous park and open space areas, bikelanes, walking paths, archaeological preserves, and school sites. We are honored to have an opportunity to build a community where so many kama'āina will be able to make their home.

Developing Kamakana Villages means developing infrastructure, including water systems, to support this community. We are very concerned that designation of the Keauhou Aquifer will delay and likely jeopardize our ability to affordably and efficiently develop the water system that is needed by this community. Designation would add an expensive and unnecessary layer of State control over a process that is currently comprehensively managed by the County Department of Water Supply.

The Water Code already has a process for designating water management areas based on scientific investigations and research. That process can be initiated by CWRM itself, or by the petition of others. Once the process has started, the law requires consultation with the County Council, County Mayor and County Water Board, and factual data must prove that designation is necessary. The NPS proposal would gut this deliberate and fact-based process, strip away the authority of the County, and force Big Island water users to obtain permission from the State in order to continue to use water from this aquifer, or to develop new water systems to serve area residents and enterprises.

While I personally support the conservation and other good missions of the NPS at Kaloko-Honokohau National Park, we have not seen any scientific evidence that the Keauhou Aquifer System (1) is near or can be expected to be at or near its sustainable yield capacity in the forseeable future, (2) is being mismanaged, or (3) that withdrawals from this aquifer have adversely affected water quality along the coastal areas, including the Kaloko-Honokohau National Park.

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FOREST CITY
HAWAII KONA, LLC

We therefore believe that the extreme measures proposed by the NPS are unnecessary towards their conservation mission and would only serve to thwart the many other good community-serving efforts and missions underway by others in the Kona area.

We urge you to support the motion to oppose designation of the Keauhou Aquifer.

Thank you for your consideration.

Sincerely yours,

Ann Bouslog
Development Manager

Cc: Mr. Terry Dunlap, County of Hawaii (tdunlap@co.hawaii.hi.us)
Mr. Ken Melrose, Kona CDP Action Committee (melrosek001@hawaii.rr.com)

5173 Nimitz Road Honolulu, Hawaii 96818 | Main: 808. 839.8768 Fax: 808.836.7008

Mana Purdy
75-1000 Henry Street, Suite 207
Kailua-Kona Hawai'i 96740
Email – mana@onipaa.org
Phone – (808) 895-7578

April 30th, 2014

RE: Testimony in Support of Motion to Oppose NPS Petition To Designate the Keauhou Aquifer as a Groundwater Management Area.

Mr. Greg Ogin and Kona Community Development Plan Action Committee,

Aloha my name is Mana Purdy and I am providing this testimony on behalf of myself. I have attended several meetings about and related to the National Park Service (NPS) petition to designate the Keauhou aquifer. These include the site visit to Kaloko Honokohau National Park and County Council meetings on 2/18/14 and 3/18/14, West Hawai'i Water Issues Forum on 3/20/14, Kona CDP Action Committee Meeting on 4/2/14, and the Kona Hawaiian Civic Club Meeting on 4/3/14. I have had the opportunity to witness presentations supporting and opposing the petition from experts in their field. As a result of the knowledgeable information given to me, I would like to support the Motion to oppose the National Park Service petition.

As a kama'aina of West Hawai'i, I am concerned with the implications a designation would pose on meaningful and necessary development in Kona. When an aquifer is designated, planned development (new water users) gets placed on hold until the State issues permits to existing development (existing water users) first. I am sure you are all familiar with the challenges associated with the designation of the Iao aquifer on Maui relating to the lengthy resolution of contested case hearings for water use permit applications. There are permits that are still unresolved after 11 years. If this were the case in Kona, future community opportunities spread over generations that are made possible through current development plans will be no longer.

I worked with Kohanaiki's ponds and near shore waters department specializing in anchialine pool restoration. There has been a dramatic increase in biological health of their 211 anchialine pools (northern edge of Kaloko Honokohau National Park), placing them among the most pristine in Hawai'i and very likely the world. I have visited Hualalai's anchialine pools recently (formerly a kiawe forested marsh) with similar observations of phenomenal pool health. Keahuolu's anchialine pools (southern edge of Honokohau) are some of the most pristine pools in West Hawai'i as documented by anchialine pool experts. With that being said, neighboring landowners have been acting upon what they can directly control to ensure the

health and protection of their own resources. There is no doubt that if the same type of energy and effort were put forth at Koloko Honokohau National Park, there would be a dramatic change in the health of their resources and no need to address this issue at the highest level of Hawai'i government and community involvement.

I am in support of the Motion to oppose the National Park Service petition for designation of the Keauhou aquifer. There is no threat to the coastal resources at Kaloko Honokohau National Park in the near or foreseeable future; the petition is a premature action.

Mahalo for your time.

Aloha,

Mana Purdy

GREGORY CHUN, PH.D.
AWA KELE LLC
73-1543 HAO WAY
KAILUA-KONA, HI 96740

April 30, 2014

Mr. Greg Ogin, Chair
Kona Community Development Plan Action Committee (AC)

Re: Testimony to Support Motion to Oppose the NPS Petition to Designate the Keauhou Aquifer System as a Water Management Area

Aloha mai. My name is Greg Chun, a resident of Kaloko Ma uka and registered voter in Council District 8. I have worked professionally in West Hawai'i since 1999, first with Parker Ranch and most recently with Kamehameha Schools. I am currently with the University of Hawai'i at Mānoa and continue a small consulting practice in sustainable development with clients on Hawai'i Island and the State. This letter requests that the AC support the motion to oppose the NPS petition to designate the Keauhou Aquifer System as a Water Management Area.

Testimony in support of the motion to oppose that addresses the technical issues required to meet the criteria for designation, as well as the long term economic implications of designation for Kona, is being offered by others. I would like to focus, instead, on the structural importance of the proposed motion on how public policy decision-making is made in our community.

Government, regulatory bodies, and community engagement are strange bedfellows. By purpose and law our democratic system is based on, and requires public input into, policy decisions. The processes by which this occurs, however, are designed to be adversarial in nature and, in most cases, defers ultimate decision-making to our legal system. This makes community engagement a challenging, if not uncomfortable, process for elected and appointed officials. It is also a process subject to the timing of elections, votes, and other factors not related to the specifics of an issue but more related to the politics of the process. The end result is that decisions concerning hugely impactful concerns such as resource management, land use, and industry are often being made by arbiters of a process and not necessarily by those most knowledgeable of the issues and we end up with less than innovative solutions that can come out of true collaboration.

I support this motion to oppose because it recommends a process through which we can structure into our system a means for developing a much needed water resources plan for West Hawai'i that ensures stakeholder engagement outside of a legal process. Through this action the AC can influence the design of how public policy decisions regarding water resource decisions in West Hawai'i are made that will have generational impacts. Hawai'i Islands' geology and aquifer system are unique, as our values and vision for the future as a community. As such, we need to ensure our planning and policy decision making processes are designed to ensure the best and most innovative collection of knowledge and mana'o relevant to our needs and this motion is a step in that direction.

Me ka ha'a ha'a.

Queen
Lili'uokalani
Trust

'E 'ONIPA'A KAKOU
Let us all be steadfast.

April 29, 2014

Mr. Greg Ogin, Chair
Kona Community Development Plan, Action Committee

Re: Testimony in SUPPORT of the Motion to oppose the NPS Petition to designate the Keauhou Aquifer as a Water Management Area

My name is LeeAnn Crabbe, Vice President at Queen Lili'uokalani Trust. The Trust recommends that the National Park Service petition to designate the Keahuou Aquifer as a Water Management Area be denied at this time.

In 1909, Hawaii's beloved Mō'ī Wahine Lili'uokalani created a special trust dedicated to the welfare of orphaned and destitute children of Hawai'i. Over 100 years later, we continue to be inspired by the Queen's foresight, vision and values that serve as the foundation of our work.

The sacred duty of the Queen Lili'uokalani Trust is to manage the Queen's lands to serve and provide for her beneficiaries. Core trust assets include approximately 6,200 acres of Hawai'i real estate, the vast majority of which are located on Hawai'i Island. 92% is agriculture/conservation land, with the remainder zoned for residential, commercial or industrial use. Hawai'i Island holdings include the 3,400-acre ahupua'a of Keahuolū in North Kona.

The Trust is sustained and nurtured by careful and increasingly complex management, conducted by a dedicated and competent corps of trustees, administrators, staff and collaborative partners. This careful management of the Trust enables our Children's Centers to address and meet the needs of our Hawaiian children and families through a service strategy that is collaborative, holistic and culturally based. The Trust charges no fees for services to beneficiary children and their families.

To sustain and expand these services, the Trust is pursuing projects to utilize its assets in order to ensure continued financial stability. Trust lands at Keahuolū provide the only source of significant future income for expanding our charitable programs. This is why we have followed and actively engaged in discussions over development and water sustainability issues on Hawai'i Island.

The National Parks Service has petitioned the State Commission on Water Resource Management to designate the Keauhou Aquifer System as a Water Management Area. The

Parks Service says this is necessary to protect the Kaloko-Honokōhau National Historic Park from future proposed development in Kona.

Queen Lili'uokalani Trust respects the work being done by the National Parks Service throughout the state of Hawai'i. We agree these national parks are important cultural treasures. not just to the Hawaiian community, but for the entire state.

But we do NOT believe there is a need to designate the Keauhou Aquifer System as a Water Management Area.

We have conducted extensive studies on groundwater issues. We work closely with the Kona Water Roundtable, state and county officials and the local community. We rely on reliable and credible sources of data for decision-making.

We would not utilize a fresh water source that would negatively impact the community, future generations, or the environmental and cultural resources at the Kaloko-Honokōhau National Historic Park or anywhere else in Hawai'i Nei. If credible information were to prove otherwise. the Trust would be the first to re-evaluate its land use and water practices.

We have healthy and pristine anchialine ponds at Keaholu and are committed to their protection. proper care and restoration. We have seen no evidence that up-gradient or lower-level fresh and brackish water wells have impacted these ponds, nor do we expect. based on all available research. that additional wells would negatively impact them.

The Queen remains a guiding spirit. *ka lama o ka no'eau* for those of us who strive to fulfill her mandate to manage and grow Trust assets to ensure that the work of our Children's Centers continues in perpetuity. In this second century of providing service to the Queen's beneficiaries. her vision, ideals and values remain strong and empowering. *E 'onipa'a kākou!*

Mahalo for your consideration. I urge you to support the Motion to oppose the NPS Petition to designate the Keauhou Aquifer as a Water Management Area.

Aloha,

LeeAnn E.P. Crabbe
Vice President

NEIL ABERCROMBIE
GOVERNOR

CRAIG K. HIRAI
EXECUTIVE DIRECTOR

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT AND TOURISM
HAWAII HOUSING FINANCE AND DEVELOPMENT CORPORATION
677 QUEEN STREET, SUITE 300
Honolulu, Hawaii 96813
FAX: (808) 587-0600

IN REPLY REFER TO:
14:DEV/0047

April 29, 2014

Mr. Greg Ogin, Chairperson
Kona Community Development Plan Action Committee
Via email: oginhi@hawaiiantel.net

Re: Testimony in Support of the KCDPAC Motion to Oppose Designation of the Keauhou Aquifer System Area

Dear Mr. Ogin:

Thank you for this opportunity to add our voice to Forest City's opposition to the National Park Service's (NPS) petition to designate the Keauhou Aquifer as a Ground Water Management Area.

The State of Hawaii, Hawaii Housing Finance and Development Corporation (HHFDC) has selected Forest City Hawaii Kona, LLC to be its developer for Kamakana Villages, a mixed-use housing project in the urban area of Kona to include up to 2,330 residential units, more than 50% of which will be sold or rented to Hawaii households who earn140% or less of the HUD area median income.

HHFDC shares Forest City's concern that designation of the Keauhou Aquifer will seriously delay and likely jeopardize their ability to affordably and efficiently develop the water system that is needed by this community. Designation would add an expensive and unnecessary layer of State control over a process that is currently comprehensively managed by the County Department of Water Supply. HHFDC also agrees that the Water Code already has a process for designating water management areas based on scientific investigations and research.

We likewise believe that the measures proposed by the NPS are unnecessary to support its conservation mission and only serves to thwart the many other good community-serving efforts and missions underway by others in the Kona area.

Sincerely,

Craig K. Hirai
Executive Director

Cc: Terry Dunlap, County of Hawaii (tdunlap@co.hawaii.hi.us)
Ken Melrose, Kona CDP Action Committee (melrosek001@hawaii.rr.com)
Ann Bouslog, Forest City Hawaii Kona, LLC

Ho'okuleana LLC
... to take responsibility ...

Peter T. Young
1539 Kanapu'u Drive
Kailua, Hawai'i 96734
(808) 226-3567 (Cell Phone)
peter.t.young (Skype)
PeterYoung@Hookuleana.com
www.Hookuleana.com

Deny the Groundwater Management Area Designation for the Keauhou Aquifer

The National Park claims that withdrawing water from fresh and brackish wells will impact the anchialine ponds, fishponds and nearshore waters, and will affect native Hawaiian practices.

However, after 25-years, with millions of gallons per day being pumped from wells above and around the Park, the National Park's own studies and statements say that the resources at the Park are in good condition and are not impaired.

The aquifer is not in trouble - whether in quantity or quality of water.

To the year 2025, with Kona's expected growth factored in, it is projected that only 22% of the total available water will be used - the rest of the water (78%) remains in the aquifer.

If there is designation, everyone must apply for a permit - no one is grandfathered in.

And, there is no guarantee that any existing user will be issued a State Water Use permit.

Water Use permits are subject to Contested Case hearings; these are administrative trials with parties represented by attorneys, and witnesses called to testify and be cross-examined. It is not a public process. The public is excluded from Contested Cases and only "interested parties" participate.

The National Park seeks to intervene in all actions before governmental agencies; they will ask for Contested Case hearings on all permit applications and then fight withdrawals of water.

If designated, all 'existing' uses must be permitted before any 'new' uses can be considered.

This will unreasonably stop the implementation of the Kona Community Development Plan.

If designation is granted, the National Park will effectively create an indefinite moratorium in Kona. This will not just affect private landowners; the moratorium will also stop public projects.

Hawai'i Community College Palamanui, the State Judiciary Complex, a new Hospital, NELHA expansion, Kona International Airport expansion, new Affordable Housing, new Schools and new Parks will all be effectively stopped. These are all new uses and must wait until water for existing uses are resolved. None of these needed public use projects are guaranteed they will get water permits under the designation.

While the National Park only provides unsubstantiated fears, the State law requires scientific investigations and research in order to designate. The National Park has no studies to corroborate their claims.

No one wants to harm West Hawai'i's natural and cultural resources. The aquifer is not in trouble, not now or in the foreseeable future.

The National Park petition for State Water Management Area designation should be denied.

Do well by doing good.

Dunlap, Terry

From: Terry Dunlap [tdunlap@co.hawaii.hi.us]
Sent: Monday, April 21, 2014 4:05 PM
To: 'Terry Dunlap'
Subject: FW: Water designation petition motion
Importance: High

Testimony from Janice Palma- Glennie o the water designation petition motion.
T

From: Janice Palma-Glennie [mailto:palmtree7@hawaiiantel.net]
Sent: Monday, April 21, 2014 11:39 AM
To: Dunlap, Terry
Cc: hawaii county planning dept; Bobby Command; karen eoff; dru kanuha
Subject: Water designation petition motion
Importance: High

Please circulate this testimony to Action Committee members immediately. Mahalo.

Aloha, Terry and KCDP action committee members,

I'm writing today in the spirit of preserving the integrity of our treasured KCDP and helping our community to move forward in the spirit in which it was written, which was to be inclusive of all community stakeholders. In that spirit and for those reasons, the motion which Ken Melrose penned on behalf of the AC should be shelved or at least tabled for now.

It's clear that the water petition process and discussion 1) is only just out of the gate, 2) deserves discussion by as many regional stakeholders as possible while allowing new science- and other fact-based information to come forward in its due time (per petition process protocol), and, most important, 3) is very divisive and, inadvertently or otherwise, is becoming a wedge between otherwise akamai individual stakeholders and groups of our North and South Kona communities.

Making a decision on the petition at this early date, without the necessary knowledge or open mindedness required to do so, will significantly damage the across-the-board appeal which the KCDP must have for it to be the effective tool it was created to be. Lack of knowledge on the designation topic has gratefully been acknowledged by some members, yet a vote on something relatively unknown, yet so important, remains a threat to the KCDP's credibility. Therefore, it behooves all AC members, in their capacity as community reps, to step back from what's becoming an unsavory fray (unfortunately largely generated through vitrolic presentations given by Kaloko Makai LLC's PR person, Peter Young and others). Despite incredulously claiming kind feelings toward National Park Service (who, as we've been reminded many times, is just doing its mandated, public-centric job job), Mr Young and others' all-out, relentless attacks on NPS as "outsider them" opposed to island "resident us" has struck deep nerves in our community, making it much more difficult to have discussions with people who otherwise would be open to sharing their views. Their negative, "divide and conquer" rhetoric has been abundantly obvious, giving pause to local residents who need to pinch themselves to remember that they're still in Hawai`i. Tragic.

Of course, petition critics, including members of the Action Committee, are free to speak their minds legally, in the proper venues and, hopefully, more transparently than the kick off dog and pony show at the County Council, which gave chance of further discussions regarding the petition an unnecessarily shaky start. However, when that show trickles down to the KCDP, a document most definitely meant to be a "we" document and ordinance, it's time for the AC members, as representatives of a community seeking to create a positive regional land use planning paradigm, to step back and disentangle that document and process from the show. Getting back down to the infinite demanding tasks that the group is entrusted with pursuing is even more logical since the AC is advisory only. Why, then, would the AC and/or the planning department not want to forego making this one decision to avoid damaging so much of the good that's been done to this point (damage which, guaranteed, has already started to happen)?

Please vote to table/defer the motion regarding the water designation petition so that the AC members can get back to the positive work that can be done for our communities, whether there's a water designation or not.

Mahalo and sincerely,
Janice Palma-glennie

cc: Planning Director Duane Kanuha; Deputy Planning Director Bobby Command; North and South Kona Council members Dru Kanuha and Karen Eoff

The Pacific Resource
PARTNERSHIP

April 30, 2014

Duane Kanuha, Director
Kona Planning Department
West Hawaii Office
74-5044 Ane Keohokalole Hwy
Kailua-Kona, HI 96740

Subject: Keauhou Aquifer System Area & Groundwater Management Area Designation

Aloha Director Kanuha and Members of the Kona Planning Department:

The Pacific Resource Partnership (PRP) serves as the critical link between Hawaii's top contractors and the largest construction union in the state, the Hawaii Regional Council of Carpenters (HRCC). As an advocate for unionized construction and a resource for management, PRP is able to bridge these traditional divides to lead efforts that sustain the robust health of the building industry. Working with its extensive network of public and private developers and contractors, and the unionized carpenters who help drive Hawaii's third largest industry, PRP has advanced initiatives that improve labor-management relationships, increase workplace safety, enhance efficiency, and reduce construction costs. PRP's mission is to strengthen the state's economy, create jobs and enhance the quality of life for all of Hawaii's residents.

PRP opposes the Designation of a Water Management Area and Groundwater Management Area for the Keauhou Aquifer System for the following reasons:

- The National Park has not provided any scientific research to validate its claims of impact on the ponds or Hawaiian cultural practices. Hawaii State law requires designation of a State Water Management Area must be "reasonably determined" "after conducting scientific investigations and research."

- For the past 25-years, millions of gallons per day have been pumped from fresh and brackish wells above and around the park. Today, the water resources at the park are in good condition and are not impaired. It should also be noted that withdrawing water from mauka wells in neighboring projects - Kukio, Hualalai and Mauna Lani - has not harmed their anchialine ponds, fish ponds or nearshore waters.

- The Keauhou Aquifer is not in trouble. The quantity and quality of water are both good. In the year 2025, with Kona's expected growth factored in, it is projected that only

about 22% of the total available water will be used. 78% of the available water will still remain in the Keauhou Aquifer. West Hawaii's natural and cultural resources are not at risk - neither now nor in the foreseeable future at the National Park.

There is an abundance of water today and well into the future and thus, we respectfully request the National Park petition for State Water Management Area designation be denied.

Sincerely,

Cindy McMillan
Director, Advocacy and Communications

Palani Ranch Company

P.O. Box 9032
Kailua-Kona, HI 96745
Phone: (808) 895-3788 • Fax: (808) 329-8044
Email: bcraven@lanihau.net

April 22, 2014

Greg Ogin, Chairperson
Kona Community Development Plan, Action Committee

RE: Testimony in support of the Motion to oppose the NPS petition on the Keauhou aquifer

My name is Britt Craven, President of Palani Ranch Company. I am a lifelong resident of Hawaii. We have been stewards of lands in North Kona since the early 1900s and we used to own the ahupuaa of Honokohau, which included the portion that was sold to the federal government for the Kaloko Honokohau National Park.

Our business employs and supports residents of our North Kona community. We actively manage and steward over ten thousand acres of land in mauka Kona and provide needed watershed/groundwater recharge for our community. If we weren't good stewards of our lands, there could be much surface water runoff. This could increase soil erosion and siltation of the near shore waters. It could prevent the rains from percolating into the ground, replenishing our high level and basal water sources that provide drinking water to our community, as well as the anchialine ponds at the Park.

The livestock business is cyclical. We are a commodity that is heavily dependent upon rainfall for feed. During lean times, we rely on our affiliated company (Lanihau Properties) for financial support. If you prevent Lanihau Properties from being successful, by restricting their access to water sources they have paid for, then you restrict our ability to remain in existence, and our ability to steward these mauka lands as we have for generations, and we expect for generations to come.

The petition to designate is premature. Please vote to oppose the NPS' in their efforts to stifle our economy, put hard working families out of a job, and cripple our ability to carry out our families stewardship mission on our mauka lands.

Mahalo for your time and contributions to our community.

Aloha,

Anthony Britt Craven
President
Palani Ranch Company, Inc.

waimea water services

To: Mr. Terry Dunlap

From: Stephen P. Bowles

Subject: Support of the Ken Melrose motion in opposition to the proposed declaration of the Keauhou Aquifer System.

I have reviewed with the ken Melrose proposal and agree that the Keauhou Aquifer System does not meet the requirements by the Commission on Water Resource Management for Designation as a water management area.

I am strongly opposed to such draconian measures at this time

I have been a principal investigator for many ground-water projects, especially North of the Palani Road junction with Queen Kaahumanu, since the 1980's. I did the original water resource evaluations for the original Keahole to Kailua development plan.

The advent of the CDP plan and water development activities in the area have clearly set the tone for cautious development and management of the ground-water resources of the area. My experience in the area supports the need for a better integration of the knowledge of these resources as proposed in the amendment.

The Kona Water Roundtable is important as a forum for such knowledge as it is obtained. Many investigations have been presented openly and are subject to peer review, namely the community impacted. This should continue.

Waimea Water Services, LLC
67-1161 Mamalahoa Hwy., Suite 5 • Kamuela, HI 96743 • Phone 808-885-5941 • Fax 808-885-7851

Carl A. Carlson, Jr.

73-1515 Apela Place Kailua-Kona, Hawaii 96740 (808) 3254005 (808) 3252511 facsimile
cacarlson1@me.com

April 28, 2014

Mr. Greg Ogin, Chair
Kona Community Development Plan, Action Committee

Re: Testimony in support of the Motion to oppose the NPS Petition to Designate the Keauhou Aquifer as a Water Management Area

My name is Carl Carlson and I live in Kaloko Mauka in a home we built in 1979. I was born on Maui, but moved to this island in 1968 and then here to North Kona at the end of 1969 to become the Ranch Manager at Huehue Ranch. My wife Christine and I have four children all of whom were born in Kona Hospital and all four live on this island with two of them residing in North Kona. We have six grandchildren with the older two of school age attending Kamehameha Schools.

At one time, the lands of Kaloko were owned and operated by Huehue Ranch. I can recall our having to catch all of the wild cattle that roamed the Makai areas from Kaloko to Ooma because the State was building the new airport at Keahole. The wild cattle got their water from the anchialine ponds at Kaloko and Kohanaiki. There were very few homes on Mamalahoa Highway back then and those that existed north of Palani Junction did not have County water service, they got their water from roof catchment. We knew how precious water was then and we now appreciate the County service that we have.

From that time and during my career, I've watched and participated in the growth and planning efforts in West Hawaii and especially in the North Kona District. When Raymond Suefuji was Planning Director in the late 1960s, he came up with the General Plan which was the first comprehensive planning document that would set the direction for growth on this island by District. That document has been updated several times over the years and is being updated at this time. As North Kona grew, it became apparent that there was need for more detailed regional planning for the area. Mayor Yamashiro came up with the Keahole to Keauhou or K to K Plan that further described or designated the pattern of growth in the region. More recently, Mayor Kim improved upon the K to K Plan with the initiation of the Community Development Plans.

Over the years, the State and County have used these various plans for their State Land Use District and County Zoning entitlement changes. The process is lengthy, deliberate and subject to numerous public hearings. Growth has occurred as planned and anticipated, it has not occurred as a random action or in a vacuum. One can agree or disagree with the result, but they have to recognize that there has been a very public process.

I was disappointed to see the National Park Service submit a petition to CWRM to declare the Keauhou Aquifer as a Water Management Area. In my opinion, this petition is premature and isn't necessary to protect and preserve the quality of the water resources in the Keauhou Aquifer. The management and regulatory tools to do so are already in existence and in place within CWRM and at the County. I am further concerned that the efforts of the NPS to seek designation are divisive in our community. These actions seem to pit some stakeholders or community members against others. At the time the Park was created, the planned growth areas were apparent.

It has been represented that designation would be the reasonable thing to do. That sounds almost too easy. That misstates the impact of designation as evidenced by the experience on Maui. It is clear that designation would be an unreasonable action and that it would be detrimental to our community. Designation would have the effect of preventing the planned growth that the Kona CDP has envisioned. There have been years of careful planning efforts including that of the CDP designed to allow for growth in a thoughtful manner. Among others, these plans have considered the protection of resources, cultural practices and the environment while at the same time providing a plan for the future of our community. As one who has lived in this community for a long time, I am appreciative of that effort and vision.

Thank you for your consideration. I would urge you to support the Motion to oppose the NPS Petition to designate the Keauhou Aquifer as a Water Management Area.

Sincerely yours,

Carl A. Carlson, Jr.

Dunlap, Terry

From: Terry Dunlap [tdunlap@co.hawaii.hi.us]
Sent: Tuesday, April 22, 2014 4:24 PM
To: 'Terry Dunlap'
Subject: FW: opposition to petition by NPS for designation of Keauhou Aquifer System

This has been forwarded to all Kona CDPaction committee members as a blind copy.
Terry

From: Don Goo [mailto:dgoo.goodesign@gmail.com]
Sent: Tuesday, April 22, 2014 2:37 PM
To: tdunlap@co.hawaii.hi.us
Subject: opposition to petition by NPS for designation of Keauhou Aquifer System

I am opposed to the petition by NPS for designation of the Keauhou Aquifer System. NPS should withdraw its petition and work with the Action Committee for the Kona CDP to lend its scientific resources and data in conjunction with the WRMP to manage the impacts of growth on all the coastal resources of Kona in a collaborative effort.

Don Goo, FAIA

KAI HAWAII STRUCTURAL & FORENSIC ENGINEERS

Ken Hayashida, P.E. | *President*
Michael Hunnemann, P.E. | *Vice President*

April 22, 2014

Mr. Terry Dunlap
County of Hawaii
Department of Planning

Via Email: tdunlap@co.hawaii.hi.us

RE: Testimony in OPPOSITION of the National Park Petition for State Water Management Area Designation of the Keauhou Aquifer System

Dear Mr. Dunlap,

As a member of the Hawaii Leeward Planning Conference, I am submitting testimony that I oppose the National Park Petition for State Water Management Area designation of the Keauhou Aquifer System.

The National Park Petition for State Water Management Area designation should be denied for the following reasons:

- There are no impacts to Native Hawaiian traditional cultural practices
- There are no impacts to the National Park
- There is an abundance of water for today and well into the future, and the quality of water is good
- A State Water Management Area designation will impact Hawaii Community College Palamanui, Affordable Housing, new schools, new parks, a new hospital, a new judiciary building, NELHA, and Kona International Airport
- State Law mandates action at 90% capacity; Keauhou Aquifer is at 32% capacity.

I respectfully request that you OPPOSE the National Park Petition for State Water Management Area designation of the Keauhou Aquifer System. Thank you for an opportunity to express my view in OPPOSITION of this petition.

Respectfully submitted,

Ken Hayashida, P.E.
President
KAI Hawaii, Inc.

50 S. Beretania Street, #C-119C | Honolulu, Hawaii 96813 | Tel: (808) 533-2210 | Fax: (808) 533-2686 | Email: mail@kaihawaii.com

Lanihau Properties LLC
P.O. Box 9032
Kailua-Kona, HI 96745
Phone: (808) 936-7129 • Fax: (808) 329-8044
Email: rsmith@lanihau.net

April 28, 2014

Greg Ogin, Chairperson
Kona Community Development Plan, Action Committee

RE: Testimony in support of the Motion to oppose the NPS petition on the Keauhou aquifer

My name is Riley Smith, President of Lanihau Properties. I am a lifelong resident of Hawaii, I am also the CEO for the combined family enterprise that includes Palani Ranch. We have been stewards of lands in North Kona since the early 1900s and we used to own the ahupuaa of Honokohau, which included a portion that was sold to the federal government for the Kaloko Honokohau National Park.

My testimony is a follow up to my comments at your meeting of April 2, 2014. Your group is entitled the Kona Community Development Plan, Action Committee. Your mission is to support the planned growth of Kona and is the result of over eight years of hard work by our entire community. This plan was adopted by ordinance by the County Council in 2008.

The NPS has shown by their actions that they are opposed to improvements in our economy. The attached article, was co-authored by Sallie Beavers, the NPS' Chief Integrated Resources Ecologist. In it, she outlines how they intentionally use existing State/County laws to enable the NPS to stop urbanization in/around the NP. Her "Lessons Learned" on the fourth page is a recipe that they have consistently followed to stop urbanization and the Kona Community Development Plan. It is the same protocol they are now following in their efforts to designate the Keauhou aquifer. Note that this article was written in 2003; 11 years ago. This clearly tells me that they are trying to stop our economy.

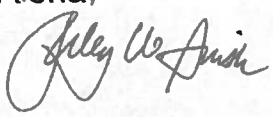
As explained to your group, when the Iao aquifer on Maui was designated in 2003, all existing water users had to re-apply to the State Commission on Water Resource Management for their well use permits. It is now 2014 (11 years later) and CWRM has not completed its review/approval of all **existing** well use permits. This means that after

11 years, that Maui County is not able to consider providing water to any **new** uses (until the existing uses are resolved). A similar impact in North Kona would be devastating. All of the proposed projects in our community would be delayed till at least 2025. As the NPS has stated, they have a public trust responsibility to intervene in all planned water uses around the Park. So, they will intervene in each of the existing well use permit applications before CWRM and delay their approval.

Until these **existing** uses are resolved, all **new** uses would be delayed. This would include the Hawaii Community College at Palamanui, the new Judiciary complex, the NELHA expansion, Kona International Airport expansion, all affordable housing projects (including the Kamakana Villages project), DHHL Laiopua Village 4, the new hospital, all new schools and the County Regional Park. These are the consequences of designating an aquifer that is currently using 14 mgd, when it is capable of providing 38 mgd. The petition to designate is premature.

Mahalo for your time and contributions to our community.

Aloha,



Riley W. Smith, P.E.
President

Attachment: Kaloko Honokohau – Using State Laws and Regulations to Protect Parks from Adjacent Development Impacts: A Case Study from Hawaii (2003)

Using State Laws and Regulations to Protect Parks from Adjacent Development Impacts: A Case Study from Hawaii

Stanley C. Bond, Jr., Kaloko-Honokohau National Historical Park, 73-4786 Kanalani Street, Suite 14, Kailua-Kona, Hawaii 96740; stanley_c_bond@nps.gov
Sallie C. Beavers, Kaloko-Honokohau National Historical Park, 73-4786 Kanalani Street, Suite 14, Kailua-Kona, Hawaii 96740; sallie_beavers@nps.gov
Nicole Walthall, San Francisco Field Office, Office of the Solicitor, U.S. Department of the Interior, 1111 Jackson Street, Suite 735, Oakland, California 94607
Roy Irwin, Water Resources Division, National Park Service, 1201 Oakridge Drive, Suite 250, Fort Collins, Colorado 80525; roy_irwin@nps.gov

Introduction

Although federal laws, regulations, and management policies govern the management of national parks, parks have little control over surrounding lands. The parks most often affected by surrounding development are small parks and those in urbanizing areas. This paper provides an example of how development outside of a park might affect park resources and how a park can use state and local land use processes to help protect those resources. Kaloko-Honokohau National Historical Park, located on the island of Hawaii, formally intervened in an administrative hearing before the Hawaii Land Use Commission (LUC) regarding a proposed industrial development upslope of the park. In this specific case, the park entered into a contested-case hearing with TSA Corporation, which sought to have the classification of 102 acres of land changed from "Conservation" to "Urban" for the expansion of Kaloko Industrial Park.

Setting

Kaloko-Honokohau National Historical Park was established to "provide a center for the preservation, interpretation and culture, and to demonstrate historic land use patterns as well as provide needed resources for the education, enjoyment, and appreciation of ... traditional native Hawaiian activities and culture by local residents and visitors...." The park encompasses an area rich in native Hawaiian sacred places and traditional practices. Located on the west coast of Hawaii Island, the park consists of 564 acres of terrestrial and 596 acres of marine ecosystems. It contains 11 endangered, threatened, and candidate species and over 230 archeological sites. Three lava flows from Hualalai Volcano dominate the landscape, as do invasive plant communities.

The park's cultural resources include Kaloko Fishpond, Aimakapa Fishpond, and Aiopio Fishtrap, all of which historically provided fish for Hawaiian families. Kaloko Fishpond is one of the most significant cultural features in the Park. The fishpond could produce up to 5,000 pounds of fish per year. The park waters are a central element in many Native Hawaiian practices and rituals performed within the park boundaries. These traditional practices rely heavily on the quality of the water, including groundwater, in the national park.

The park is located on the leeward, or dry, side of the island in the rain shadow of Hualalai Volcano and receives 15 to 20 inches of rainfall a year. However, orographic convection produces between 40 and 60 inches of rain upslope at elevations ranging from 1,000 to 6,000 ft. The porous nature of the lava allows rainfall to seep quickly underground; consequently there are no permanent streams on the west side of the island. Groundwater eventually emerges as slightly brackish anchialine pools along the coast as the lighter freshwater lens rides over the heavier seawater. Freshwater springs are also found offshore. As this water flows downslope to the park it passes beneath development and can carry nutrients and contaminants produced or discharged there. The purpose of the park's intervening in the land use change process

was to have this and future developers minimize or eliminate potential contamination of the groundwater, thus reducing potential effects on park natural and cultural resources.

Hawaii Land Use Commission

State law created the LUC in 1961 and Hawaii was the first to have a land use law. Significant revisions to the law were made in 1974. There are nine governor-appointed commissioners, one from each of the four counties and five from the public at large. Commissioners are generally a mix of lawyers, developers, and union leaders. The original organizing principles of the LUC were efficient urbanization and the preservation of agricultural and conservation lands. By law, the decision-making process of the LUC is quasi-judicial in nature to ensure that those who are affected by the decision are accorded due process before an action is taken. The park's case was strengthened by two recent Hawaii Supreme Court decisions that reaffirmed the state's constitutional requirement to protect native Hawaiian traditional and customary rights exercised for subsistence, cultural, and religious purposes. In one of those cases, the Supreme Court specifically found that the LUC had run afoul of its obligation to uphold such rights.

Land Use Classification

The LUC recognizes four categories of land classification: Urban (4.7% of the state) Conservation (48%), Agriculture (47%), and Rural (2.3%). In Hawaii, counties have exclusive administration over land uses within the Urban district. Once classified by the state as Urban, county zoning laws and regulations apply. One reason the park intervened at the state level is that we believed the state was more likely to impose additional and stricter conditions on the developer than Hawaii County.

Procedures and Proceedings

In April 2000, the park received an environmental impact statement (EIS) preparation notice from TSA Corporation for the expansion of Kaloko Industrial Park as part of a petition to the LUC to change the property's land use designation from Conservation to Urban. The park responded to the notice, voicing our concern for water quality and concern with the current development. Specifically, contaminants had been found in park wells, fishpond sediments, and fish tissue, and some waters were showing evidence of nutrification. We felt that these impacts could be attributed to the use of cesspools for wastewater disposal and dry wells for stormwater runoff in the first phases of Kaloko Industrial Park. TSA Corporation published its draft EIS for comment in August 2000. The park again commented, noting the inadequacy of scientific study to show that there would be no impact to the park from upslope development. TSA stated that they would upgrade wastewater disposal to a standard septic tank. The park argued that standard septic tanks and dry wells were inadequate methods of water treatment. The LUC held a hearing in November on the TSA EIS. The National Park Service (NPS) attended and, asserting that the EIS was inadequate, requested that the commission reject it. However the commission voted to accept the EIS.

Once the commission accepted the EIS, the park's only recourse was to become an intervening party in the LUC hearing process. The park was also encouraged to intervene by the State Office of Planning, which was concerned that the proposed development would adversely affect the environment but did not have access to the high level of expertise as did NPS. The park's desire was not to stop development but rather to ensure that it would not adversely affect park resources, primarily those dependent on good water quality. We requested four broad conditions be placed on the developer: (1) enhanced wastewater treatment to reduce nutrients; (2) stormwater runoff containment and treatment; (3) monitoring of water quality; and (4) a pollution prevention plan specific to the types of businesses that could be located within the development.

As an intervener, the park enjoyed the same standing as the other parties in this hearing: the petitioner (TSA Corporation), State

Office of Planning, and Hawaii County. We could enter and present evidence, and cross-examine and call witnesses. Legal representation is not required before the LUC. The park started the first hearing without an attorney but after having a commissioner point a finger and shout, "Park Service, get a lawyer!" we knew we needed one.

From March 2001 to February 2002 the LUC held eight hearings on the TSA petition. Perhaps the most significant event for the park came early in the hearing process when the LUC conducted a site visit to Kaloko–Honokohau. All nine commissioners and parties were present. None of the commissioners had visited the park and prior to their visit viewed the area as an unproductive lava field. Once commissioners saw and understood the significance of park's cultural and natural resources, they were much more sympathetic to the our position.

Beginning with the petitioner, each party called its expert witnesses. The petitioner had experts in groundwater, marine resources, pollution prevention, botany, wildlife biology, cultural resources, and wastewater engineering and stormwater management. State and county experts were engineers with comments on wastewater and stormwater management.

The core NPS team consisted of Nicole Walthall, an assistant field solicitor from the San Francisco Field Office; Stanley Bond, integrated resource manager; Sallie Beavers, marine ecologist; and Roy Irwin from the NPS Water Resources Division. The team pulled together information that questioned the developer's findings of no effect on the park and contacted individuals who could provide relevant information and serve as expert witnesses. The park assembled an impressive list of expert witnesses from throughout the NPS, Department of the Interior, and other public and private organizations.

Needless to say there were significant disagreements between the developer's experts, who claimed that the development would have no impact, and NPS experts, who demonstrated that the developer's studies were flawed. The weakness of the petitioner's studies and its inability to support a claim of no impact to the park was the focus of NPS' case. Testimony from state and county witnesses showed that county, state, and federal laws did not protect groundwater, except in the case of drinking water. Even the LUC members were incredulous over some of the developer's testimony, and the high point was when one commissioner, after hearing that a 10,000-gallon gasoline spill would not reach the park, stated (in Hawaiian Pidgin): "So far today I never hear anybody say it's not going to happen. All I been hearing 'it could not happen.' So you no need to be a rocket scientist to figure this out. Your spill in the area, especially on the Kona side with all the lava tubes and the cracks, you going to contain a spill in that area? I get only 12 grades of education, but I not dumb."

Outcome

Following the public hearings, each party prepared a draft Findings of Fact, Conclusions of Law, and Decision and Order. Ultimately, the LUC "supported [the precautionary principle] as applied to National Parks and determined that, for all proposed development adjacent to or near a National Park that raises threats of harm to the environment, cultural resources, or human health, precautionary measures should be taken to protect the National Park cultural and natural resources, even if some cause and effect relationships are not fully established scientifically" (Finding no. 165). The LUC adopted much of the language that was in the NPS version. As to the adequacy of the Findings on impacts to the park, the LUC stated: "For this petition, there was a lack of scientific study and research as to the potential adverse impacts from the proposed development. No risk assessments as prescribed by the NPS have been done to determine that no harm will come to the resources of the National Park, including anchialine ponds, the coral reef, and endangered and threatened species that rely on the health of those systems for habitat, and are considered sacred to native Hawaiians. Contrary to petitioner's position, a lack of scientific inquiry is cause for caution" (Finding no. 171). "There is an absence in the evidence

of competent and reliable studies showing that the proposed industrial development would not adversely impact the National Park's resources" (Finding no. 294). "Contamination of groundwater, increased nutrient load in the groundwater, changes in salinity of groundwater, and changes in groundwater volume alter the natural ecosystems in the National Park. The myriad of potential impacts from such changes—ranging from massive bird die-offs from avian botulism to increased population of toxic algae growth in the ponds—remains inadequately assessed and lack sufficient scientific study" (Finding no. 339).

The LUC concluded that, by law, it was required to develop and impose conditions that protected national park resources. In its Decision and Order, the LUC imposed 28 conditions on the development. For wastewater treatment, the lot owners are required to hook up to the central wastewater treatment system when it becomes available. Prior to availability, lot owners can use an enhanced septic system that removes 92% of the nitrogen and has added phosphorus removal. Only 45% of the lots (38) can be built upon prior to connection to the central wastewater treatment plant. For stormwater runoff, lot owners have to at least use oil/water separators or filters prior to runoff entering the ground. If a business uses nonpetroleum-based toxic substances, then the catchment basin must be designed to trap and remove them prior to the water entering the ground. The developer has to pay a pro-rated share of water-quality monitoring costs over the next ten years and produce a new Pollution Prevention Plan that is acceptable to the park and other parties.

Impact on Future Development

The LUC made it clear that these conditions would apply to other developers in the area of the park. A second commercial/light industrial development is planned for Conservation land directly south of this petition area and the park has successfully negotiated conditions with this developer. There are also broader implications to this ruling than simple effects on park resources. It appears that this Decision and Order has set an important precedent and that all future development adjacent to Class AA waters, not just in the vicinity of the park, will also likely be required to conform to these conditions.

Lessons Learned

- Comment at every opportunity so there is a record of your concerns.
- Get legal help from the Solicitor's Office early in the process. Legal processes are never simple or easy and are generally complex and extremely time consuming.
- Know what you want from the decision-making body.
- Use experts to analyze scientific documents and for testimony. Where possible, use qualified local experts who are familiar with the resource.
- Make sure your paperwork is in on time.
- Get the decision-makers to the site. Make your park and its resources concrete, not an abstraction.
- Reach out to the local community for public testimony. In the rush to pull evidence, information, and witnesses together, this is perhaps the area where we failed. It likely did not affect the final outcome, but could in future hearings.

DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAI'I
345 KEKŪANAŌ'A STREET, SUITE 20 • HILO, HAWAI'I 96720
TELEPHONE (808) 961-8050 • FAX (808) 961-8657

June 18, 2014

William J. Aila, Jr., Chairperson
State of Hawai'i
Department of Land and Natural Resources
Commission on Water Resource Management
P.O. Box 621
Honolulu, Hi 96809

REQUEST FOR COUNTY CONSULTATION ON THE KALOKO-HONOKŌHAU NATIONAL PARK SERVICE PETITION TO DESIGNATE KEAUHOU AQUIFER SYSTEM AREA AS A GROUND WATER MANAGEMENT AREA

The Water Board of the County of Hawai'i ("Board") is in the process of developing a comprehensive commentary on the Petition to Designate the Keauhou Aquifer System ("North Kona") as a Groundwater Water Management Area, which was filed on September 13, 2013, by the Kaloko-Honokōhau National Park Service ("Petitioner").

However, at this stage, the Board wanted to inform you that it is extremely disappointed in the Petitioner's initiation of the Petition. Their aggressive action and relentless and patronizing politicking have angered the Board and many in our community.

Since the petition was filed, the Board has heard presentations and received testimony (written and/or oral) from the Petitioner, Commission on Water Resource Management ("CWRM") staff, and numerous other stakeholders, as well as the Department of Water Supply's ("DWS") staff. Since 2008, DWS has also been closely involved in participating and facilitating the Kona Water Round Table ("KWRT") meetings to address the water concerns in the region and specifically within the Keauhou Aquifer system. At these KWRT meetings, presentations were made by the Petitioner as well as technical professionals in the area of groundwater hydrology, anchialine ponds or pools, groundwater quality management, and other practitioners. At each of these meetings[1], numerous people attended, including members of the Board, the CWRM, United States Geological Survey ("USGS") staff, the Petitioner, as well as many stakeholders of North Kona.

The Board finds it alarming in the Petitioner's proclamation that if a water management area is not designated, "new wells will be sited near sensitive habitat for culturally important and rare native species, thereby imperiling traditional and customary Native Hawaii rights and practices." This is grossly overreaching, and is an attack on the integrity of the stakeholders, public policies, and public agencies at the State and County levels that are charged to protect all resources.

The Board heard testimony from various landowners, some of whom are adjacent to the Petitioner's property, about the implementation of various management practices that have protected and allowed various habitats, native plants, animals, and biota to thrive within the proposed management area. It is ironic that the Petitioner

[1] KWRT Agendas [05-14-08, 7-23-14, 11-3-08, 7-22-09, 9-23-10, 3-29-12, 7-11,12, 1-17-13, 5-21,14] are attached for your reference.

has cited the protection of cultural resources as one of the primary motives for the designation of a management area; however, at a community presentation, the Petitioner admitted to suspending various traditional and customary Native Hawaiian rights and practices at the Kaloko-Honokohau National Park with no foreseeable date for restoring them. As of this writing, the Board has not seen any baseline information, evidence, or studies that support the Petitioner's claims of endangerment as outlined within their Petition, nor the necessity to suspend customary Native Hawaiian rights.

The Board also takes exception to the Petitioner's nonchalant assertion that the water management designation would simply mean another permit. The Board heard overwhelming testimony from CWRM showing that is simply not the case. Members of the community, specifically the Kona Community Development Plan Action Committee, heard numerous members of the community speak in strong opposition to the designation and to the submission of critical concerns that the management designation would delay, halt, and increase the costs for much-needed community projects. Among the community projects at risk are the West Hawaii Community College, West Hawaii judiciary complex, the Natural Energy Laboratory of Hawai'i Authority (NELHA), Kona International Airport, and affordable housing projects planned for the area.

As mentioned above, the Board plans to submit comprehensive commentary on the Petition. However, this process has stirred passionate discussion, divided our community, and the Board feels it important to frame and reflect the community sentiments and the extensive efforts from all stakeholders on the enormous value placed on the management and protection of groundwater and the sustainability of our resources.

Based on the information received, the Board recognizes and believes that a strong and valid effort is in place to protect the groundwater sustainability, which includes discharge into the near-shore waters, and that the scientific investigation and research that we have reviewed thus far do not justify designation. We are hopeful the CWRM will do the right thing and deny the petition to designate the Keauhou Aquifer System as a managed area.

Sincerely yours,

Kenneth Kaneshiro, Chairperson
Water Board

KK: jms

Encs.

copy: Honorable William P. Kenoi, Mayor, Hawai'i County
Honorable Neil Abercrombie, Governor of the State of Hawai'i Hawai'i County Council
Kona Community Development Action Committee
Kamehameha Schools
Queen Lili'uokalani Trust
Palamanui Global Holdings, LLC
Kohanaiki Shores LLC

State of Hawai'i, Department of Hawaiian Home Lands
Natural Energy Laboratory of Hawaii Authority
State of Hawai'i, Department of Transportation
National Park Service
Forest City Hawaii Kona, LLC

DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAI'I
345 KEKŪANAŌ'A STREET, SUITE 20 • HILO, HAWAI'I 96720
TELEPHONE (808) 961-8050 • FAX (808) 961-8657

July 10, 2014

Mr. Riley Smith, P.E.
President/Chief Executive Officer
Lanihau Properties, LLC
P.O. Box 9032
Kailua-Kona, HI 96745

REQUEST FOR CLARIFICATION FROM DWS ON IMPACTS IF KEAUHOU AQUIFER IS DESIGNATED

In response to your inquiry, if the Keauhou aquifer is designated a ground water management area, based on our current understanding of the process, the Department of Water Supply (DWS) will postpone installation of new water services.

Lacking any specific conditions or exemptions from the Commission on Water Resource Management (CWRM), all new water services will require a new Water Use Permit approved by CWRM thus, DWS feels this would be the prudent and equitable option.

Should you have any questions, please call Mr. Keith Okamoto at 961-8050.

Sincerely yours,

Quirino Antonio, Jr., P.E.
Manager-Chief Engineer

KKO:dmj

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON

KAMANA BEAMER
MICHAEL G. BUCK
MILTON D. PAVAO
LINDA ROSEN, M.D., M.P.H.
JONATHAN STARR

WILLIAM M. TAM
DEPUTY DIRECTOR

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

September 22, 2014

Mr. Duane Kanuha, Director
Planning Department
County of Hawaii
Aupuni Center
101 Pauahi Street, Suite 3
Hilo, HI 96720

Aloha Mr. Kanuha,

We are writing to follow up the Commission on Water Resource Management ("Commission") September 24, 2013 letter (attached) to you requesting information about land use plans and entitlements in the Kona Community Development Plan district.

As you know, the United States National Park Service petition to designate the Keauhou Aquifer System Area ("ASA") (North Kona) as a Ground Water Management Area requires the Commission to analyze land uses. One of the criteria the Commission must consider in deciding whether to designate a water management area under the State Water Code is authorized planned uses by the county.

Specifically, Haw. Rev. Stat. §174C-44 *Ground Water Criteria for Designation* provides, in part,

> (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 ground water management area. [emphasis added]
> . . . .

Haw. Rev. Stat. §174C-3 Definitions, defines "authorized planned use."

> "Authorized planned use" means the use or projected use of water by a development that has received the proper state land use *designation and county development plan/community plan approvals.* [emphasis added]

The County makes decisions about land uses and, in particular, county development plan/community plan approvals. The Hawaii County Planning Department is the repository of those decisions and that information.

Therefore, the Commission requests that the Hawaii County Planning Department provide the Commission with a list of:

A) All county development plan/community plan approvals, including all zoning and proposed land developments for the Kona Community Development Plan district as outlined in the attached September 24, 2013 letter.

B) All county building permits issued or applied for new developments, and whether any of these have been approved in the Kona Community Development Plan.

We have also been in contact with the Hawaii County Department of Water Supply which is compiling a list of current and future water users.

On October 9, 2014, the Commission will conduct a *second* field investigation and site visit in the Keauhou Aquifer System Area. As part of this site visit and investigation, the Commission requests that the Hawaii Planning Department make a presentation to the Commission describing the Department's role in coordinating land use and water planning. At the presentation, it would be useful if the Commissioners could have hard copies of the information requested above. We will let you know the location and time of the briefing. Currently, we expect to meet at the King Kamehameha Hotel beginning about 2:00 pm on October 9, 2014.

After the October 9, 2014 investigation and site visit, the Commission anticipates returning to Kona on December 10, 2014 to decide whether or not to continue the designation process into the next ("public hearing") phase. If the Commission decides to continue the process, then a public hearing will be scheduled sometime in January or February 2015.

After the public hearing is concluded, the Commission will set a time in early March to return to Kona to decide on the petition itself.

Therefore, we request your *formal* response to the Commission's September 24, 2013 letter no later than October 30, 2014, so that the Commission may analyze the land use data in detail and include it in the Commission's preliminary findings of fact. These findings need to be completed and made available to the public for review well in advance of the December 10, 2014 meeting in Kona.

If you have any questions, please contact either Roy Hardy (808-587-0274) or me (808-587-0214). Thank you.

Very truly yours,

WILLIAM M. TAM
Deputy Director
Attachment

c: Quirino Antonio Jr., PE. Hawaii Department of Water Supply

DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAI'I
345 KEKŪANAŌ'A STREET, SUITE 20 • HILO, HAWAI'I 96720
TELEPHONE (808) 961-8050 • FAX (808) 961-8657

October 24, 2014

2014 OCT 27 AM 11:31

Mr. William Aila, Chairperson, and
Members of the Commission on Water Resource Management
State of Hawai'i
Department of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

KEAUHOU AQUIFER – DWS NORTH KONA WATER SYSTEM
PETITION TO DESIGNATE THE KEAUHOU AQUIFER AS A GROUNDWATER MANAGEMENT AREA

Dear Chairperson Aila and Members of the Commission:

Thank you for taking the time to visit our Kahaluu Shaft and Keopu Well sites and allowing us to offer information regarding our North Kona water system and future projections at the West Hawai'i Civic Center on October 9, 2014. We want to be sure that we are able to clarify any questions that may have gone unanswered as our time was extremely limited. We want to assure you that we have and will continue to work diligently to provide all pertinent information that is requested by the Commission and staff.

Our update to the Water Use and Development Plan (WUDP) will continue to be worked on, and information will be conveyed to the Commission as expeditiously as possible. We have concerns that the petition used information in the 2010 WUDP in a misleading manner as it is obvious that we will not be developing 600% of the sustainable yield as stated in the petition. In addition, our Department has also contracted Tom Nance Water Resource Engineering (TNWRE) to do a study on the impact of pumping the high-level water and the basal aquifer. This study is currently on-going and data is being gathered from several of our existing high-level wells and monitoring basal wells that are in the near vicinity of the high-level wells, one of which is along Hinalani Street, directly above the park approximately half way between the high-level sources and the shoreline.

As we pointed out during the site visit, the Kahaluu Shaft was developed by the State and granted to our Water Board with the intent to eventually pump 10 million gallons per day (mgd) in North Kona. We have expended millions in capital improvement costs in the recent past on projects to reduce our pumping from the shaft. Our overall pumpage from the shaft has been reduced from approximately 6 mgd to 4 mgd while our overall pumping has increased. This is mainly due to the development of the high-level (and high-quality) sources and related infrastructure to transmit the high-level water to the makai areas where the growing demand is occurring. Our Department has and continues to work with State and County agencies as well as private developers not only to improve the water quality being provided, but also to increase our dependability to keep a continuous water supply.

Our Department regularly collaborates with elementary through high school teachers to educate their students about water conservation and stewardship both in the classroom and at our facilities. We also participate in the annual statewide "Detect-a-Leak Week" campaign where we work with local hardware stores to hand out free toilet tank leak detection tablets to customers island-wide. An unaccounted water program has also been in place for over 20 years, and our leak detection program has been a statewide leader as evidenced by our

participation with assisting the Honolulu Board of Water Supply in establishing their program. To date, our Department has installed thousands of data loggers which help to detect leaks whether in the public water system or through customers piping. Also, more reliable and accurate meters have been installed at our sources so that we can compare pumping and consumption more dependably. Telemetering equipment was also installed/replaced to ensure that pumps shut off when the tanks are full and not overflow the tanks. The Department has put in a substantial effort in determining and minimizing unaccounted water as we realize that reducing waste is important in keeping our resources sustainable in the long run.

We are also collaborating with our County Department of Environmental Management (DEM) on the use of reuse water for non-potable needs. Our Department has offered the use of a 1.0-million gallon reservoir at the bottom of Hinalani Street to DEM for storage needs when the reuse water becomes available. Although this reservoir currently would serve as a back-up to pump water up Hinalani Street, we felt it was more beneficial to the community and our resources to help bring reuse water on-line for non-potable uses. Our Department and the State Department of Health (DOH) also collaborate on protecting the source waters. We are using the DOH's GIS files to develop a database identifying properties within the source water zones of influence. We are in preparation of a presentation for those identified properties/landowners to educate them on the importance of their role in protecting our water resources. We have also done numerous presentations at our local schools dealing with the importance of source water protection, including water conservation.

We respectfully and humbly request that our Department, along with our consultant for the WUDP update, Fukunaga & Associates, Inc., be afforded more time with the Commission to be able to provide our data and projections as well as answer and clarify any questions or concerns that may arise. We also feel that having our consultant for the high-level study, TNWRE, present a brief explanation of the intent of that study will be very helpful in our attempts to determine the impact our pumping has and will have on the basal aquifer. As you and the Commission may already know, we strongly feel that designation of the Keauhou Aquifer as a management area is not needed at this time. There are measures that can be put into place so that necessary decisions and adjustments can be made prior to any adverse impacts occurring.

We feel that public resources are currently sound and protected and not threatened and that premature designation will result in a negative impact to our Kona community via loss of jobs, loss or delay of the following key projects: affordable housing at Kamakana, higher education opportunity at the UH West Hawai'i, judicial facility, NELHA, Makaeo Park, and Kealakehe Regional Park.

If there are any questions, please do not hesitate to contact us at (808) 961-8050.

Sincerely yours,

Quirino Antonio, Jr., P.E.
Manager-Chief Engineer

KO/KI/KA:dmj

copy - Honorable William P. Kenoi, Mayor, County of Hawai'i
Honorable J Yoshimoto, Hawai'i County Council
Water Board of the County of Hawai'i
Mr. Duane Kanuha, Director, Planning Department

William P. Kenoi
Mayor

Walter K.M. Lau
Managing Director

Randall M. Kurohara
Deputy Managing Director

County of Hawai'i
Office of the Mayor

25 Aupuni Street, Suite 2603 • Hilo, Hawai'i 96720 • (808) 961-8211 • Fax (808) 961-6553
KONA: 74-5044 Ane Keohokalole Hwy., Bldg. C • Kailua-Kona, Hawai'i 96740
(808) 323-4444 • Fax (808) 323-4440

October 27, 2014

Via Electronic mail: william.j.aila@hawaii.gov; hard copy to follow

The Honorable William Aila, Chair
Board of Land and Natural Resources
State of Hawai'i
P.O. Box 621
Honolulu, Hawai'i 96809

Re: *Request for Additional Investigative Meeting and Time to Allow Important Information to be Provided to the Commission on Water Resource Management ("CWRM") prior to any Decision-Making on the National Park Service's Petition seeking designation of the Keauhou Aquifer System Area as a Groundwater Management Area.*

Aloha Chair Aila:

We appreciate the CWRM's action to conduct investigations and site visits prior to taking action on the National Park Service's Petition to designate the Keauhou Aquifer as a groundwater management area.

We are concerned, however, about the disproportionate level of input the County of Hawai'i ("County") and other affected parties have had in providing input to the CWRM, as compared to the numerous opportunities offered to the National Park Service. The recent CWRM meetings in Kona illustrate this.

The National Park Service was given several opportunities to provide statements during their site visits on September 17, 2014 and then allotted three (3) hours at the following CWRM meeting in the afternoon. At the most recent site visit and October 9, 2014 meeting, the County was given only forty-five (45) minutes to provide statements. With the limited time, presenters were rushed.

Most concerning was the apparent lack of respect to Aunty Elizabeth Lee and other members of her ohana. The Lee's are lineal descendants of the area and sought to provide input, however, after waiting for three (3) hours at the meeting, she was not able to provide a statement.

The County would like to address the CWRM prior to its decision-making, tentatively scheduled for December 10, 2014. In addition, we believe there are other affected parties who should be able to provide statements to the CWRM.

As such, we are asking that prior to any decision-making concerning whether to move the Petition forward or not, you conduct another investigative meeting in Kona for the County and other affected parties to provide statements to the CWRM. This could be held sometime in November 2014.

Given that the National Park Service was given in excess of three (3) hours and the County was only given forty-five (45) minutes, to date, we believe you should allow us three (3) hours to present statements.

Again, we appreciate your willingness to conduct these investigative meetings and hope you will recognize the importance of being fair in the process.

Mahalo,

WALLY LAU
Managing Director of the County of Hawai'i

WKML:stw

C: William P. Kenoi, Mayor, County of Hawai'i
Quirino Antonio, Manager, Department of Water Supply
Duane Kanuha, Director, Department of Planning

William P. Kenoi
Mayor

West Hawai'i Office
74-5044 Ane Keohokalole Hwy
Kailua-Kona, Hawai'i 96740
Phone (808) 323-4770
Fax (808) 327-3563

OFFICE COPY

County of Hawai'i
PLANNING DEPARTMENT

Duane Kanuha
Director

Bobby Command
Deputy Director

East Hawai'i Office
101 Pauahi Street, Suite 3
Hilo, Hawai'i 96720
Phone (808) 961-8288
Fax (808) 961-8742

October 29, 2014

Mr. William J. Aila, Jr., Chairperson
Commission on Water Resource Management
Department of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

Dear Mr. Aila:

SUBJECT: Review of Petition to Designate the Keauhou Aquifer System as a Ground Water Management Area; North Kona, Hawai'i

We are in receipt of your letter dated September 22, 2014 requesting comments from this office regarding the subject Petition. We understand that the National Park Service (NPS), through the Superintendent of Kaloko-Honokōhau National Park (KHNP), has filed the Petition to designate the Keauhou Aquifer System Area in North Kona as a Ground Water Management Area.

Requested Information:

The previous correspondence from your office dated September 24, 2013, requested a number of items, some of which were already provided. However, in our letter dated October 8, 2013 we requested more time to provide the following:

1. A list of planned or proposed land developments that our Department is aware of along with details such as county zoning designation, number of proposed housing units, tax map key numbers, and the proposed water source and projected water use.
2. Whether any of these developments have received county development plan or community plan approvals and the status of any county permits applied for.

In addition, your most recent letter requested the following additional information:

3. All county development plan/ community plan approvals, including all zoning and proposed land developments for the Kona Community Development Plan district as outlined in the previous correspondence.
4. All county building permits issued or applied for new developments, and whether any of these developments have been approved in the Kona Community Development Plan.

Additional Information and Clarifications:

In addition to the requested data, we would like to provide supplemental information to clarify our understanding of the authorized planned use (APU) definition and how we apply it to land use consideration in Hawai'i County.

According to Hawai'i Revised Statutes, Section 174C-3, "Authorized planned use" means the use or projected use of water by a development that has received the *proper state land use designation and county development plan/ community plan approvals* [emphasis added]. We are assuming the reference to "proper state land use designation" is to the State Land Use (SLU) Urban designation. Both the County of Hawai'i General Plan 2005 (as amended) and the Kona Community Development Plan (Kona CDP) were adopted by ordinance, and the policies therein are considered during review of all land use applications. There are no separate CDP approval requirements as suggested by the definition of APU.

The General Plan includes a Land Use Pattern Allocation Guide (LUPAG). As noted in Section 14.1.1 of the General Plan, the methodology used to develop the LUPAG reflects estimates of future population based on economic and employment evaluations, existing land uses and zoned areas, determination of community facility needs, and transportation demands for the entire island. The topography and other physical features of each area were also analyzed, and other factors, particularly economic, social, and physical characteristics, were noted. The LUPAG map is not to be used as a definitive map but as a broad, flexible design intended to guide the directions and quality of future developments.

Although the General Plan is adopted by ordinance, the LUPAG is not considered "authorized planned use" as defined in HRS Section 174C-3, as these designations are not grants of development rights. However, it appears that NPS assumed that the LUPAG is APU, as their petition noted the density allowed by the LUPAG would exceed Sustainable Yield of the Keauhou Aquifer System by 600%; such extrapolation is not reflective of the multitude of factors that guide land use decisions in Hawai'i County.

The Land Use Commission (LUC) authorizes SLU district boundary amendments among the four recognized SLU categories of Urban, Rural, Agricultural and Conservation. Within the Urban, Rural and Agricultural districts, the County has land use jurisdiction through the County zoning code. The County will not support any district boundary amendments to an Urban classification if it is not consistent with the LUPAG, the Kona CDP, and if County water is not available as determined by the Department of Water Supply (DWS). Available water is defined as "water commitments" and executed "developer agreements." Additionally, projects must have the appropriate SLU designation before they receive a change of zone as approved by County Council. The concurrency for a change of zone requires that any project be adequately supported by a county water system or private water system of equivalent design and capacity.

Authorized Planned Use Proposed Projects:

The proposed development projects on the following page have been updated from the October 9, 2014, PowerPoint presentation and are considered to be APU with DWS water commitments or development agreements. As requested, we have provided the county zoning designation, number of proposed housing units, tax map key numbers, the proposed water source, and the status of permits. The allocation of water can be more accurately provided by the Department of Water Supply under separate cover.

We hope you find this information useful in your deliberations. If you have additional questions, or if you need further assistance, please feel free to contact me or April Surprenant at (808) 961-8125.

Sincerely,

DUANE KANUHA
Planning Director

BJM:AJS:cs
P:\April S\Water-CWRM\CWRM-Petition to designate Keauhou Aquifer 102814-6.doc

cc: Mr. William P. Kenoi, Mayor
Mr. Wally Lau, Managing Director
Mr. Randall M. Kurohara, Deputy Managing Director
Water Board of the County of Hawai'i
Karen Eoff, Hawai'i County Council
Drew Kanuha, Hawai'i County Council
Mr. Quirino Antonio, Jr., P.E., Manager-Chief Engineer, Department of Water Supply
Planning Department- Kona Office

Authorized Planned Use Proposed Project List:

Applicant	TMK	SLU	Zoning	Units	Status	Water
Palamanui	7-2-005:001	U	PD, MCX-20	845	Tentative subdivision approval	DWS Devel Agmt
William & Dixie Minson	7-3-051:065	U	MCX-1a	2	Plan Approval	DWS Commitment
Kohanaiki (Waiaha S.)	7-3-009:003	U	RM-3, V-1.25, RS-10, CV-10, Open	1,850	Final subdivision approval	DWS Devel Agmt
Kaloko Heights – phase 1	7-3-009:062, 061, 060, 059, 058, 057, 032	U	RS-15, RS-10, RS-7.5, RM-3, CN-20, Open	813	LUC, rezone	DWS Commitment
Lanihau Properties	7-4-008:013, 76-79	U	MG-1a, MXC 20	TBD	Rezone	DWS Devel Agmt
QLT	7-4-020:010	U	CG-10	TBD	Master planning phase	DWS Devel Agmt
Laiopua Village 4	7-4-021:010, 012,	U	RS-7.5	259	Tentative subdivision approval	DWS Devel Agmt
Forest City	7-4-021:020, 024, 025, 026, 027	U	A-5a	2,330	Final subdivision approval, Phase 1	DWS Devel Agmt
SCD Kona 108	7-5-003:007, 008, 009	U	RM-3.5, RA-1a	73	Rezone with time extension - needs subdivision/plan approval	DWS Commitment
Komo Brothers/ Lahaina Petroleum	7-5-003:024	U, Ag	A-5a, CN-20	72	Rezone - needs subdivision/ plan approval	DWS Commitment
Hu-Ko-Pa LLC	7-5-017:042	U	RS-10	53	Planned Unit Devel	DWS Commitment
Millicent Towata Grand	7-6-004:018	U	RS-20	2	Subdivision	DWS Commitment
Kona Vista LLC	7-6-021:004, 009-013, 015, 017	U	RM-5	256	Rezone - needs subdivision/ plan approval	DWS Commitment
Parcel 26 at Kahaluu/ Towne Development	7-8-010:004	U	RM-3.5, V-1.25	338	Draft EA	DWS Commitment
Kona Country Club, Inc.	7-8-010:101	U	RM-30	60	Plan Approval for 29 Units	DWS Commitment
			Total	**6,953**		

DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAI'I
345 KEKŪANAŌ'A STREET, SUITE 20 • HILO, HAWAI'I 96720
TELEPHONE (808) 961-8050 • FAX (808) 961-8657

November 3, 2014

The Honorable William Aila, Chairman
Department of Land and Natural Resources
State of Hawai'i
P.O. Box 621
Honolulu, HI 96809

The Honorable William Tam, Deputy Director
Commission on Water Resource Management
State of Hawai'i
P.O. Box 621
Honolulu, HI 96809

2014 NOV -6 AM 10: 13

REQUEST TO PROVIDE CWRM WITH CRITICAL WATER CALCULATION INFORMATION RELATED TO THE PETITION TO SEEK DESIGNATION OF THE KEAUHOU AQUIFER SYSTEM AREA AS A GROUND WATER MANAGEMENT AREA

Dear Chairman Aila and Deputy Director Tam:

The County of Hawai'i, Water Board ("Board"), strongly urges the Commission on Water Resource Management ("CWRM") to schedule a special fact-finding meeting on or before **November 30, 2014, on the Big Island**, to allow accurate information from the County of Hawai'i ("County") to be included within the CWRM's staff reports and recommendations ("Report") that are to be reviewed by CWRM Commissioners related to the petition to seek designation of the Keauhou Aquifer System Area as a Ground Water Management Area ("Keauhou Aquifer").

The Board observed CWRM's meetings on September 17, 2014, and October 9, 2014 ("Meetings'), and asserts that the Meetings failed to provide the County ample opportunity to educate CWRM on all of the technical and scientific information gathered by the County that would be critical to the development of the Report.

The Board further recognizes that to have a comprehensive Report, it should also seek direction and input of various stakeholders and lineal descendents of the area. Again, the Meetings failed at securing this type of input.

The Board also reviewed a complaint to the Office of Information Practices ("OIP") regarding possible Sunshine Law violations by CWRM. Under separate letter, the Board will be asking OIP to direct its findings and background analysis of this complaint to the Board to ensure any and all information related to the Keauhou Aquifer is available with the County of Hawai'i Department of Water Supply.

Simply put, much of what has transpired has fostered and created an unfair advantage to the National Park Service, the petitioner in this request, and it would be appropriate to schedule another meeting regarding the Keauhou Aquifer on or before **November 30, 2014, on the Big Island**.

The primary goal of any assembled body is to allow for "opening up the governmental processes to public scrutiny and participation which is the only viable and reasonable method of protecting the public's interest." With this in mind, it appears warranted that CWRM entertain action to defer any decision-making scheduled for December 10, 2014, until all information is appropriately received and vetted.

Sincerely yours,

G. Rick Robinson
Vice-Chairperson, Water Board, County of Hawai`i

SL/KAG:jms

cc: Mr. Kamana Beamer, Commissioner, Commission on Water Resource Management
Mr. Michael G. Buck, Commissioner, Commission on Water Resource Management
Mr. Milton D. Pavao, Commissioner, Commission on Water Resource Management
Dr. Linda Rosen, Commissioner, Commission on Water Resource Management
Mr. Jonathan Starr, Commissioner, Commission on Water Resource Management
Honorable Neil Abercrombie, Governor, State of Hawai'i
Honorable William Kenoi, Mayor, County of Hawai'i
Mr. Duane Kanuha, Planning Director
Honorable J. Yoshimoto, Chairperson, Hawai'i County Council
Honorable Karen Eoff, Council Member, Hawai'i County Council
Honorable Dru Kanuha, Council Member, Hawai'i County Council
U.S. Senator Brian Schatz
U.S. Senator Mazie Hirono
U.S. Representative Colleen Hanabusa
U.S. Representative Tulsi Gabbard
State Senator Joshua Green, State of Hawai'i
State Representative Cindy Evans, State of Hawai'i
State Representative Nicole Lowen, State of Hawai'i
Editor, West Hawai'i Today
Editor, Hawai'i Tribune-Herald
Editor, Honolulu Star Advertiser

DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAI'I
345 KEKUANAOA STREET SUITE 20 • HILO, HAWAI'I 96720
TELEPHONE (808) 961-8050 • FAX (808) 961-8657

November 3, 2014

2014 NOV -6 AM 10: 34

Ms. Cheryl Kakazu Park, Director
Office of Information Practices, State of Hawai'i
No. 1 Capitol District Building
250 South Hotel Street, Suite 107
Honolulu, HI 96813

S APPEAL 15-8: REQUEST FOR DECISION AND FINDINGS RELATED TO THE COMMISSION ON WATER RESOURCE MANAGMENT'S FAILURE TO COMPLY WITH PART 1 OF CHAPTER 92, HAWAI'I REVISED STATUTES

The County of Hawai'i Water Board, hereinafter ("Water Board"), requests a copy of any and all information including any decision or opinion by the Office of Information Practices ("OIP") regarding the above-referenced matter, hereinafter, S APPEAL 15-8.

The Board has authority over, and plays a critical role, regarding water and water issues in Hawai'i County. Therefore, S APPEAL 15-8 and its findings are essential to future discussions and decisions made by the Water Board.

S APPEAL 15-8 will also have an impact on the future progress of the matter in question (National Park Service Petition). It is prudent for the Water Board to assess the findings of OIP, and any impacts the findings would have on water issues in Hawai'i County, and to ensure that any and all information related to the Keauhou Aquifer is made available to the County of Hawai'i, Department of Water Supply.

We look forward to the information and your findings.

Sincerely yours,

G. Rick Robinson, Vice-Chairperson
Water Board, County of Hawai'i

SL:KAG:jms

cc: Mr. Kamana Beamer, Commissioner, Commission on Water Resource Management
Mr. Michael G. Buck, Commissioner, Commission on Water Resource Management
✓ Mr. Milton D. Pavao, Commissioner, Commission on Water Resource Management
Dr. Linda Rosen, Commissioner, Commission on Water Resource Management
Mr. Jonathan Starr, Commissioner, Commission on Water Resource Management
Honorable Neil Abercrombie, Governor, State of Hawai'i
Honorable William Kenoi, Mayor, County of Hawai'i
Mr. Duane Kanuha, Planning Director, County of Hawai'i
Honorable J. Yoshimoto, Council Member, Hawai'i County Council
Honorable Karen Eoff, Council Member, Hawai'i County Council
Honorable Dru Kanuha, Council Member, Hawai'i County Council
U.S. Senator Brian Schatz
U.S. Senator Mazie Hirono
U.S. Representative Colleen Hanabusa
U.S. Representative Tulsi Gabbard
State Senator Joshua Green, State of Hawai'i
State Representative Cindy Evans, State of Hawai'i
State Representative Nicole Lowen, State of Hawai'i
Editor, West Hawai'i Today
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DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAI'I
345 KEKŪANAŌ'A STREET, SUITE 20 • HILO, HAWAI'I 96720
TELEPHONE (808) 961-8050 • FAX (808) 961-8657

November 18, 2014

Mr. William Aila, Chairperson, and
Members of the Commission on Water Resource Management
State of Hawai'i
Department of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

KEAUHOU AQUIFER – DWS NORTH KONA WATER SYSTEM
PETITION TO DESIGNATE THE KEAUHOU AQUIFER AS A GROUNDWATER MANAGEMENT AREA

Dear Chairperson Aila and Members of the Commission:

First of all, the Department of Water Supply, County of Hawai'i (DWS), would like to reiterate its objection to having to expend funds to attend a meeting in Honolulu to provide information rather than being allowed to present this information on the Big Island. Additionally, DWS was given a very short time period to respond to the specific questions you posed in your October 30, 2014, letter, which questions seem outside the scope of information necessary to make a decision on the National Park Service's Petition for Designation before you. However, in an effort to be cooperative and provide the Commission with accurate information, we provide the following initial responses to your letter dated October 30, 2014, and will attend your November 19, 2014, regular meeting on Oahu and take the time to present additional information as requested to provide the Commission with the most recent and reliable data available to ensure that valid decisions will be made and justified. We are also continuing our update to the Water Use and Development Plan (WUDP) and information will be conveyed to the Commission as expeditiously as possible.

Please see the following for our responses to your written inquiries:

1. A complete electronic copy of the Kona Community Development Plan, including all Volumes and all appendices.

   Planning Department will provide this information under separate letter.

2. Dates of the most recent Hawai'i General Plan and Kona Community Development Plan approvals? When do each of these plans sunset?

   Planning Department will provide this information under separate letter.

3. With regard to the Kona Community Development Plan, how many units are identified for "commercial" use? How many acres of land are identified for "commercial" use? What are the sunset dates for each (if any)?

   Planning Department will provide this information under separate letter.

4. A detailed list of Hawai'i Department of Water Supply a) high-level sources; b) basal sources. Please provide the chloride level measurements for each well for the past year.

   See attached Exhibit A, Monthly Ground Water Use Reports that the Department submits to the Commission along with a summary for chloride results.

5. A detailed description of the methodology the County proposes to use in updating the Hawai'i County Water Use and Development Plan for the Keauhou Aquifer System Area. As you are aware, the methodology must be approved by the Commission before the County may apply it to update its Water Use and Development Plan for the Keauhou Aquifer. When do you expect to formally submit the methodology to the Commission?

   The DWS has retained Fukunaga & Associates, Inc., who had prepared the original 2010 Hawai'i County Water Use and Development Plan Update, and together with the Planning Department are working with CWRM staff to gather data and perform preliminary assessments, which is necessary to develop a suitable "detailed" technical approach. The detailed evaluation intended for the WUDP Update requires substantial effort and analysis. Formal submittal of the project description is expected in the first quarter of 2015; however, the County intends to work closely with the CWRM staff during the development of the document.

6. Details of the County's assumed population growth for the Island of Hawai'i and for the Keauhou Aquifer for the next 40 years. Please describe the assumptions and method you use to make this calculation.

   It was not anticipated to carry population projections out to 40 years as the Statewide Framework for Updating the Hawai'i Water Plan requires a 20-year projection. Our consultant, Fukunaga & Associates, Inc., intends to use the best available information to project population growth, including but not limited to data from County of Hawai'i General Plan, State DBEDT, and U.S. Census. Currently one approach could be to utilize the 2005 General Plan, which provides population projections to the year 2020, and is the best available information for a localized area. Therefore, the growth rate from 2015 to 2020 (11.48% for North Kona per the General Plan) could be applied beyond 2020, but will be discussed further as part of the County's update efforts. The Planning Department will embark on the General Plan update process in early 2015, which includes a study to reassess population projections. Another approach is to utilize DBEDT's long range projections (projections only out until 2040 or approximately 26 years). However, the DBEDT plan only gives projections for the overall island of Hawai'i and does not cover specific areas of the island. Also, to project population

growth for 40 years with any degree of accuracy is typically not prudent due to numerous factors and uncertainties.

7. The current Daily per capita use of water in the HDWS Kona Water System for urban land? For Agricultural land?

   The per capita use of water for "urban" land varies substantially and is not necessarily tied to "per capita" as urban land classification includes numerous types of land use, such as residential (single and multi-family), commercial, industrial, airport, resort, etc. In light of this, DWS offers information for single family residences. Based on recent meter data, the average daily demand for single family residences is approximately 429 gallons per day (gpd). The 2010 County of Hawai'i Data Book (published by County of Hawai'i, Department of Research and Development) Table 1.7b indicates average household size in the North Kona district of 2.67. The corresponding per capita use for single family residences is approximately 160 gallons per capita per day (gpcd).

   The per capita use of water for agricultural land is also not a typical means of assessing current and future agricultural water demand. However, DWS offers that agricultural use in its North Kona water system is 14.5% of the total water demand. It should be noted that this value is skewed by a single large user, NELHA, which uses approximately 6% of the total water demand alone. What should also be noted is that recent meter data for the State Agricultural park located mauka of the Kona International Airport was analyzed for water use. The subject park covers approximately 195 acres and uses approximately 270,000 gpd. This averages to approximately 1,400 gallons per acre per day (gpad). Based on Department of Agriculture guidance, the 2004 Agricultural Water Use and Development Plan (AWUDP) planning unit demand rates for agricultural irrigation has typically been 3,400 gpad (and can generally be considered a conservative estimate).

8. The County's annual budget for new source development in each of the last 10 years a) for the County as a whole; b) for the Keauhou Aquifer System Area? What is the budgeted amount in the current and next 5 years a) for the County as a whole; b) for the Keauhou Aquifer System Area?

   The DWS annual budget for new source development for the past 10 years has been approximately $3.6M (or $36M for the 10 year period) for the entire island and is for the construction only. This excludes land acquisition, planning, environmental review, and design costs. This does include drilling wells and outfitting wells for production along with the necessary storage tank and appurtenant infrastructure such as piping, electrical controls, control building, etc. The annual construction budget for the Keauhou Aquifer during this 10 year period has been approximately $1.0M.

   For the next 5 years, the budgeted amount for new source development is $15.8M for the entire island and $8.3M for the Keauhou Aquifer.

9. The capital costs for new source development to develop the next one (1) mgd?

   The DWS anticipates that the cost to develop the next one (1) million gallons per day (mgd) of new source within the Keauhou Aquifer will be approximately $7.5M (including land, planning/environmental/design/construction) and assuming 1.0 million gallon (MG) Reservoir. This is assuming the source will be developed at approximately 1,700' msl elevation and that adequate electrical power is available.

10. The cost to install transmission pipe per mile in the Keauhou Aquifer?

    The DWS is providing estimated costs for installing transmission pipelines as follows:
    24" - $2.6M per mile
    16" - $1.6M per mile
    12" – $1.2M per mile

    These estimates are assuming the design and construction of a waterline project only which includes all fittings, valves, excavation, backfill, pavement restoration, etc. This does not include land acquisition (easements) if necessary. It should also be noted that costs can vary due to factors such as soil type, rural or urban area, total length of project, etc. It should also be noted that cost estimates here as well as Item Nos. 8 and 9 above do not include operation and maintenance costs.

11. Details of conservation measures the HDWS is undertaking in the Keauhou Aquifer? How much is spent per year on conservation in Keauhou Aquifer?

    The DWS has targeted the North Kona Water System as its primary focus to reduce unaccounted water. This was the first system that we implemented the check valve repair and source meter replacement programs to ensure that we could accurately assess our unaccounted water. Beginning in 2003, the DWS implemented its fixed logger leak detection program and again started in the Keauhou Aquifer (North Kona Water System). We have effectively reduced our unaccounted water in the Keauhou Aquifer to below 10%. The DWS has also shortened purge times for the wells by monitoring the turbidity as the well starts up. Each time the well starts, the water has to be purged for water quality purposes and runs anywhere from 3 to 8 minutes, depending on the individual well characteristics. DWS also implemented its own specifications over and beyond the State Well Construction Standards in requiring the well casing in the water table up to a minimum of 10 feet above the static water level to be stainless steel, thus allowing us to minimize the purge times for the wells as there is less turbidity in the source water upon startup of the well and to ensure that the casing does not corrode and fail which could result in deeming the well unusable for production purposes.

    As for the expenditure of DWS funds on conservation, DWS has basically applied its conservation efforts island wide and has targeted the education system to help get our message

across to our customers. We also budget approximately $150K per year for our unaccounted water program which is for equipment maintenance and replacement only.

12. Current and future potable vs. non-potable demands.

The DWS is providing information in regards to the DWS water system information only and as all water under DWS purview from source to distribution is considered potable, we will respond to this in terms of 'domestic' vs. 'non-domestic'.

Current amount of water pumped by DWS sources for the period of July 2013 through June 2014 is 11.0 mgd. Of this, the amount going to domestic end users which include residential, commercial, industrial, medical, government and non-profit is 84% or 9.2 mgd. Non-domestic users which include agricultural and irrigation make up 16% or 1.8 mgd. Again, as mentioned previously, a single large user accounts for a disproportionate share of agricultural use, in the order of between 0.6-0.7 mgd.

The DWS does not anticipate substantial changes to these percentages in the future.

13. Details of existing non-potable water sources in the Keauhou Aquifer and any future plans for additional non-potable water source development, including projected quantities and timeframes.

The DWS defers to the CWRM for the details on current and future non-potable ground water sources as all of DWS sources are potable.

What we are able to offer, is the Department of Environmental Management, County of Hawai'i, is in the planning stages to upgrade the Kealakehe Wastewater Treatment Plant to produce R-1 water. The current average day wastewater flow received by the existing plant is approximately 1.5 mgd. The plant capacity is 5 mgd. R-1 production is dependent upon the quantity of wastewater received, which in turn is dependent upon future development plans and timeframes. The capital cost associated with production and delivery of the reclaimed water resource is extremely high, much to do with the distances to probable customers. Preliminary estimates indicate the upgrade for treatment alone would be on the order of $60M. This does not include the cost to install the transmission and distribution system. The County is continuing evaluation to develop a reasonable and feasible approach for the upgrade.

14. Using a map of the Keauhou Aquifer, details of the source development and transmission build-out that the County currently plans and foresees over the next ten (10) years. Which of these will be County projects? Which will be private projects? How will specific public (State and County) water needs be met?

The DWS is providing the information to the best of its knowledge regarding proposed improvements by those other than the DWS on the attached Exhibit B. We would defer to

CWRM for information on other potential source developments as may be available from Well Construction Permits.

As far as specific public projects, the following is information that DWS has:
State projects:

- Palamanui UH West Hawai'i – currently has 15 water units or 6,000 gpd via a water development agreement with Palamanui,
- NELHA expansion – currently no additional water available from DWS,
- Keahole airport – currently no additional water available from DWS,
- DHHL Villages of La'i'Ōpua – currently no additional water available from DWS for future phases, additional source required at minimum,
- Kamakana – currently has 1,680 water units, or 672,000 gpd, via a water development agreement; for further development, additional source required at minimum,
- Judiciary building – pending final water demand calculations, water may be available via land use application and water commitment process from the existing water system.

County projects:

- Makaeo (Old Airport) Park - proposed use of R-1 for irrigation water needs,
- Kealakehe Regional Park – currently no additional water available from DWS, possible use of R-1 water for irrigation water needs.

If there are any questions, please do not hesitate to contact us at (808) 961-8050.

Sincerely yours,

Quirino Antonio, Jr., P.E.
Manager-Chief Engineer

KO/KI:dmj

copy - Honorable William P. Kenoi, Mayor, County of Hawai'i
Honorable J Yoshimoto, Chair, Hawai'i County Council
Water Board of the County of Hawai'i
Mr. Duane Kanuha, Director, Planning Department

DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAI`I
345 KEKŪANAŌ`A STREET, SUITE 20 • HILO, HAWAI`I 96720
TELEPHONE (808) 961-8050 • FAX (808) 961-8657

November 28, 2014

2014 NOV 31 PM 2:54

Mr. William J. Aila, Jr., Chairperson and Commissioners
Commission on Water Resource Management
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawai'i 96809

Re: *Water Board and Department of Water Supply of the County of Hawai'i's Response to Kaloko-Honokōhau National Park Service Petition to Designate Keauhou Aquifer System Area (North Kona), Hawai'i as a Ground Water Management Area*

Dear Mr. Aila and Commissioners:

Thank you for allowing the Water Board of the County of Hawai'i ("Board") to comment on the Petition to Designate the Keauhou Aquifer System ("Petition") as a Ground Water Management Area, which was filed on September 13, 2013, by the National Park Service ("NPS"). **The Board respectfully opposes the Petition, as designation of the aquifer is not warranted.** We therefore urge you to NOT pursue the designation process.

I. INTRODUCTION

Since the Petition was filed, the Board has heard presentations and received testimony (written and/or oral) from the NPS, Commission on Water Resource Management ("Commission") staff, numerous representatives of stakeholders in the Kona community (public, private, and cultural), scientists in the fields of hydrology, hydrogeology, geochemistry, and biology as well as engineers, among others, as well as the Department of Water Supply's ("DWS") staff. Since 2008, the DWS has also been closely involved in formulating and continuing the Kona Water Round Table ("KWRT") meetings to address the water concerns in the region and specifically within the Keauhou Aquifer system. At these KWRT meetings, presentations were made by the NPS as well as professionals in the area of ground water hydrology, anchialine ponds or pools, ground water quality management and other pertinent professions and practitioners. At each of these meetings, numerous people have attended, including members of the Board, the Commission, United States Geological Survey ("USGS") staff, the NPS, as well as many stakeholders of North Kona. Based on the information received, the Board recognizes and believes that a strong and valid effort is in place to protect the ground water sustainability, which includes discharge into the near-shore waters, and that the scientific investigation and research does not justify designation.

Numerous scientists[1], including **petitioner's own hydrologist, Paula Cutillo[2], stated there is no evidence that current pumping has adversely impacted resources at the park or along the coast**. In fact, data from monitoring wells near or within the park indicate no increase in salinity and in some cases a decrease in salinity over the past 19 years. Rising sea level has an impact of shifting the basal lens inland; however, that does not equate to a threat to fresh water supply. It should also be noted that consumptive uses are also a public trust use of water.

The following are facts regarding why each of the criteria for designation is NOT MET.

II. CRITERIA NECESSARY FOR DESIGNATION TO PROCEED

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. [Hawai'i Revised Statutes ("HRS") § 174C-44(1)]

Conclusion:

CRITERIA 1 IS NOT MET. Not only is the "authorized plan use" nowhere near the ninety percent mentioned in the statutes, but there is scientific evidence that the sustainable yield number utilized by the Commission is far less than the actual sustainable yield.

Discussion:

A. Water Use and Development Plan

Petitioner relies heavily on a misinterpretation of the Water Use and Development Plan of the County of Hawai'i ("WUDP"). The WUDP addresses a theoretical potential full build out based on the Land Use Pattern Allocation Guide ("LUPAG") map, which only considers theoretical full build out of the entire area without regard to time. The medium growth rate projections show that in 2025, it is estimated that the water use, including agricultural use, will be approximately 18.6 million gallons per day, or about 48.9% of the sustainable yield ("SY"), even if the SY of 38 million gallons per day ("mgd") is used.[3]

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[1] *See Summary of Scientific Research on the Northern Section of the Keauhou Aquifer System*, prepared by Steve Bowles, Ph.D, Tom Nance, P.E., and . Richard Brock, Ph.D, presented to the Kona Water Roundtable on July 30, 2014 attached as Exhibit "A".

[2] National Park Service, U.S. Department of the Interior, Water Resources Division presentation: *NPS Petition for Water Management Area Action: Scientific Overview*, presentation by Paula A. Cutillo, Ph.D, at the Kona Water Roundtable on August 27, 2014.

[3] *See Hawai`i County Water Use and Development Plan Update* (August 2010) available at: http://www.hawaiidws.org/7%20the%20water/wudp.htm

B. Sustainable Yield

The current SY of 38 mgd was based on a total estimated ground water recharge of 87 mgd, while recent studies by USGS[4], reported to the Commission has shown that actual ground water recharge is estimated to be approximately 77% greater or approximately 154 mgd – four times the amount of the current SY.

As our consultant for the WUDP, Jon Nishimura, explained at the Commission on Water Resource Management meeting on November 19, 2014, the use of LUPAG and associated water demand was based on a **theoretical** full build-out scenario where every single square foot of area was developed to its theoretical maximum extent, was never intended to be a projection of actual water use. Growth projections were also made in the WUDP to use as a guide for future planning; and based upon the medium growth rate as the most likely to occur, it is estimated that in 2025, the water demand, including all agricultural use, will reach approximately 18.6 mgd (or 49% of SY) and further projecting that number out, it would be 25.2 mgd in 2045 (or 66% of SY), again assuming that SY is 38 mgd.

C. Authorized Planned Use

"'Authorized Planned Use' means the use or projected use of water by a development that has received the proper state land use designation and county development plan/community plan approvals." *HRS § 174C-3.*

While the Commission has requested an abundance of data from the DWS, the statutory definition of Authorized Planned Use must be adhered to by the Commission. The following is the "Authorized Planned Use" as of writing this letter:

Water Commitments that have land use approvals from the County (i.e., zoning, subdivision, etc,)	1.14 mgd
Developer Agreements that have land use approvals from the County	1.21 mgd
Vacant Service Laterals that have been paid for and installed by previous developments but are not in use because a meter has not been installed, or in some cases because development plans have changed	1.10 mgd
Open Building Permits that fall outside of the above categories	.09 mgd
TOTAL	3.54 mgd

During the DWS' truncated presentation after the October 9, 2014 site visits on the Big Island, the DWS included 1.99 mgd for "other private wells." However, the Water Board and the DWS have no jurisdiction over private wells. The only non-DWS municipal wells

[4] *See* excerpts from USGS Scientific Investigations Report 2011-5078, "A Water-Budget Model and Assessment of Groundwater Recharge for the Island of Hawai`i, attached as Exhibit "B" hereto (hereinafter "2011 USGS Groundwater Recharge Study"). A complete copy of the study is available at: http://pubs.usgs.gov/sir/2011/5078/sir2011-5078.pdf

whose developments have all land use authority for full build-out are at Kukio. At full build-out Kukio's use will be approximately 0.4533 more than its existing use (this number was calculated from information obtained from an employee of Kukio). The remainder of the 1.99 mgd was given to DWS staff by Commission staff. DWS has questioned this number. DWS does not have information on the location of these irrigation wells. Whether these wells are or would be considered for a development's "authorized plan use" is highly questionable. Additionally, the Commission should NOT calculate "authorized planned use" based upon pump capacity, because: (1) there are redundant sources within the system; (2) no well would be pumped 24 hours a day; and (3) the design of the pump capacity would be much greater than actual planned use.

D. Permitted Wells

Petitioner is attempting to alarm the Commission by claiming that there are 51 permitted wells for production and that less than one third are reporting pumpage to the Commission. However, what Petitioner fails to understand is that some permitted wells are not in production. DWS knows that at least 26 of the 51 permitted wells not owned by them are also not in production. DWS has 14 of the listed wells, is reporting pumpage on 12 of the wells and 2 of the wells cannot be reported because the wells are not in production yet. Additionally, as a practical matter, wells are generally not pumped to their capacity, and back-up wells are standard practice as the equipment requires quite a bit of maintenance and often requires replacement which could take several months to accomplish. Therefore, total pumping capacity is always significantly higher than what is actually being used.

E. Protecting Native Hawaiian Rights and Practices

Petitioner accuses both the Commission and DWS of not considering the supply of water necessary to protect the traditional and customary Native Hawaiian rights and practices. This is simply not true.

The SY determination considers many factors, including ground water discharge that may affect recreational as well as aquatic and wildlife habitat (USGS Circular 1186). Though the original model may not have accounted explicitly for these issues, the recent studies that are resulting in much higher SY numbers do.

2. ***There is an actual or threatened water quality degradation as determined by the department of health. [HRS § 174C-44(2)]***

Conclusion:

CRITERIA 2 IS NOT MET. To the Board's knowledge, the Department of Health has not made any finding that there is an actual or threatened water quality degradation. *See also* discussion under Criteria 4.

3. ***Whether regulation is necessary to preserve the diminishing ground water supply for future needs, as evidenced by excessively declining ground water levels. [HRS § 174C-44(3)]***

Conclusion:

CRITERIA 3 IS NOT MET. Overall recharge is 77% higher than what was used to determine the currently used SY of 38 mgd.

Discussion:

The Petition references the 2011 USGS Groundwater Recharge Study that addresses climate change and refers to Timm and others (2009) and their study on rainfall estimates for the late 21st century on the Big Island.

The 2011 USGS Groundwater Recharge Study projects a slight increase in precipitation for most of the Big Island, including Kona. This study also addresses the ground water recharge and estimates that the overall recharge is approximately 77% higher than what was used to determine the SY of 38 mgd. *See* Exhibit "B". This section also states that the RAM methodology for determining SY did not consider these trends in rainfall and sea level. It should be pointed out that the 2011 USGS Groundwater Recharge Study does consider the climate change in determining overall recharge. Finally, the SY is not the only criteria that is being looked at by the many scientists who have come forth and shared information in determining potential impacts based on the ground water withdrawal.

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. [HRS § 174C-44(4)]***

Conclusion:

CRITERIA 4 IS NOT MET. There is no evidence of any danger to the aquifer due to the existing withdrawals. As the Commission witnessed and heard at the site visit at the Kahalu'u Shaft on October 9, 2014, shaft pumpage is being reduced and will be relegated to use as a back-up source in the near future.

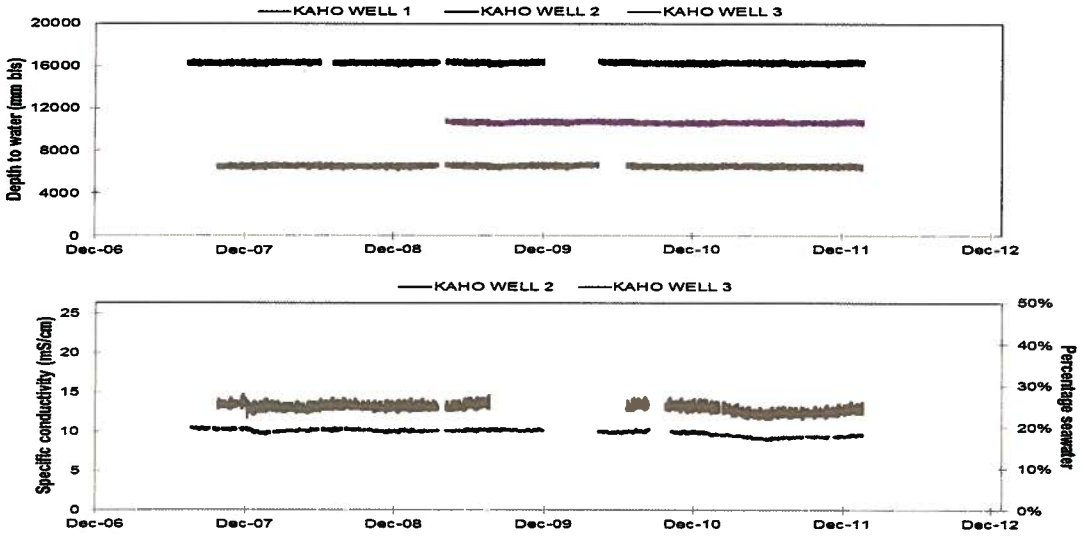
Discussion:

The Petition is inaccurate and misleading. Paragraph 4 on page 33 of the Petition states that "In 2011, sodium levels in drinking water from Kahalu'u well field were as high as 185 milligrams per liter (mg/L)..." and "As of January 2013, chloride levels in Kahalu'u well field remained as high as 410 mg/L..." THESE STATEMENTS ARE INCORRECT AND MISLEADING.

In 2011, the average sodium level in the Kahalu'u well field (Kahalu'u Wells A, B, C, and D) was approximately 80 mg/L (ppm). The report presumably extracted the 185 mg/L sodium result from the DWS' 2011 Consumer Confidence Report (aka Water Quality Report). This 185 mg/L result is actually a Kahalu'u Shaft sample, and not from the

Kahalu'u well field. Also, the average chloride concentration from the Kahalu'u Wells A, B, C, and D between January 2012 and December 2012 was approximately 138 mg/L (ppm) (*See* http://www.hawaiidws.org/7%20the%20water/ccrpage.htm). The Petition appears to total the chloride concentrations from the Kahalu'u wells, which is incorrect. DWS has already begun the process of reducing the pumpage of the Kahalu'u Shaft, as explained at the site visit on October 9, 2014, and the Kahalu'u Shaft will be relegated as a back-up source.

There is simply no evidence that any increase in the number of pumping wells located in the vicinity of Kaloko-Honokōhau would have an effect on freshwater discharge to coastal ecosystems within the Park. In fact, in the graphic shown below, which is from Paula Cutillo's presentation to the Commission on September 17, 2014, shows conductivity (an indication of salinity) at a stable level from 2007 through 2011.



5. ***Whether the chloride contents of existing wells are increasing to levels which materially reduce the value of their existing uses. [HRS § 174C-44(5)]***

Conclusion:

CRITERIA 5 IS NOT MET. The DWS typically attempts to blend the Kahalu'u Shaft and Kahalu'u Well water sources with each other in order to dilute the chloride concentrations. In addition, where it is physically and hydraulically possible, the higher-elevation/lower-chloride sources are blended with the Kahalu'u Shaft and Kahalu'u Well water sources. The blending of water sources reduces the chloride levels in the water system and is done for the benefit of the community and water users, and the blending inherently increases the "value" of the water. The DWS has invested time and monies to develop additional higher-elevation/lower-chloride water sources in order to reduce the daily pumpage from the Kahalu'u Shaft and Kahalu'u Wells.

Discussion:

As documented, in the early 1990's Keauhou-Kamehameha Well 2 and Kalaoa Well were drilled at higher elevations, and a high-elevation water sources was discovered with significantly lower chlorides. As additional high-elevation water sources were developed, the DWS would pump and transmit the lower-chloride water to customers in the vicinity of the high-elevation sources. Recently, due to the completion of new transmission waterlines, the DWS blends the Kahalu'u Shaft and the Kahalu'u Wells' water with these higher-elevation water sources in order to dilute and decrease the chloride concentrations, thereby increasing the aesthetic and overall "value" of the water. Recent water quality analyses for chlorides in the North Kona water system has shown that this high-elevation/lower chloride water is flowing to portions of the water system that were previously served by the Kahalu'u Shaft and Kahalu'u Wells. Thus, the "value" of the water has increased in these areas that now receive waters with lower chloride levels.

6. ***Whether excessive preventable waste of ground water is occurring.***
[HRS §174C-44(6)]

Conclusion:

CRITERIA 6 IS NOT MET. The Petition inaccurately states the amount of single-family use. In addition, the DWS is a statewide leader in leak detection.

Discussion:

The Petition inaccurately states: "According to the County of Hawaii 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)." The 1000 gallons per day (gpd) is per connection, which includes larger meters. The DWS has performed a recent assessment of average residential use rates in the area and has determined that accounts in typical residential subdivisions use an average of approximately 410 gpd. This is in line with what the DWS uses island-wide at 400 gpd average. *See Rules and Regulations of the Department of Water Supply, County of Hawai'i,* effective October 21, 2004 (as revised) ("DWS' Rules") available at: http://www.hawaiidws.org/3%20about%20water/3d%20rules/Rules%20and%20Regulations%20Effective%2010-21-04.pdf

The DWS also aggressively addresses waste and conservation.

An unaccounted water program has been in place at the DWS for over 20 years, and our leak detection program has been a statewide leader as evidenced by our participation with assisting the Honolulu Board of Water Supply in establishing its program. To date, DWS has installed thousands of data loggers which help to detect leaks, whether in the public water system or through customers' piping. Also, more reliable and accurate meters have been installed at our sources so that we can compare pumping and consumption more dependably. Telemetering equipment was also installed/replaced to ensure that pumps shut off when the tanks are full and do not overflow the tanks. The DWS has put in a substantial

effort in determining and minimizing unaccounted water, as we realize that reducing waste is important in keeping our resources sustainable in the long run.

Additionally, the DWS regularly collaborates with elementary through high school teachers to educate their students about water conservation and stewardship, both in the classroom and at our facilities. We also participate regularly in the annual statewide "Detect-a-Leak Week" campaign, where we work with local hardware stores to hand out free toilet tank leak detection tablets to customers island-wide.

7. ***Serious disputes respecting the use of ground water resources are occurring. [HRS § 174C-44(7)]***

Conclusion:

CRITERIA 7 IS NOT MET. There are no disputes regarding the use of ground water resources except for this disputed Petition, which is unsupported by scientific facts.

Discussion:

NPS claims that it has commented on numerous "issues" with respect to ground water in the area, making it clear that NPS is the only entity which, irrespective of scientific data, is creating these "disputes".

We believe that NPS' "issues" are being addressed and that real efforts are being made, including the addition of monitoring wells to obtain additional information within the aquifer. In fact, the DWS is currently working on a monitoring plan for its high level sources, including a component to concurrently monitor a down gradient basal source. We intend to share this information with the Commission as it becomes available.

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. [HRS § 174C-44(8)]***

Conclusion:

CRITERIA 8 IS NOT MET. *See* discussions above.

III. OTHER IMPORTANT CONSIDERATIONS

1. No Adverse Effects on the NPS

NPS relies on a ground water model and analysis done in 1999 and states: "… that if all permitted wells were pumped at their maximum rate, ground water 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)."

There are more recent models and analyses done, and the results referred to in the above paragraph are no longer valid. The Board was not presented with any evidence that freshwater

discharge to the National Park was diminished or would be diminished in the foreseeable future as described in the 1999 study. As a matter of fact, a review of the conductivity data from 2008 to 2012 from two observation wells, KAHO 2 and KAHO 3, indicated conductivity levels have dropped slightly, indicating a slight increase of freshwater (https://irma.nps.gov/App/Reference/Profile/2193295)

NPS makes repeated references to the EA for the Palani Ranch Well (Geometrician Associates LLC 2009). The EA addresses the cumulative pumping effects on salinity increase and thermal change at the NPS inland ponds as well as coastal waters. The EA specifically addresses the orange-black damselfly, and the one completed lab test (a total of 3 were to be done) showed that the predicted salinity increase and thermal change was insignificant to the habitat of the studied damselfly. The EA also addressed mullet and other native fish that have a wide range of tolerance for salinity and will not be impacted.

2. Protecting Public Trust Resources

The NPS vastly overstated the precautionary principle and omitted an essential part of the code. The Petition provides: "Pursuant to the precautionary principle, when 'the water resources in an area may be threatened by existing or proposed withdrawals or diversion of water' the Commission has a duty to designate a water management area [HRS § 174C-41]". What the Petition fails to include in its quotation is the following: "**When it can be reasonably determined, after conducting scientific investigations and research** that the water resources in an area may be threatened by existing or proposed withdrawals or diversions of water, the commission shall designate the area . . ." The Petition's omission is not only glaring, but an indication of the Petitioner's lack of **any** scientific proof that ground water withdrawals or proposed withdrawals from the Keauhou Aquifer are affecting or will affect the Kaloko-Honokōhau National Historical Park. As a political subdivision of the State, DWS recognizes its duty to conserve and protect Hawai`i's natural resources. We further understand our obligation to promote the development and utilization of these resources in a manner consistent with their conservation and in furtherance of the self-sufficiency of the State. With this in mind, we also recognize that the waters of the State are held for the benefit of the citizens of the State, and that the people of the State are beneficiaries and have a right to have the waters protected for their use. The policies set forth in the Hawai'i State Constitution and in the State Water Code are what guide DWS when implementing its programs and policies concerning water resources within the County of Hawai'i. In furtherance of these policies, DWS remains active in its conservation efforts. To address the problems of supply and conservation of water, DWS has a rigorous leak detection program, and an active conservation education program, and also has dedicated $150,000 of its budget for its unaccounted water program for equipment maintenance and replacement.

Although the DWS only provides potable water, if a customer wants a meter for irrigation/landscaping use, the DWS requires the customer execute an Irrigation Agreement/Master Landscape Water Meter Agreement, which, amongst other terms, authorizes the DWS to terminate or restrict the meters in its sole discretion. DWS may also limit or restrict water flow to all agricultural water uses in the event water service to domestic water uses is detrimentally impacted due to agricultural water use or a water shortage. *See* DWS' Rules.

Per DWS' Rules, water commitments are based on the availability of water. In determining the availability of water, DWS considers population, projections, environmental constraints, past water usage, zoning, land use districting, water system constraints, outstanding water commitments, capital

improvement program scheduling, undeveloped available water resources, regulatory requirements of ground water control areas, and any other significant factor, including public trust principles. *See* Rule 5, DWS' Rules.

DWS recognizes that adequate provision of water resources shall be made for the objectives set forth in the State Water Code. Although the priority of water uses has not been an issue, DWS is prepared and understands the State's policy to prioritize the provision of water resources for the "protection of traditional and customary Hawaiian rights", the "protection and procreation of fish and wildlife, the maintenance of proper ecological balance and scenic beauty, and the preservation and enhancement of waters of the State for municipal uses, public recreation, public water supply, agriculture, and navigation."

DWS continues to work to protect and improve the quality of the waters within the County of Hawai'i, and through continual monitoring and maintenance of operations strives to protect existing water from contamination and to maintain a high standard of water quality. DWS works closely with the Commission in monitoring the pumpage of its wells, and voluntarily adjusts pumpage when prudent.

3. Designation is not Necessary

Petitioner's Petition centers around the premise that without designation, the Commission has no tools to manage the aquifer. This is simply not true. The Commission already has the tools and does not need to rely on a water management area. Some of the greatest tools are the components of the Hawai'i Water Plan, which includes the Commission's Water Resource Protection Plan, the State's Water Quality Plan, the State Water Projects Plan, the Agricultural Water Use and Development Plan, and the Counties' WUDPs. The Board would also like to take this opportunity to point out that the County of Hawai'i was the first to update its WUDP and is currently in the process of updating it once more, including the section on the Keauhou Aquifer System area.

Additionally, designation is NOT necessary for the Commission to regulate the location and pumpage of wells in the Keauhou Aquifer System. Existing well construction and pump installation permit processes allow opportunities for input. *See* Figure 1 attached hereto. In fact, through discussions with Commission staff regarding a well in Ka'ū, the DWS has limited the pumping from that source.

The Board is convinced that water resources are protected by multiple layers of review and enforcement currently in place at the county, state and federal levels. The Board acknowledges the successes at nearby Kohanaiki and NELHA as primary examples of this. They have not only complied with laws and regulations, but have collaboratively worked with the community and area stakeholders to create successful ecosystems balanced with successful financial ventures.

The Board believes there is and will continue to be an abundance of fresh ground water adequate to meet the needs of public trust resources for the foreseeable future. The Board echoes frustration heard within the community about the actual ability to perform Native Hawaiian practices within the Kaloko Honokōhau National Park ("Park") since it was established 36 years ago. The abundance of fresh ground water is likely to be more apparent with the proper maintenance and removal of invasive plant species within the Park. Perhaps the NPS should focus more effort and resources within the Park's boundaries prior to an exterior focus.

IV. CONCLUSION

The Board, after a comprehensive assessment of the information available, finds that the Board must continue to work collaboratively with private entities, federal, state and county agencies, as well as the local community, in managing the development of the North Kona water system for the benefit of the community while collectively working to protect the Keauhou Aquifer as a public trust resource. Mr. William Tam, Water Commission Director, addressed designating all of Hawai'i as a water management area by warning against letting isolated conflicts drive designation. He states: "In areas not under stress, you don't need to permit everything right now because of a conflict. There's always the danger of the tail wagging the dog, of using a water conflict to get the zoning."[5] It would appear to the Water Board that this particular petition could become an isolated conflict and designation would not be necessary to address the concerns of the NPS.

We propose to continue to work with the Commission, NPS and community stakeholders in making sound decisions that will be in the best interests of the community, county, and state, as well as help keep our natural public trust resources protected. We would not support a decision to designate the Keauhou Aquifer System, and therefore request again that you deny the petition.

Sincerely,

Water Board Chairman

Quirino Antonio, Jr., Manager-Chief Engineer

c: Honorable William P. Kenoi, Mayor, Hawai'i County
Honorable David Ige, Governor-Elect of the State of Hawai'i
Hawai'i County Council Chairperson, J Yoshimoto
Hawai'i County Council Chairperson-Elect, Dru Kanuha
Hawai'i County Council members (elect)
Senator Josh Green
Senator Mazie Hirono
Senator Lorraine Inouye
Senator Gilbert Kahele
Senator Russell Ruderman
Senator Brian Schatz
Representative Richard Creagan
Representative Tulsi Gabbard
Representative Nicole Lowen
Representative Mark Nakashima
Representative Richard Onishi
Representative Joy San Buenaventura
Representative Mark Takai

[5] *Environment Hawai`i,* Volume 24, Number 10, April 2014

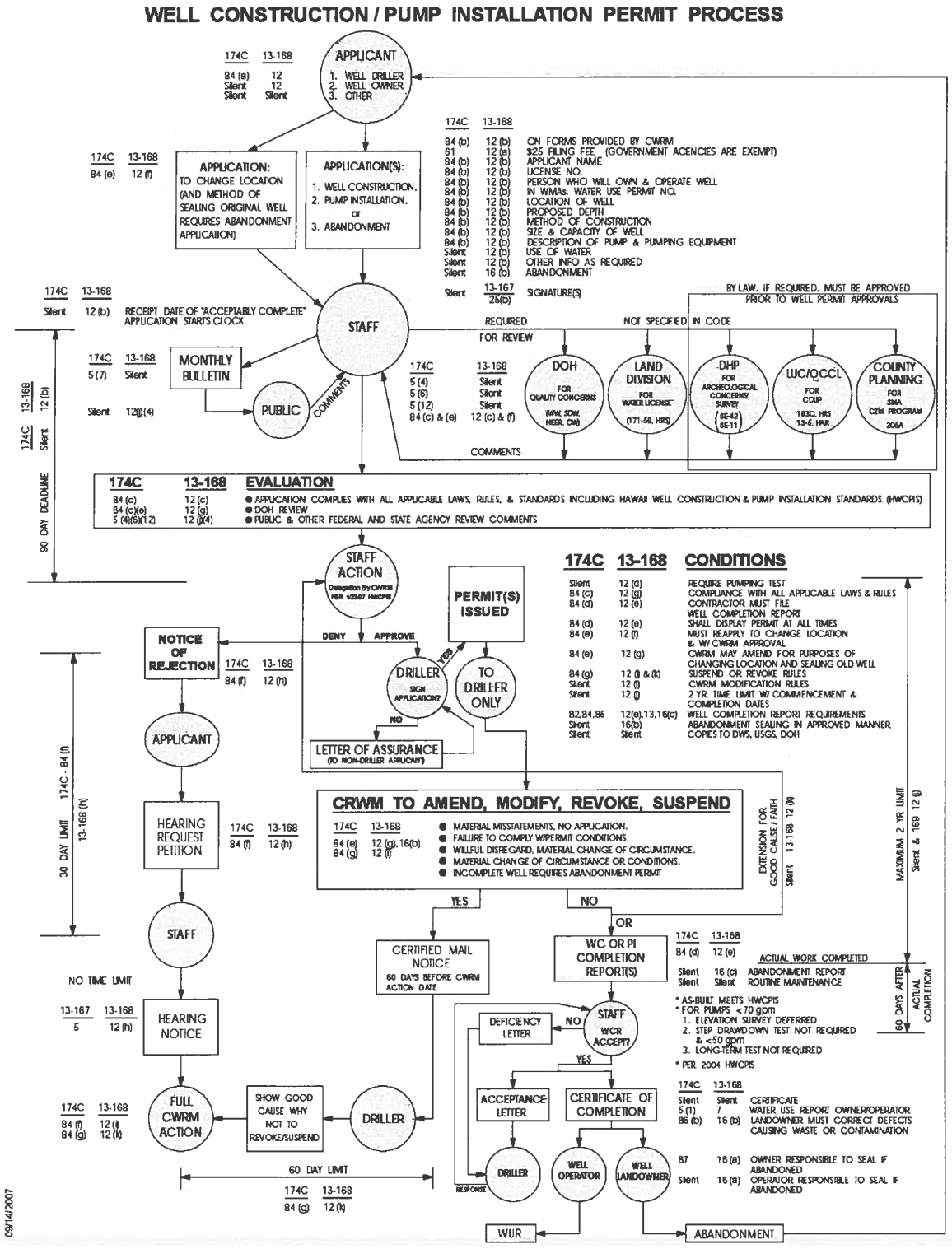

WELL CONSTRUCTION / PUMP INSTALLATION PERMIT PROCESS
APPLICANT
1. WELL DRILLER
2. WELL OWNER
3. OTHER
APPLICATION: TO CHANGE LOCATION (AND METHOD OF SEALING ORIGINAL WELL REQUIRES ABANDONMENT APPLICATION)
APPLICATION(S): 1. WELL CONSTRUCTION, 2. PUMP INSTALLATION, or 3. ABANDONMENT
ON FORMS PROVIDED BY CWRM
$25 FILING FEE (GOVERNMENT AGENCIES ARE EXEMPT)
APPLICANT NAME
LICENSE NO.
PERSON WHO WILL OWN & OPERATE WELL
IN WMAs: WATER USE PERMIT NO.
LOCATION OF WELL
PROPOSED DEPTH
METHOD OF CONSTRUCTION
SIZE & CAPACITY OF WELL
DESCRIPTION OF PUMP & PUMPING EQUIPMENT
USE OF WATER
OTHER INFO AS REQUIRED
ABANDONMENT
SIGNATURE(S)
BY LAW, IF REQUIRED, MUST BE APPROVED PRIOR TO WELL PERMIT APPROVALS
RECEIPT DATE OF "ACCEPTABLY COMPLETE" APPLICATION STARTS CLOCK
STAFF
REQUIRED FOR REVIEW
NOT SPECIFIED IN CODE
MONTHLY BULLETIN
PUBLIC
COMMENTS
DOH FOR QUALITY CONCERNS (WW, SDW, NEER, CWI)
LAND DIVISION FOR WATER LICENSE (171-58, HRS)
DHP FOR ARCHEOLOGICAL CONCERNS/ SURVEY (6E-42 6E-11)
LUC/OCCL FOR CDUP (183C, HRS 13-5, HAR)
COUNTY PLANNING FOR SMA CZM PROGRAM 205A
90 DAY DEADLINE
EVALUATION
APPLICATION COMPLIES WITH ALL APPLICABLE LAWS, RULES, & STANDARDS INCLUDING HAWAII WELL CONSTRUCTION & PUMP INSTALLATION STANDARDS (HWCPIS)
DOH REVIEW
PUBLIC & OTHER FEDERAL AND STATE AGENCY REVIEW COMMENTS
STAFF ACTION
PERMIT(S) ISSUED
DENY
APPROVE
NOTICE OF REJECTION
DRILLER SIGN APPLICATION?
YES
NO
TO DRILLER ONLY
LETTER OF ASSURANCE (TO NON-DRILLER APPLICANT)
APPLICANT
30 DAY LIMIT
CONDITIONS
REQUIRE PUMPING TEST
COMPLIANCE WITH ALL APPLICABLE LAWS & RULES
CONTRACTOR MUST FILE WELL COMPLETION REPORT
SHALL DISPLAY PERMIT AT ALL TIMES
MUST REAPPLY TO CHANGE LOCATION & W/ CWRM APPROVAL
CWRM MAY AMEND FOR PURPOSES OF CHANGING LOCATION AND SEALING OLD WELL
SUSPEND OR REVOKE RULES
CWRM MODIFICATION RULES
2 YR. TIME LIMIT W/ COMMENCEMENT & COMPLETION DATES
WELL COMPLETION REPORT REQUIREMENTS
ABANDONMENT SEALING IN APPROVED MANNER
COPIES TO DWS, USGS, DOH
HEARING REQUEST PETITION
CRWM TO AMEND, MODIFY, REVOKE, SUSPEND
MATERIAL MISSTATEMENTS, NO APPLICATION.
FAILURE TO COMPLY W/PERMIT CONDITIONS.
WILLFUL DISREGARD, MATERIAL CHANGE OF CIRCUMSTANCE.
MATERIAL CHANGE OF CIRCUMSTANCE OR CONDITIONS.
INCOMPLETE WELL REQUIRES ABANDONMENT PERMIT
EXTENSION FOR GOOD CAUSE / FAITH
MAXIMUM 2 YR LIMIT
YES
NO
OR
STAFF
CERTIFIED MAIL NOTICE
60 DAYS BEFORE CWRM ACTION DATE
WC OR PI COMPLETION REPORT(S)
ACTUAL WORK COMPLETED
ABANDONMENT REPORT
ROUTINE MAINTENANCE
60 DAYS AFTER ACTUAL COMPLETION
* AS-BUILT MEETS HWCPIS
* FOR PUMPS <70 gpm
1. ELEVATION SURVEY DEFERRED
2. STEP DRAWDOWN TEST NOT REQUIRED & <50 gpm
3. LONG-TERM TEST NOT REQUIRED
* PER 2004 HWCPIS
NO TIME LIMIT
HEARING NOTICE
DEFICIENCY LETTER
NO
STAFF WCR ACCEPT?
YES
ACCEPTANCE LETTER
CERTIFICATE OF COMPLETION
CERTIFICATE
WATER USE REPORT OWNER/OPERATOR
LANDOWNER MUST CORRECT DEFECTS CAUSING WASTE OR CONTAMINATION
OWNER RESPONSIBLE TO SEAL IF ABANDONED
OPERATOR RESPONSIBLE TO SEAL IF ABANDONED
FULL CWRM ACTION
SHOW GOOD CAUSE WHY NOT TO REVOKE/SUSPEND
DRILLER
60 DAY LIMIT
RESPONSE
DRILLER
WELL OPERATOR
WELL LANDOWNER
WUR
ABANDONMENT
09/14/2007

Figure 1

Summary of Scientific Research on the Northern Section of the Keauhou Aquifer System

Prepared by:

Steve Bowles
Groundwater Geologist

Tom Nance, PE
Hydrologist/Water Resource Engineer

Dr Richard Brock, Ph.D.
Aquatic Resource Specialist

Dr Steve Dollar, Ph.D.
Coastal Zone & Coral Reef Specialist

Presented to:

Kona Water Roundtable
July 30, 2014

Exhibit A

Preface

In response to the September 13, 2013 petition filed by the Kaloko-Honokōhau National Historical Park to designate the Keauhou Aquifer System as a Groundwater Management Area, four professionals prepared summaries of their ongoing work in the region.

The findings of these studies come to a consistent conclusion: no evidence collected to date indicates that withdrawals of groundwater resources from the high-level and basal aquifers in the northern section of the Keauhou Aquifer System have negatively impacted basal groundwater, the ponds, and the nearshore marine waters.

This document summarizes their decades of work in and around the Keauhou Aquifer System area. These collective scientific investigations and research address the issues from several perspectives: looking at the area's quantity and quality of water in the subsurface, in anchialine pools, in fish ponds and in the nearshore marine environment. This document contains all four reports.

The reports are presented to the Kona Water Roundtable, a cooperative assembly of government representatives, professionals, landowners, consultants and others who share an interest and concern for the condition of the aquifer. The Roundtable is a venue to share information. The reports provide a comprehensive look at respective findings and conclusions of their ongoing research.

Following are highlights of their respective findings. This is followed by a map of the region, Executive Summaries of each report and each of the full reports.

Summary of Findings:

Steve Bowles, Groundwater Geologist

"Cumulative hydro-geologic data and field observations of the Keauhou Aquifer System obtained during the past half century support the conclusion that declaration of the Keauhou Aquifer System is not necessary at this time."

"The discovery of high-level ground-water by Kamehameha Schools/KSBE in 1990 set the precedent for the subsequent development of high level ground-water by the DWS and others."

"The high level ground-water system is complex with various water levels and has numerous compartments. Large quantities of high level ground-water in the south sector remain undeveloped."

"Sustainable yield assumptions based upon only a basal lens inaccurately describe the complexity of ground-water occurrence in the Keauhou Aquifer System. The recharge estimates by the USGS further reduce the present accuracy of sustainable yield estimates."

Steve Dollar PhD, Coastal Zone Specialist

"Repetitive analyses of water chemistry in the two large fishponds in KAHO reveal no negative impacts were detected in nutrient dynamics over the last 12 years. In fact, time-course data indicate a potential reversal of pond metabolism toward a less senescent (biological aging) stage."

"Based on the results, it appears that the existing development upslope of KAHO is not causing detectable input of nutrient subsidies, or reduction in groundwater flux to the ponds."

Tom Nance, PE, Hydrologist

"High level pumpage began in 1994 and is now at about 4.0 to 4.5 MGD ... The TNWRE monitoring data (of continuous water level recording in the Kamakana well and time series salinity profiles in three others in the immediate vicinity of the National Park) establish that no impact to basal groundwater as a result of high level groundwater pumpage has been identified to date."

"The discovery of fresh water under artesian pressure at depth below the basal lens in the Keōpū and Kamakana deep monitor wells suggest that some or possibly even most of the high level groundwater actually flows beneath the nominally downgradient basal lens rather than into it. If discharge of high level groundwater into the basal lens is only occurring in limited amounts, then foreseeable future increases in pumpage of high level groundwater will have little or no impact on the basal lens."

Richard Brock PhD, Aquatic Resource Specialist

"Despite the fluctuations in concentrations of some nutrients in anchialine pools, there is no evidence of decline to pond biota connected to changes in water quality."

"In the Ocean: No evidence of increased nutrients due to development when compared to adjacent control areas."

"On Land: Transitory increases seen in anchialine pools but the signature is lost at the shoreline. No decline found in the pond biota connected to changes in water quality."

Google Earth Image Noting Keauhou Aquifer System Area, the Kona CDP Urban Area and the National Park

Steve Bowles

Groundwater Geologist

Findings and Conclusions

Cumulative hydrogeologic data and field observations of the Keauhou Aquifer System (KAS) obtained during the past half century support the conclusion that declaration of the Keauhou Aquifer System (KAS) is not necessary at this time. The KAS as a whole is underdeveloped at this date.

Early work in preparing estimates of sustainable yield is inadequate. Many of the descriptions of the hydrogeology have oversimplified the actual occurrence of the local ground-water. Further deep core drilling is needed to better under-stand the geologic elements which make up the working components of the KAS. A comprehensive water resource management plan must also be prepared and modified as knowledge through exploration continues.

Findings:

Our work, covering 40 years of investigation, has led us to create the findings listed in the first four items below.

1) The Keauhou Aquifer System consists of four basic units:
   a) North sector – high level and basal
   b) South sector – high level and basal
2) Likely causes of high level ground-water occurrence:
   a) Fault scarps covered by younger lavas
   b) Trachyte lava flows
   c) Combinations of a and b
3) Multiple water levels in the high level aquifer region of KAS indicate a complex of aquifer compartments.
4) Cold water shoreline basal springs between Keahole Point and Kaiwi Point result from:
   a) Deep ocean temperature intrusion
   b) Highly permeable shallow lavas
   c) Tide fluctuations and their efficiency

The bullet points listed below best describe the present operating status of the KAS.

- The management programs of well spacing and pumping at the Huehue Ranch and Kohanaiki well fields have had no significant direct impact on the basal lens quality at the shoreline.
- The high level well pumping has had no direct impact on the basal lens in the north sector to date.
- Over pumping of the Kahaluu shaft and the Kahaluu wells in the south sector has resulted in dynamic salt water encroachment which is reversible when pumping is reduced.
- Water development in the north sector does not impact the south sector ground-water flow or quality. Efforts to provide a model simulation of the entire KAS are futile.
- The specific migration of high level ground-water flow to the ocean is not yet defined. Evidence from the Kamakana Bore (well 3959-01) and from well 3858-01, (thick, dense lavas, combined with artesian flow) provides some explanation (see Tom Nance presentation). Similar evidence is also found in the Huehue wells and in wells on the north slope of Hualalai.

- The high level ground-water system is complex with various water levels and has numerous compartments. Large quantities of high level ground-water in the south sector remain undeveloped.
- Sustainable yield assumptions based upon only a basal lens inaccurately describe the complexity of ground-water occurrence in the Keauhou Aquifer System. The recharge estimates by the USGS (J.A. Engott 2013) further reduce the present accuracy of sustainable yield estimates. The actual sustainable yield most probably lies between the two estimates.
- It is important to note that all pumped water is either discharged to the atmosphere by
    - evapo-transpiration;
    - infiltration from irrigation; or
    - shallow disposal of storm water and wastewater.

There is no discharge or runoff directly to sea in the north sector. Some extreme storm runoff does occur in the south sector.

Tom Nance, PE

Hydrologist/Water Resource Engineer

Findings and Conclusions

Using monitoring data of North Kona groundwater that TNWRE has compiled, this report addresses whether or not impacts to basal groundwater have occurred as a result of pumping the six high level groundwater wells located above Mamalahoa Highway from Kalaoa to Waiaha. High level pumpage began in 1994 and is now at about 4.0 to 4.5 MGD (Figures 2 and 3 in the report).

The TNWRE monitoring data that addresses this question consists of continuous water level recording in the Kamakana well and time series salinity profiles in the Kamakana, Kaloko-2, Ooma Mauka, and Ooma Makai wells. The report presents and evaluates this data. The water levels at Kamakana and the salinity profiles at all four wells establish that no impact to basal groundwater as a result of high level groundwater pumpage has been identified to date.

A key unresolved issue is whether or not the high level groundwater actually drains into the nominally downgradient basal lens in the area between Keahole Point and Kailua Town. Evidence gathered to date suggests that at least some, if not most, of the high level groundwater actually flows at depth beneath the basal lens to discharge into the marine environment offshore.

The anomalous characteristics of the basal lens suggest this: very low water levels relative to the actual ocean level; very high salinity; temperatures significantly lower than the high level groundwater; and increasing salinity in wells under modest pumping rates.

The more compelling evidence is provided by the discovery of fresh water under artesian pressure at depth below the basal lens in the Keopu and Kamakana deep monitor wells. If leakage of high level groundwater into the basal lens is limited or only occurring in modest amounts, then foreseeable future increases in pumpage of high level groundwater will have little or no impact on the basal lens.

With this unresolved issue, monitoring for potential impacts to basal groundwater going forward should be continued and even expanded. This expansion should include deepening the Kaloko-2 well so that possible changes to the thickness of the basal lens at this location can be tracked.

Dr Steve Dollar, Ph.D.

Coastal Zone & Coral Reef Specialist

Findings and Conclusions

This report has been prepared in response to a petition by the National Park Service (NPS) to the State Commission on Water Resource Management to designate the Keauhou Aquifer as a Groundwater Management Area. The petition asserts that present or planned future use of groundwater from the Keauhou Aquifer will reduce the flow of basal groundwater through Kaloko Honokohau (KAHO) National Historical Park, thereby causing harm to KAHO's anchialine ponds and its nearshore marine environment.

This report summarizes data collected by Marine Research Consultants, Inc. during four field surveys between 2000-2012 for the purpose of evaluating the composition of waters within two large fishponds within KAHO(Aimakapa and Kaloko) and the coastal ocean offshore of these fishponds, with particular emphasis on evaluating the contribution and fate of groundwater input.

In the earlier studies (2000, 2007) Aimakapa Pond exhibited little vertical and horizontal stratification, appearing as a uniformly well-mixed system with long residence time. These conditions were characterized by near complete uptake of all inorganic nutrients entering the ponds through groundwater flux, and elevated values of organic nutrients that are the product of decomposition of organic material. This condition indicated the pond was progressing toward a terminal successional stage where the pond becomes a sediment-filled wetland. More recent studies in 2012 reveal consistent input of groundwater along the landward shoreline of the pond, resulting in steep gradients of salinity and inorganic nutrients found in groundwater. These results suggest that there has not been a detectable decrease in basal groundwater to the ponds; in fact the opposite appears to be the case. While the differences in groundwater dynamics within the ponds over the 12-year interval of studies may reflect the relationship between sampling and tidal state, results of these studies indicate that at a minimum the fishponds are not in a cycle of uninterrupted progression toward a more senescent state.

Scaling nutrients concentrations to salinity indicate that there are no nutrient subsidies to the ponds from sources other than naturally occurring groundwater. None of the data scaling inorganic nutrients to salinity within the ponds or nearshore ocean indicate substantial nutrient subsidies to groundwater that could be a result of human activities in upland areas. These results indicate that under the present scenario, the existing development upslope of KAHO is not causing detectable input of nutrient subsidies, or reduction in groundwater flux to the ponds. Rather, recent conditions in the ponds appear to represent a more open system with respect to hydraulic and nutrient fluxes.

In a companion report TNWRE found no impacts to basal groundwater have been identified to date as a result of high level groundwater pumpage. While it is not resolved whether high level groundwater actually drains into the nominally downgradient basal lens, evidence gathered to date suggests that at least some, if not most, of the high level groundwater actually flows at depth beneath the basal lens to discharge into the marine environment offshore. If leakage of high level groundwater into the basal lens is limited to the modest amounts that evidence collected to date suggests, then the foreseeable future increases in pumpage of high level groundwater will have little or no impact on the basal lens.

If indeed pumping of high level groundwater has minimal effects on basal groundwater, then it is clear that pumping high level groundwater will also have no effect on nearshore processes influenced by basal groundwater. The results summarized in this report correspond to such a conclusion, as no negative impacts were detected in nutrient dynamics of the KAHO fishponds over the last 12 years.

Dr Richard Brock, Ph.D.

Aquatic Resource Specialist

Findings and Conclusions

As part of the permitting process allowing the Kohanaiki development to occur, the County of Hawai'i imposed a requirement for a water quality monitoring program to insure that the quality of the ground and nearshore marine waters are not degraded as the development proceeds.

This monitoring program was reviewed by federal and approved by state and county agencies. The methods follow the Hawai'i State Department of Health (DOH) Regional water quality monitoring protocols. Sampling is carried out six times a year during dry periods as well as following high rainfall events where the "trigger" initiating sampling is 1.5 inches or more of rainfall falling within a 24-hour period. In each survey between 105 to 110 samples are collected.

Samples are collected from the ocean, in brackish anchialine ponds present on the project site and from wells present in the project area. Ocean samples are collected fronting the project site as well as at control sites. Sampling commenced in 2005 and up to present there have been 57 monitoring surveys collecting and reporting on 5,683 samples making this monitoring program the most stringent of all such non-potable monitoring programs in West Hawai'i.

Findings:

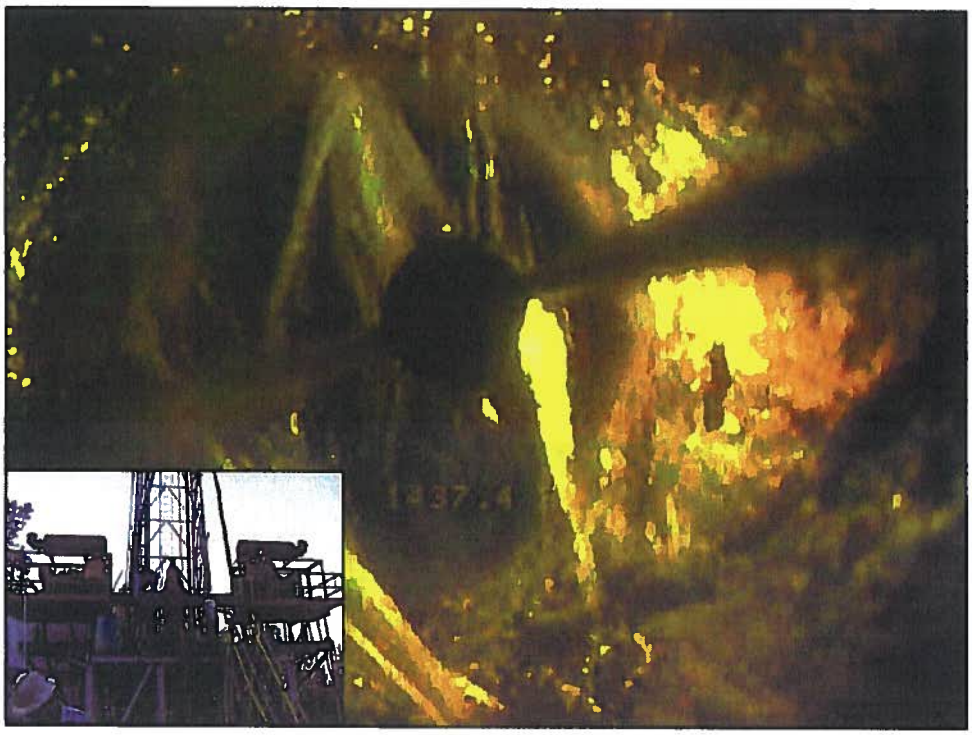
1. Non-compliance with state water quality standards among parameters measured in the ocean occurs on a coast-wide basis and is not differentially greater at sample sites fronting the Kohanaiki development. Indeed, highest parameter means are found at control locations which is related to greater groundwater flow at those locations.
2. In natural undisturbed West Hawai'i environments, nutrient concentrations (which is what we measure) in the seaward flowing coastal groundwater vary tremendously through both time and space. At some locations concentrations are naturally elevated and at others they are low, but all of them have high variability in concentrations through time. However as groundwater approaches the ocean these high concentrations decrease tremendously primarily due to dilution.
3. With development the same facts hold but coastal development will usually cause increases in some nutrient concentrations and these are seen at sample points makai of the development (primarily in anchialine pools) but again the signature continues to be lost at the shoreline. Increases in concentrations are transitory and are usually seen during the period of golf course turf establishment and once completed, concentrations decrease. Despite the fluctuations in concentrations of some nutrients in anchialine pools, there is no evidence of decline to pond biota connected to changes in water quality. This is due to: (1) these increases are usually less than the concentrations found at some completely undisturbed sites, (2) the anchialine biota have evolved in a system with this high natural variability in concentrations and are completely insensitive to it and (3) if a nutrient is in excess, adding more will not have an impact at the concentrations measured in this study.

Keauhou Aquifer System
Summary of Hydrogeology Findings

Prepared by:
Steve Bowles
Groundwater Geologist
Waimea Water Services
67-1161 Mamalahoa Highway
Kamuela, HI 96743

Keauhou Aquifer System

Summary of Hydrogeology Findings



A rarely observed event: High-level ground-water entering an uncased well bore in the uplands of Palani Ranch, Island of Hawai'i. The water level was found to stand at about 95 feet above sea level and penetrated a high-level compartment of the Keauhou Aquifer System.

By Stephen P. Bowles and Waimea Water Services

July, 2014


Keauhou Aquifer System

Keauhou Aquifer System: Hydrogeology Findings By S.P. Bowles and Waimea Water Services A Summary

EXECUTIVE SUMMARY

Cumulative hydrogeologic data and field observations of the Keauhou Aquifer System (KAS) obtained during the past half century support the conclusion that declaration of the Keauhou Aquifer System (KAS) is not necessary at this time. The KAS as a whole is underdeveloped at this date.

Early work in preparing estimates of sustainable yield is inadequate. Many of the descriptions of the hydrogeology have oversimplified the actual occurrence of the local ground-water. Further deep core drilling is needed to better understand the geologic elements which make up the working components of the KAS. A comprehensive water resource management plan must also be prepared and modified as knowledge through exploration continues.

Introduction

The Keauhou Aquifer System (KAS) has been the subject of numerous studies which have resulted in a progressive accumulation of knowledge of the hydrogeology. For this review, we have divided the KAS into north and south sectors for convenience of discussion.

The first drilled well (1944) for exploration was built on Hualalai road and produced brackish water to supplement the water supply from Waiaha spring. During the 1950s and early 60s construction of Kahaluu wells began in the south sector and the brackish well at Kealakehe elementary school in the north sector. These wells led to the construction of the Kahaluu Shaft and an exploration well at Kalaoa (Kona Palisades).

The KAS can best be described by recognizing two distinct geologic compositions, which result in a complex hydro-geologic ground-water occurrence (see attached maps). Mauna Loa lavas are generally thin bedded with numerous clinker formations and dominate the southern sector. The northern half of KAS is dominated by shallow thin bedded lavas which overlay massive trachyte flows of the Hualalai volcano.

The geology is further complicated by evidence of major slumpage of the slopes of Mauna Loa and possibly Hualalai volcanos (J. G. Moore, et al. JGU 1989).

Northern Sector

The emphasis for this review is with the northern sector, as water from the shallow basal lens provides the majority of the visible shoreline discharge. Initial knowledge of this sector, beginning with the brackish wells mentioned above, was assumed to be dominated by the basal lens where fresher waters float on salt water. The earliest (about 1990) estimate of sustainable

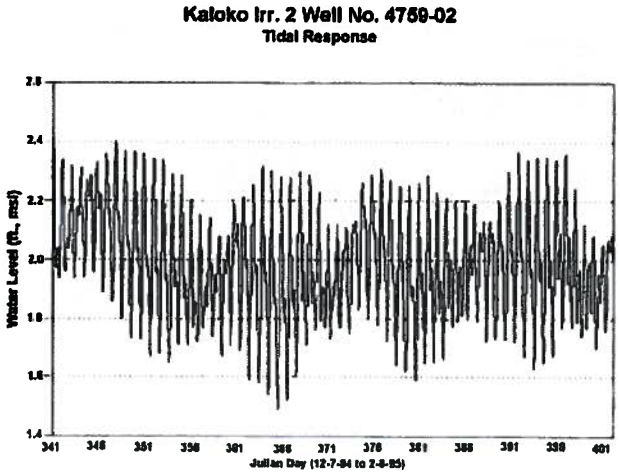
yield for KAS by Mink and Lau was based on the assumption that ground-waters of the KAS occur only as a basal lens.

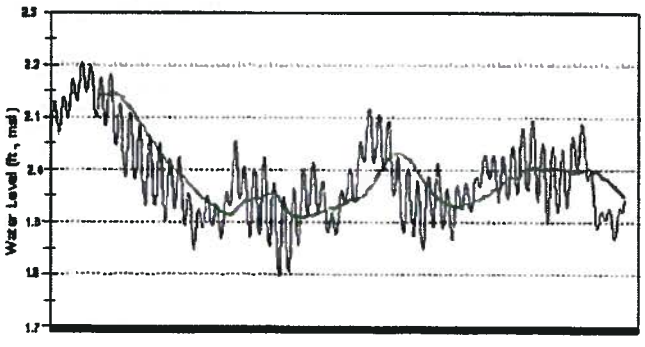
NELHA Injection Well study (1)

In conjunction with a request by the Natural Energy Lab at Keahole Point (1970's), John F. Mink and S. P. Bowles prepared a manuscript report which included data from the DLNR well to Kona Palisades (well # 4360-01). The well was slightly brackish and clearly tapped only the thin brackish lens.

TSA Golf Course Wells (2)

S. P. Bowles was contracted to evaluate the hydrology and develop two wells for the proposed TSA Golf course located adjacent to Hinalani Drive (wells # 4160-01, 4160-02). These wells each proved to be high yielding and brackish (chlorides @ 1000 milligrams per liter). Tide records of ocean and well levels in 4160-02 (note: mislabeled in graph) presented below were subsequently measured by Glenn Bauer of the Commission on Water Resource Management (CWRM).

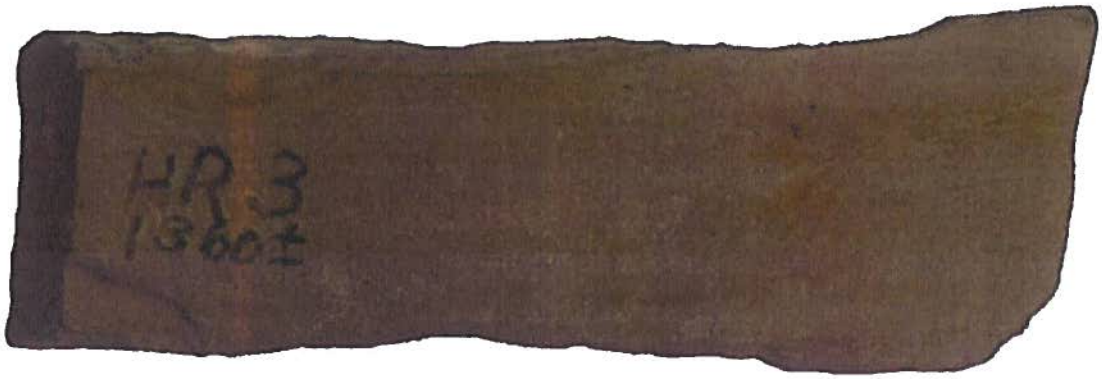




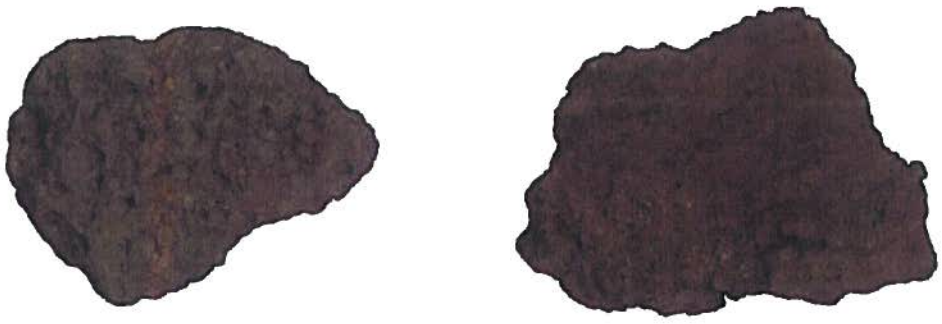
Kukio Resort-Huehue Ranch Well Field (3)

Drilling of water wells at about elevation 1600' for the Kukio Resort began in 1989 with HR - 1 (4559-01) which struck the basal lens with a water level at about elevation +8'. The first water pumped contained hydrogen sulfide and more detailed chemistry showed the water to be hydrothermally altered, indicating the presence of at least gas emanating from the deep magma. The total dissolved solids exceeded the secondary standards for drinking water (appendix 1). As the well field drilling progressed, the HR wells (4459-01, 4558-01, and 4459-02) all found similar water and penetrated thick, dense trachyte lava flows.

At a depth of 1360', HR 3 struck a particularly thick, dense formation. A sample was dated by the Hawaii Volcanos Observatory and found to have an age of about 100,000 years bp (before present).



DENSE TRACHYTE BASALT



POROUS OLIVINE BASALT

Trachyte sample statistics including ages of various sources including the wells in the Northern sector of KAS.

Table 1. Water Well Localities Intersecting Trachyte, Hualalai Volcano

Locality	Lab Number	Well Number	Depth (m)	Sample Interval
Huehue Ranch #1	MH84-190	4559-01	265-372	~326
Huehue Ranch #3	HR3-1373	4508-01	315-440	418
Huehue Ranch #5	HR-5	4558-02	236-462	337-353
Kalaoa	4358-0	4358-01	509-512	509-512
Kohanaiki #2	2	4458-02	432-484	457-460
Puu Lani (Anahulu)	4850-01/470, /490	4850-01	0-279	143-146, 149-152
Keopu	No sample	3957-01	~408	No sample

Table 4. Results of Ar-Ar Incremental Heating Analyses[1],

Sample	Huehue#1	Kalaoa	Kalaoa[2]	Kohanaiki	Kohanaiki[2]	Puu Anahulu	Puu Anahulu[2]	Waha Pele	Waha Pele[2]	Huehue#3
Integrated Age (ka)	110	113	116	117	112	128	162	110	107	113
2sd	4	4	4	3	3	4	7	3	17	7
Plateau Age (ka)	104.4	104.3			105.9			110.1	105.7	107.3
2sd	1.4	1.4			0.8			1.2	2.4	3.9
MSWD[4]	0.79	1.90			1.06			0.81	0.61	0.55
Steps	K-K	H-L			B-F			C-I	D-J	C-K
%^{39}Ar	51.2	50.2			57.8			48.8	54.7	64.6
Isochron Selected Steps[5]										
Isochron Age (ka)	107....	86.3	56.6	105.1	104.6	115.1	113.3	110	103	95
2sd	9.8	9.1	7.7	3.0	2.8	9	3.7	24	5.5	13
^{40}Ar/^{36}Ar$_i$	294.8	303.5	301.5	301.2	297.0	301.0	300.9	295	297.0	301.5
2sd	4.4	3.4	2.1	2.1	1.8	3.3	0.9	16	2.0	7.4
MSWD	1.05	0.48	1.60	0.91	0.84	0.71	1.60	1.1	0.52	0.30
Prob. Of Fit[6]	0.40	0.92	0.15	0.51	0.55	0.64	0.20	0.33	0.86	0.97
Included	C-Q	C-O	C-I	D-M	B-J	C-I	C-O	C-P	ALL	A-K
%^{39}Ar	98.1	89.3	62.8	84.2	94.6	44.4	55.6	97.8	100	96.7
^{36}Ar		X	X	X		X	X			

Preferred Ages (ka)						
Sample	HueHue#1	Kalaoa	Kohanaiki	Puu Anahulu	Waha Pele	Huehue#3
	107.2	92.3	104.0	113.6	103.3	95
2sd	9.8	5.9	2.0	3.4	5.3	13
		Mean	Mean	Mean	Mean	
Comments	Isochron age	Isochron age	Isochron age	Isochron age	Isochron age	Isochron age

[1] All uncertainties are given at the 95% confidence level. Ages were calculated using an age of 28.02 Ma for Fish Canyon sanidine [*Renne et al*, 1998] and the decay constants and isotopic abundances of [*Steiger and Jager*, 1977].

[2] indicates samples heated with a resistance furnace; other samples heated with a broad beam CO_2 laser

[3] Plateau criteria are those of *Ludwig* [1999].

[4] MSWD refers to mean sum of the weighted deviates, a measure of scatter in x and y about a best fit line [*McIntyre et al.* 1966].

[5] Steps are omitted from the regression if: 1) including them would cause the probability of fit to drop below 0.15 (see below), or 2) they are highly imprecise, that is, analytical errors exceed those of the most precise steps obtained for the sample by a factor of >5 or more.

[6] Probability that scatter of data about isochron is explained by analytical uncertainties alone; a value > 0.15 is considered acceptable [e.g. *Ludwig*, 1999]

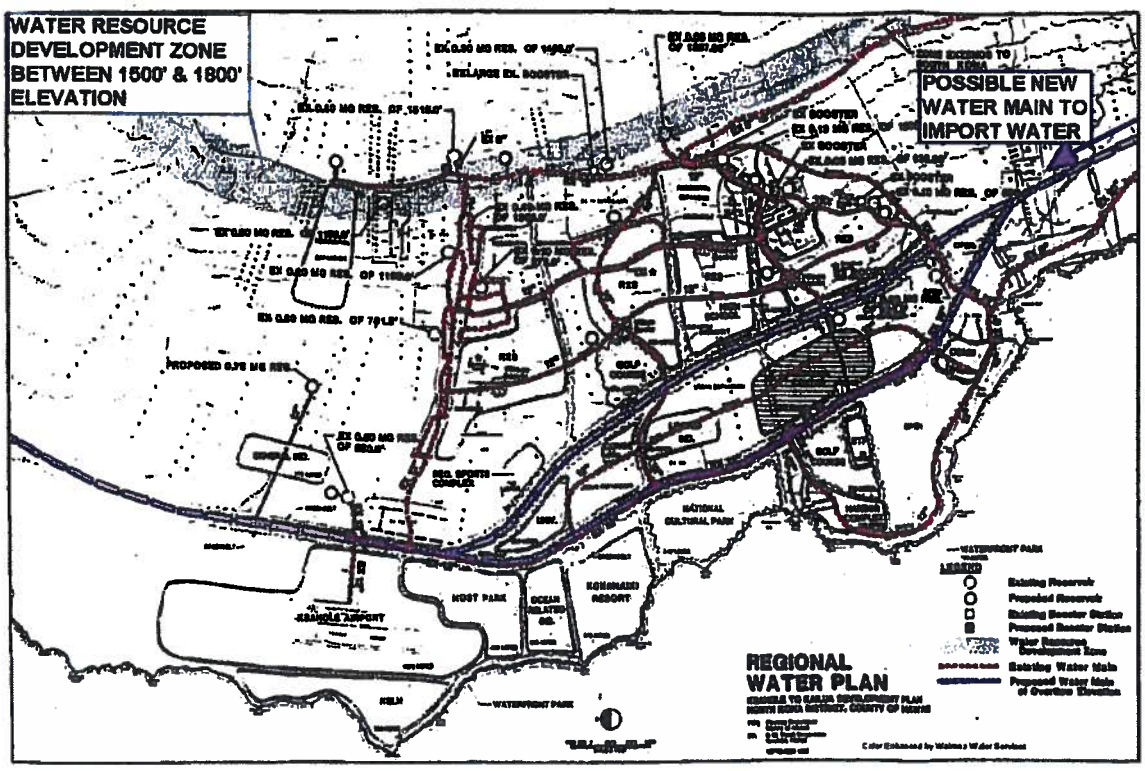
Excerpt from:

Cousens, B.L., D. A. Clague and W.D. Sharp, 2003 Chronology, Chemistry, and Origins of Trachytes from Hualalai Volcano, Hawaii. *Geochemistry Geophysics Geosystems* 4(9):1-27.

Subsequent development of these wells (which were spaced approximately 1000' apart) was placed into production with a combined estimated sustainable rate of 1.96 mgd (million gallons daily). In 2006, a major pumping test was conducted to stress the aquifer to determine how sensitive the basal lens was to pumping (appendix 1). Based on this data, the estimated sustainable pumping rate was raised to 2.5 mgd. The average pumpage from these wells today is 1.38 mgd.

Keahole to Kailua Development Plan

The original success of Kukio-Huehue well field continued to support the assumption that fresh basal ground-water could only be found by drilling wells above elevation 1500'. As presenter of the hydrogeology for the Keahole-to-Kailua (K-to- K) Development Plan of the county of Hawaii, S. P. Bowles recommended that potable water development for this area be developed first in the higher elevations and further, that when this pumpage reached a high point of production, that water must be imported from the south sector of the KAS.



KSBE High Level Discovery (South Sector) (4)

In the meantime, in the south sector of KAS, Kamehameha Schools/Bishop Estate (KSBE) drilled a deep well from elevation 1618'. Water was struck and found to stand at elevation +278' above sea level. Following the advice of S.P. Bowles, the first well was drilled to sea level and water was found to saturate the rock to sea level indicating a very large compartment of high level ground-water. This marked the discovery of the major high level ground-waters in the KAS.

Kalaoa-Honokohau Wells–DWS DLNR (5)

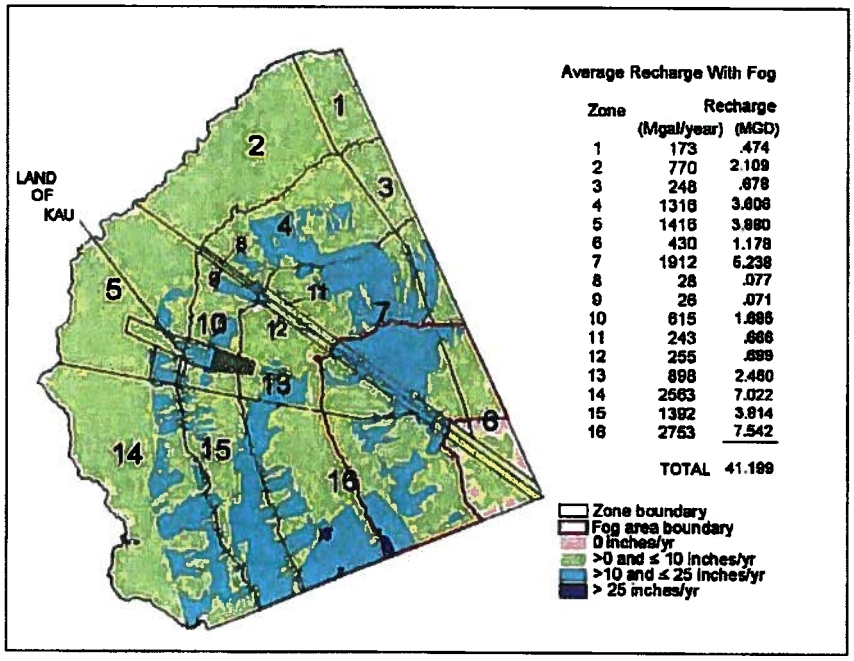
Following the strategy presented in the K-to-K Plan, the Department of Water Supply (DWS), in conjunction with the State Department of Land and Natural Resources, developed 2 wells (well 4358-01, well 4258-03). The average pumpage from these wells in 2013 was 0.89 mgd. Adding north sector wells, #4158-02 and #4057-01, brought the total to 3.67 mgd.

According to information obtained during construction, it was determined that the wells penetrated several dense strata with the water level rising with increasing depth.

This is further substantiated by Glenn Bauer who stated in his 2003 report, "*Even though the DWS' Kalaoa Well (4358-01) had a measured water level at 237.5± ft., msl in 1990, the bottom elevation is –57 ft., msl. When the DWS' Hualalai Well (4258-03) was drilled 1.5 miles south of Kalaoa Well, the initial water level was 191± ft., msl when the bottom elevation of the well was –43 ft., msl. After an initial aquifer test was performed, the well was deepened 99 ft. to –142 ft., msl. As a result, the water level in the well rose to 293± ft., msl. Deepening this well provides implications for ground-water flow in the high-level water body.*" *(Bauer, 2003, A Study of the Ground-Water Conditions in North and South Kona and South Kohala Districts Island of Hawaii, 1991-2002).*

KSBE, Kukio, Palamanui Hydrologic Budget

KSBE and Kukio Resorts contracted Waimea Water Services to conduct a hydrogeology of the north Hualalai Volcano. In addition, Palamanui had requested a study for their land use application. A portion of the hydrologic budget within the KAS north sector (units 5, 9, 10, 12, 13, 14, 15 and 16) from that study (see map) is presented is presented below. It was estimated from that study that the high level aquifer compartments receive recharge of about 10.7 mgd and the thin basal lens receives about 11.7 mgd. There is no direct runoff to the sea and the evapotranspiration is accounted for prior to estimating recharge.

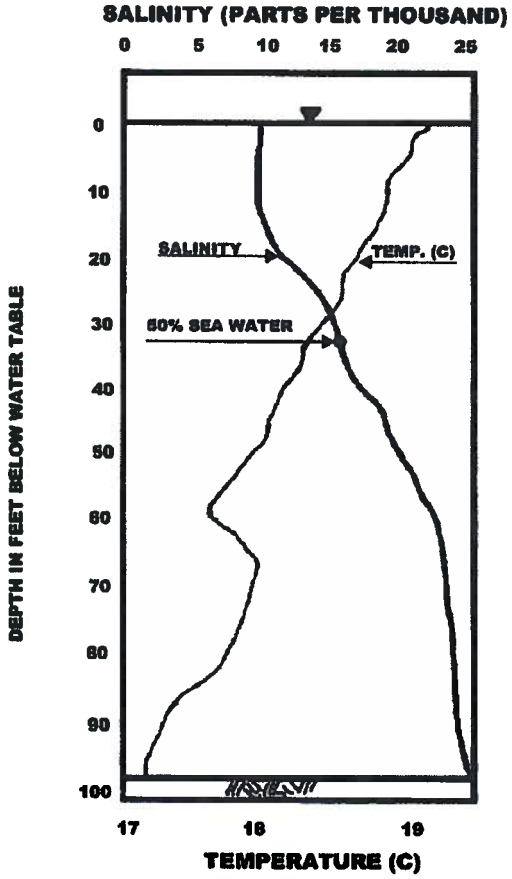


Average Recharge With Fog

Zone	Recharge (Mgal/year)	(MGD)
1	173	.474
2	770	2.109
3	248	.678
4	1316	3.606
5	1416	3.880
6	430	1.178
7	1912	5.238
8	28	.077
9	26	.071
10	615	1.685
11	243	.666
12	255	.699
13	898	2.460
14	2563	7.022
15	1392	3.814
16	2753	7.542
TOTAL		41.199

Ooma Test Well (6)

An exploration well (4262-01M) was drilled on the land of Ooma, makai of Queen Kaahumanu Highway, to explore the ground-water on that parcel. This well was the first to penetrate deep below sea level and led to a major discovery of decreasing temperature with depth with an increase in salinity.



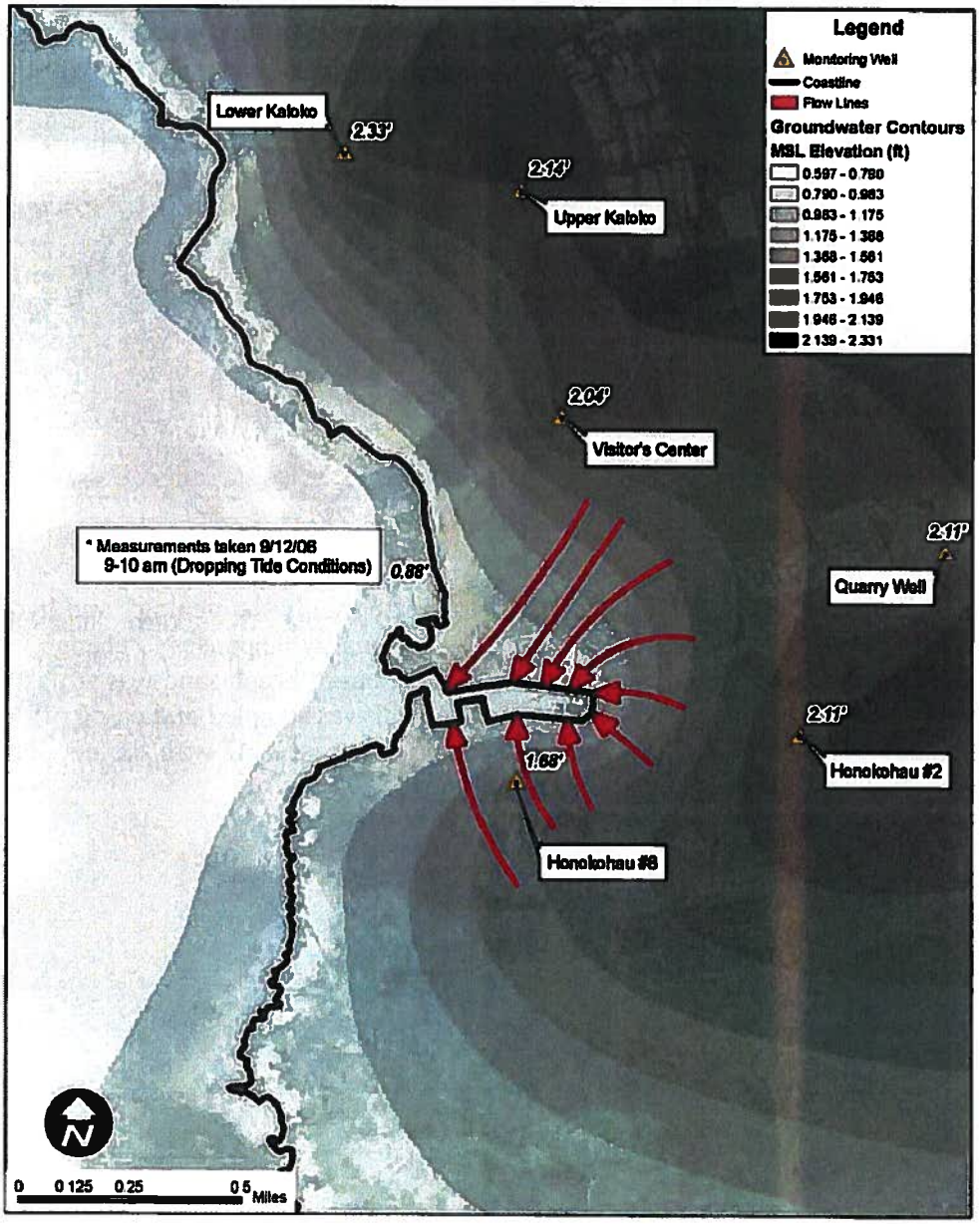
Previous thermal infrared studies of near shore ocean water had indicated numerous plumes of spring discharge which were assumed to discharge cold freshwater (W.A. Fischer, et al, HA-218, 1966). The Ooma data and test results provided an alternative explanation of shallow, cold water discharge of very brackish ground-water springs.

Kealakehe Wastewater Treatment Plant & Kona Kai Marina (7)

Waimea Water Services was contracted to evaluate the impact of the treated wastewater discharge mauka of Queen Kaahumanu Highway. There had been implications that the wastewater was causing an algae bloom in Honokohau Harbor. Water samples were collected from spring orifice points around the edge of the man-made harbor as well as in the outgoing

channel. Samples were also collected from the finished treated water within the WWTP. Summaries of data are contained in appendix 2.

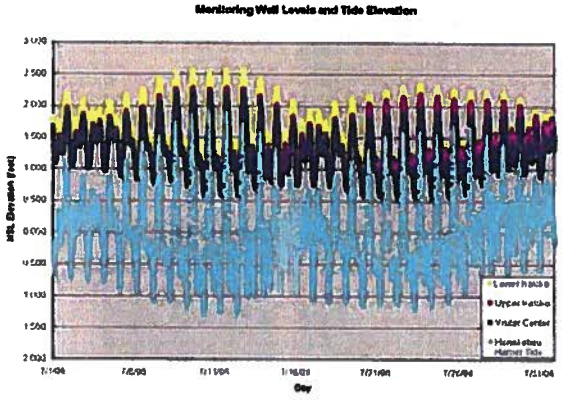
Harbor water samples were collected for the purpose of detecting evidence of contaminants from the wastewater discharge pit of the Kealakehe WWTP located adjacent to the County Police Station. There was no conclusive evidence of the injected wastewater found in any of the samples. A water level contour map (below) was prepared in conjunction with the marina proposal which shows the anticipated direction of ground-water flow into Honokohau Harbor. Subsequent studies, using refined analytical techniques, detected evidence of the injected effluent reaching the harbor (Hunt 2008).

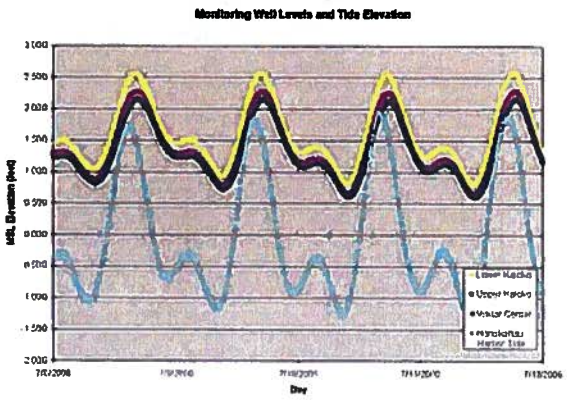


The original plan for Kealakehe WWTP called for an injection well to be drilled to discharge the treated effluent. Dye had been injected via a test well into the water table and was never seen to discharge. As part of the study mentioned in the following paragraph, it was determined that the dye never left the bore hole.

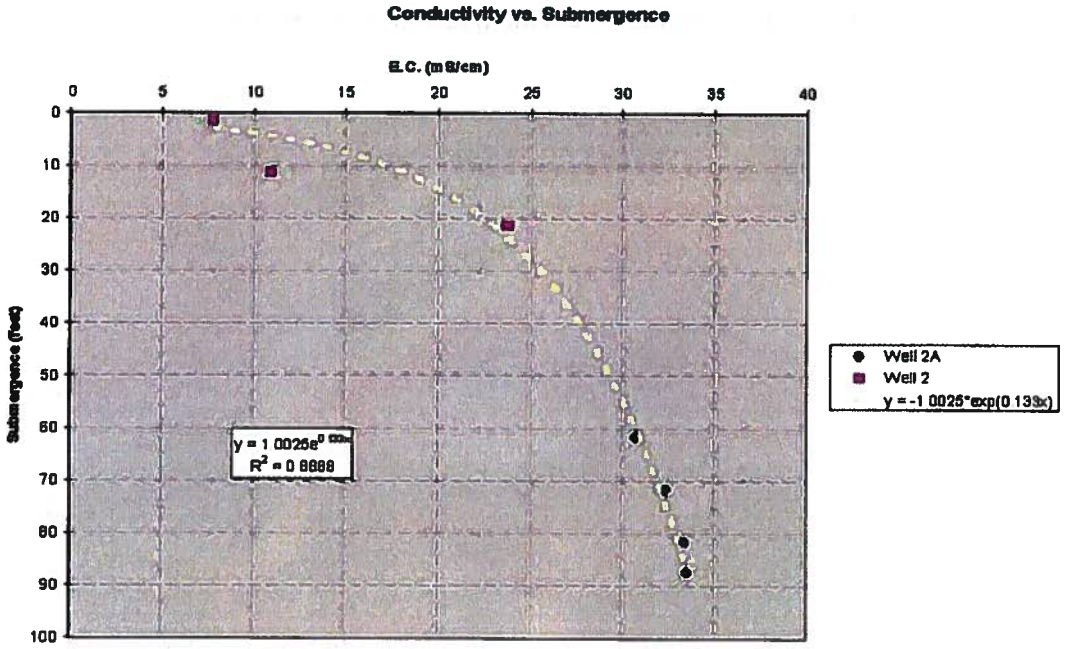
Regardless, the tidal and temperature evidence was well documented and important in understanding the impact of the highly permeable lavas of the shallow basal aquifer.

Kona Kai Ola Marina (KKOM) was proposed as an expansion of Honokohau Harbor. A series of shallow bore holes were drilled along the alignment of expansion and monitored for geology and hydrologic data. The primary purpose was to evaluate changes which might result from developing the marina and to better understand how the local ground-water was responding to tide changes. Tide changes were recorded and sample graphs are included below.



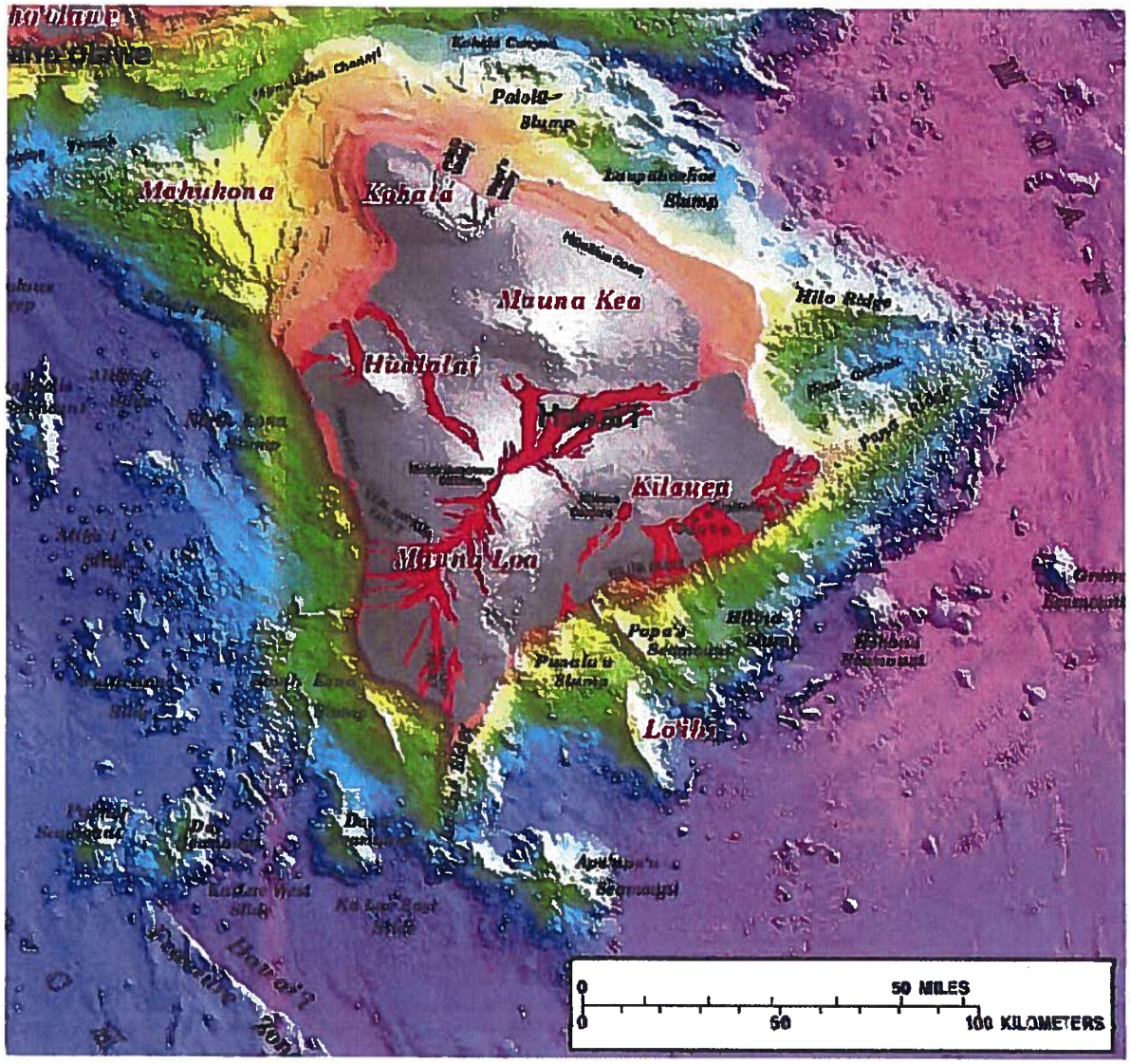


Honokohau Wells 2 and 2A were constructed to further study the geology and hydrology as part of the KKOM project to provide a basis of water quality responses to change. The wells were built in two distinct vertical sections. An olivine basalt beach sand was struck at a depth of 80-90 feet which continued to fill the bore. The well was sampled and cased off. A second bore was made adjacent to the first bore. The sand was cased off with the new bore drilled deeper. The results of that sampling are shown below.

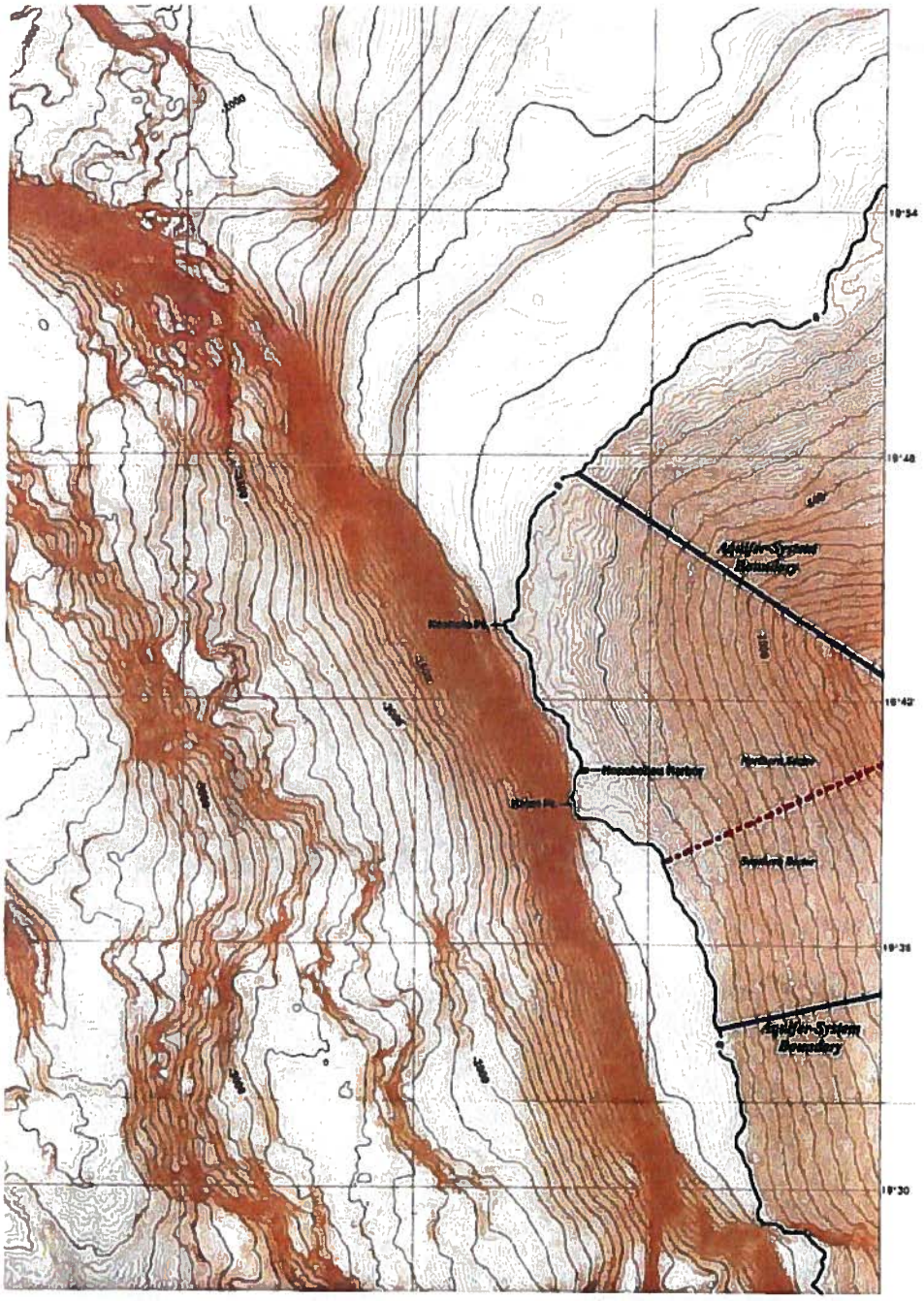


As stated earlier, the evidence of cold water discharge between Keahole and Kaiwi Points accompanied by very high tidal efficiency in well water levels are likely caused by proximity to deep ocean water circulation inland.

The ocean bathymetry is shown in the following maps (note the North Kona Slump and Alika Slides).



From B.W. Eakins, et, al., 2003, Modified by WWS, 2014

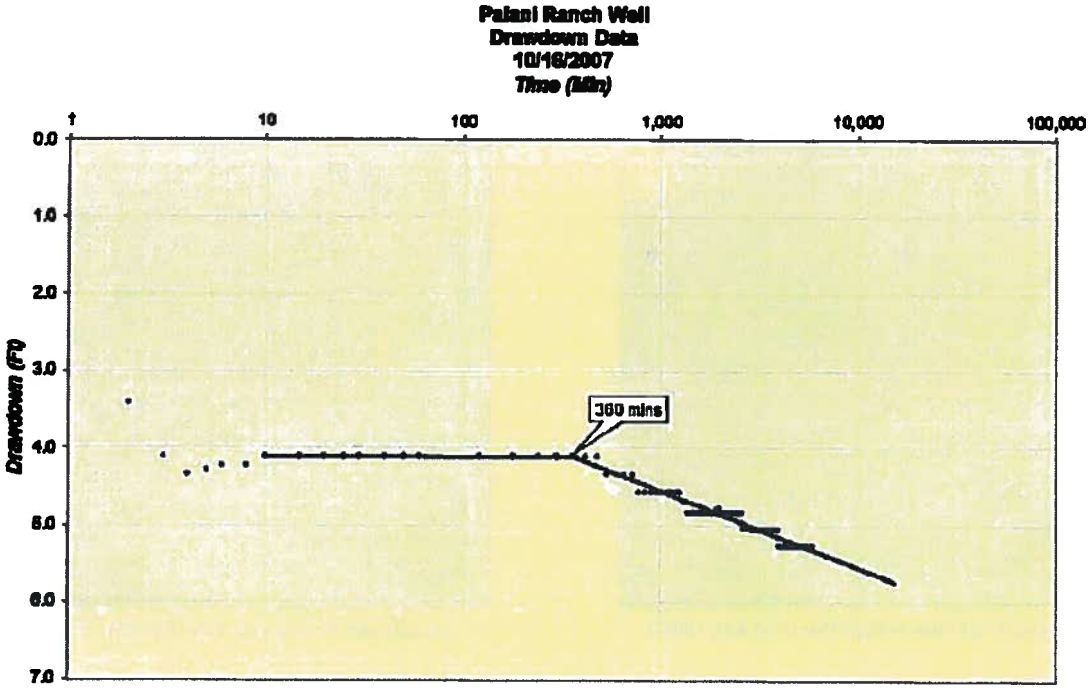


Bathymetry from W.W Chadwick,Jr, et al, 1994. Notes by WWS, 2014

Palani Ranch Well (8)

In support of the proposed business park of the Lanihau Corporation mauka of Honokohau Harbor, a major well was built (well #4158-03) in the uplands of Palani Ranch. The well is being placed into service with the Department of Water Supply. The water level was found to stand at about 95 feet above sea level and penetrated a high-level compartment of the KAS.

Ground-water under pressure entered the uncased well bore at a depth of about 1438 feet.



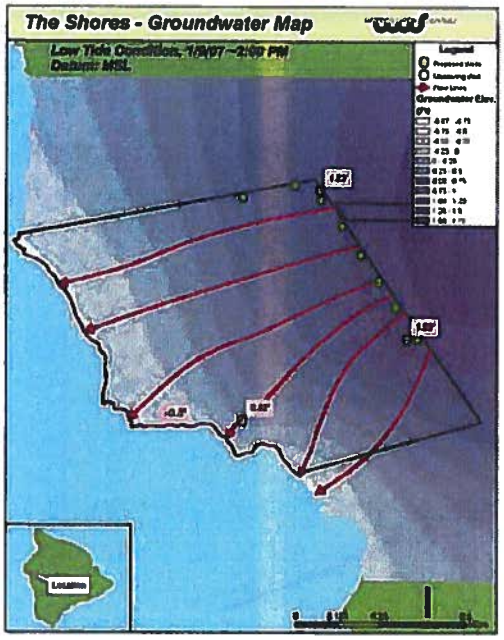
Sustained pumping rate of 1123gpm throughout test

A long term pump test indicated that a discharge boundary was struck after 360 minutes and drawdown was calculated to sustain the pumping yield of 1,200 gallons per minute for 16 hours per day.

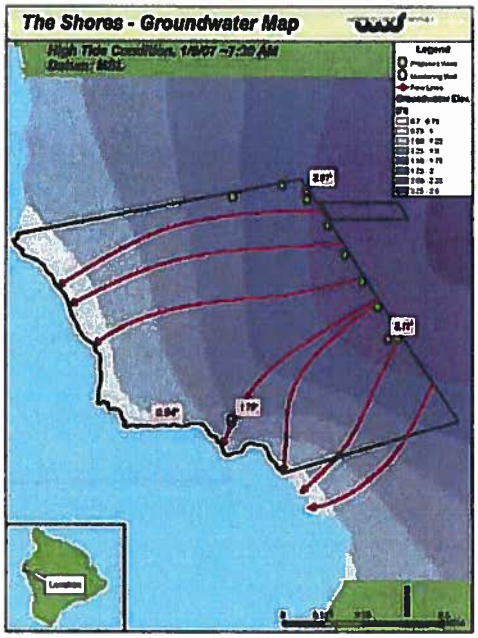
Kohanaiki (The Shores at Kohaniki) (9)

The Kohanaiki resort is located just north of the Kaloko - Honokohau National Historical Park complex. Waimea Water Services was contracted to design, build and operate a water source for the purpose of providing brackish water irrigation to the project.

The ground-water study was based on two existing water sampling wells and a number of anchialine ponds. Time of day water level measurements were made to observe ground-water flow direction.

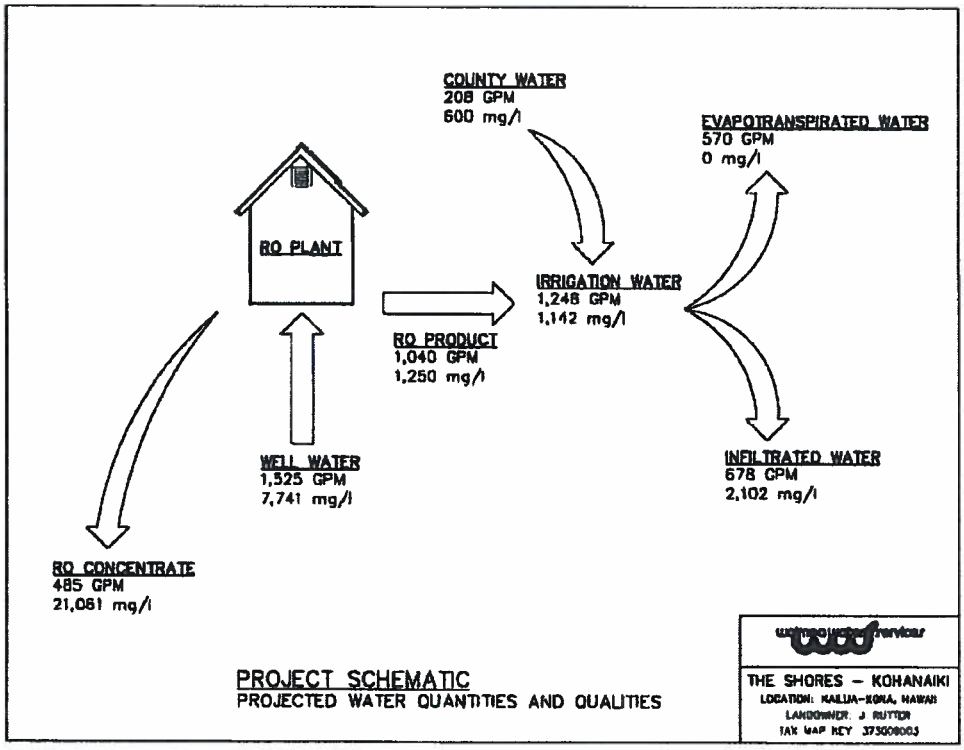


Groundwater Flow at High Tide (7:30 AM, 1/9/07)



Groundwater Flow at Low Tide (2:00 PM, 1/9/07)

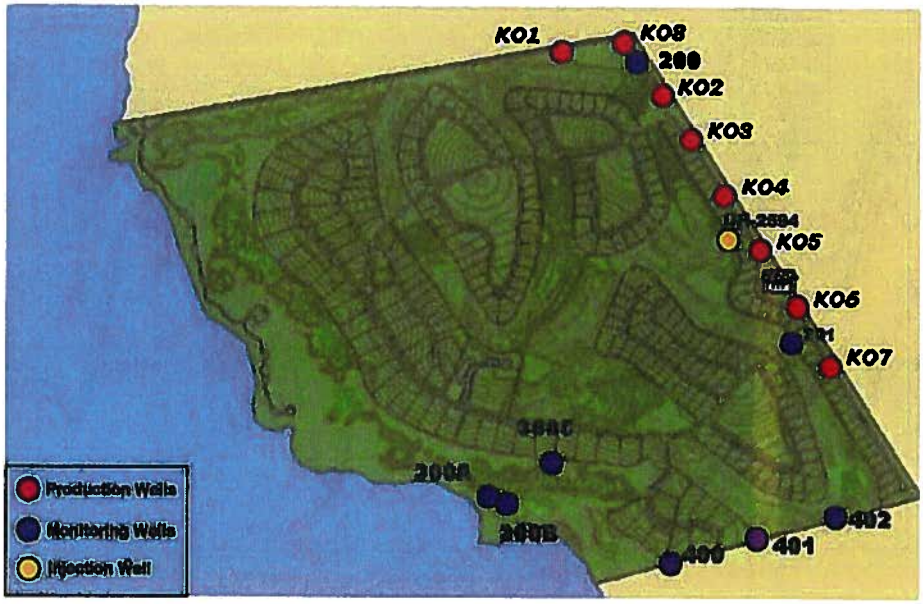
Construction water supply consisted of water furnished from an onsite brackish well for dust control and freshwater imported from the DWS potable system. Based on the initial supply, the gradient of the water table, water quality from the observation wells, and proposed irrigation water demand, WWS derived a hydrologic cycle projection for planning purposes.



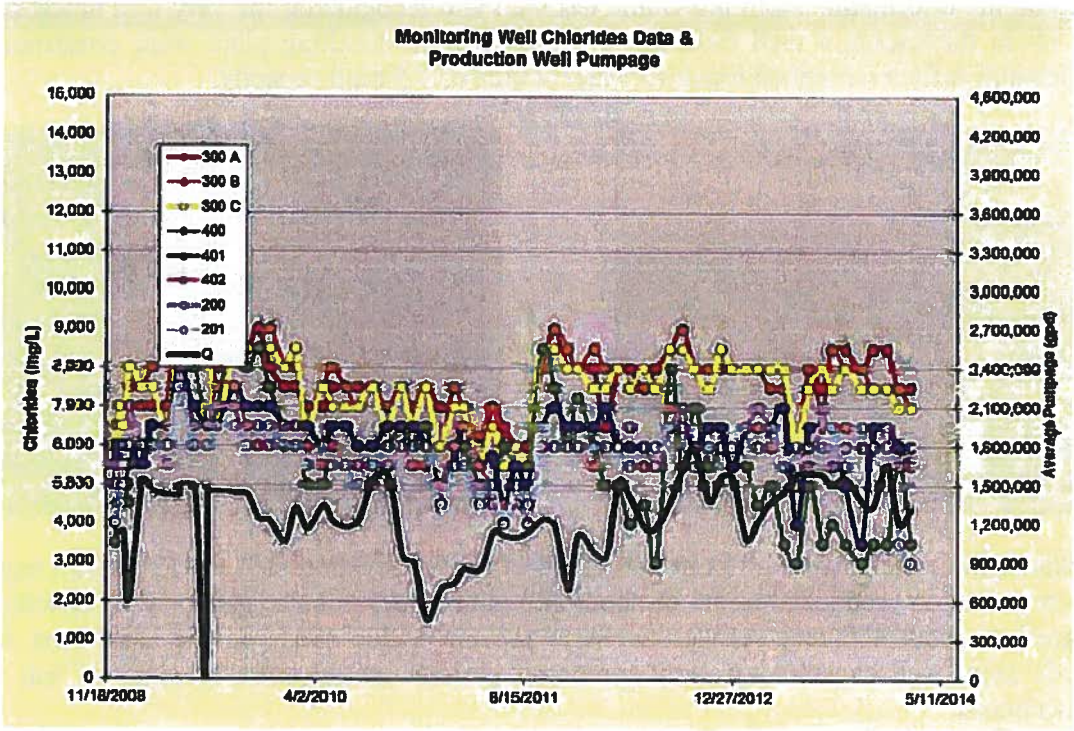
Based on the information from the Ooma test well and recognizing the very thin brackish lens (10' +/- in thickness), a well field and reverse osmosis desalting plant were constructed to develop and deliver a finished brackish water source of 1.5 mgd capacity.

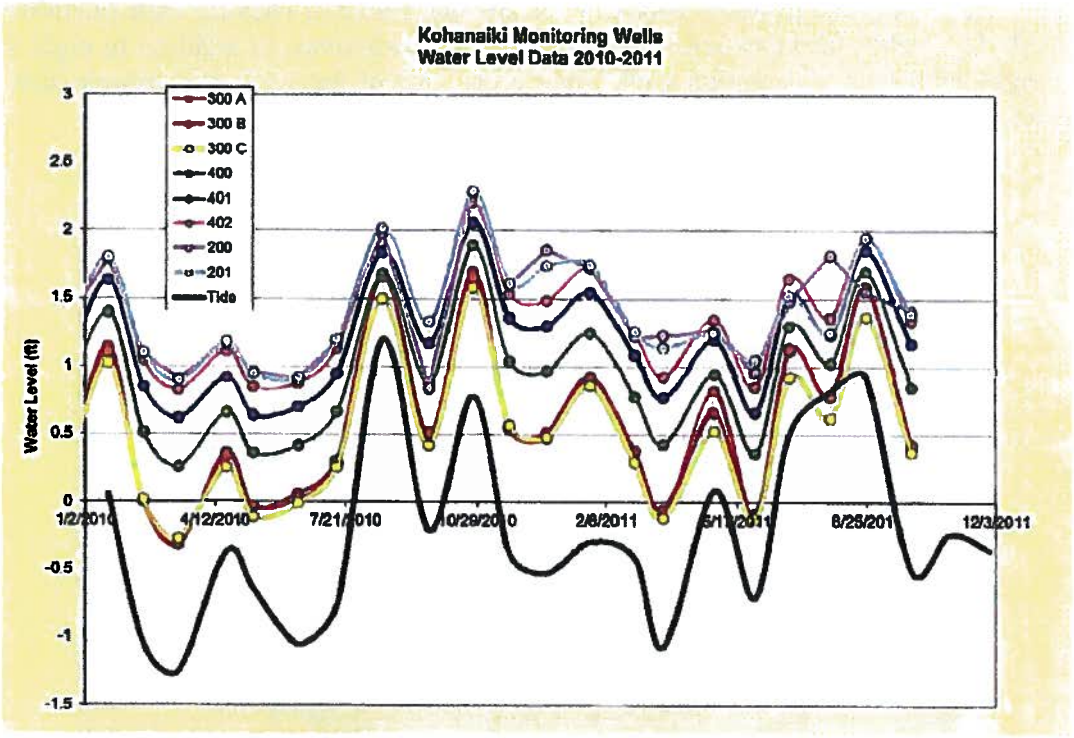
Brackish source wells were all built and cased to about elevation -10' to -12'. Well capacity was controlled to produce at a rate of about 200 gallons per minute (gpm). Well spacing was designed at about 400 feet between wells to prevent undue stress on the basal lens and to provide extra well capacity to allow some rest periods should there be signs of salt water encroachment.

In order to meet requests from the Kaloko - Honokohau National Historic Park (KHNHP) and to provide for careful management of the ground-water resources, in addition to eight supply wells, eight additional observation wells were built. All of the wells and sample sites have been sampled for water quality since pumping began in 2008.



Well Locations at Kohanaiki





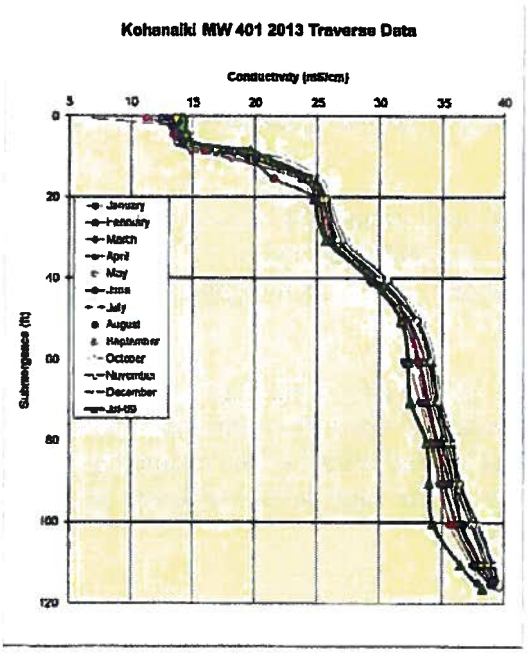
Graphs of the pumpage, tides and salinity data

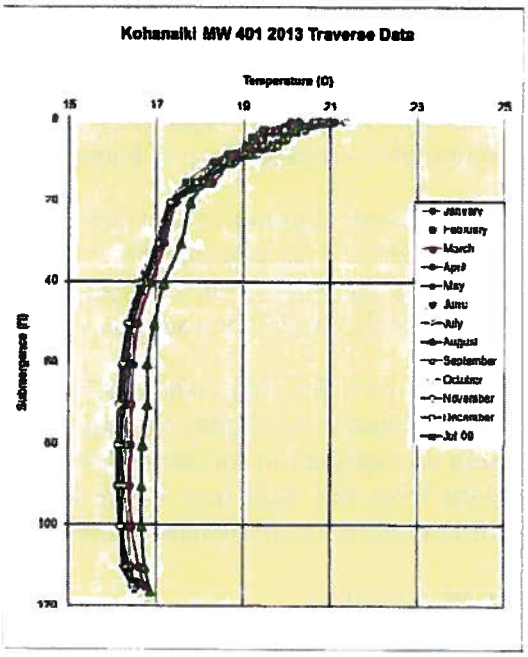
The salt concentrate discharge from the RO plant is injected by gravity at a rate of about 450 gallons per minute (gpm) to about elevation -100 feet via a specially designed well.

To determine the potential impacts of the well field pumping and the injection well, sampling is performed monthly at the following wells:

- Monitoring Well 300A (4162-005)
- Monitoring Well 300B (4162-006)
- Monitoring Well 300C (4162-007)
- Monitoring Well 400 (4162-004)
- Deep Monitoring Well 401 (4161-011)
- Monitoring Well 402 (4161-012)
- Monitoring Well 201 (4161-010)
- Monitoring Well 200 (4262-003)

A deep monitor well was constructed to elevation -114 feet to observe any changes within the basal lens which might be influence by the pumping or the injection of concentrate. The data from this well is summarized in the graphs below.





The top 10' of the basal lens will is sensitive to the application of water applied on the land surface within the resort area. A freshening of the lens may occur when water of lower salinity is applied in over-irrigation. It is noted that MW400 of the observation wells (4162-004) detected fresh water leaking from a faulty valve.

Keopu-Doutor Coffee (10)

The well bore for the Keopu project penetrated stream gravels at a depth of 960'. Subsequently, the gravels were determined by David Clague of Hawaii Volcano Observatory to consist of weathered trachyte from Hualalai volcano. The final water level was found to stand at elevation +47 feet.

Located at elevation 1445 feet, just makai of Mamalahoa Highway, the Doutor Coffee well also taps high-level groundwater standing at +43' near the Keopu project.

Boundary of Northern and Southern Sectors of the Keauhou Aquifer System

Wells 3957-01 and 3957-05 mark the approximate location WWS has used to demark the approximated boundary of the extreme Hualalai trachyte lava influence on the high–level portion of KAS and the likely boundary of the Alika slides of Mauna Loa. This is not conclusive but is used to better describe some of the reasons for increasing water levels evidenced during well construction during drilling along with actual recovery of trachyte cuttings. It is a convenient point of separation between the northern and southern sectors of KAS.

Kahaluu Wells, Shaft and Golf Course Wells (11)

Waimea Water Services has conducted a variety of studies in this complex. Efforts were been made to improve the water quality by back filling of the golf course brackish wells in addition to photographic investigations of Kahaluu wells.

The high volume of ground-water flow, with a low basal head of about 4' to 5' above mean sea level, has led to a concentration of development for potable water. This pumping concentration has resulted in a dynamic increase in salinity. As shaft pumpage was reduced, the salinity in the produced water has improved.

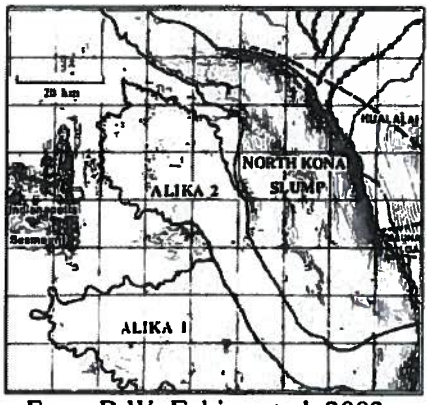
Exploration well 3657-02, while located significantly inland and north from the producing wells, was found to be slightly brackish with a chloride salinity 400 milligrams per liter. There has been no explanation for such a salinity as the well is located inland of the producing wells. Evidence from this well may imply that the influence of the high level confining geologic structures created locally reduced flows in the basal lens.

KSBE Well Field (4)

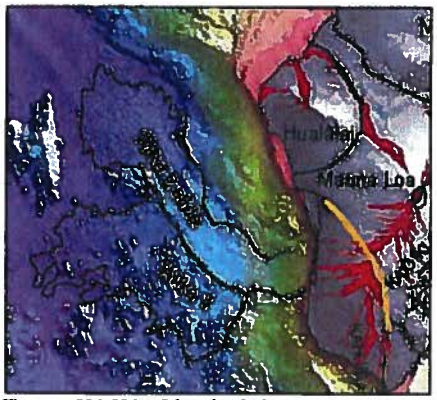
As mentioned earlier, the KSBE well field is located at the site of the first discovery of the high level ground-water aquifers in the Keauhou Aquifer system. In addition to the initial work by WWS, Tom Nance has conducted a number of well field studies.

As of this date there has been no conclusive evidence as to the geologic impediments creating the high level aquifers. S.P. Bowles speculates that the cause is most likely the influence of faulting as well as the confinement of the trachyte lavas as found primarily in the north sector and, particularly where lavas have flowed over fault scarps.

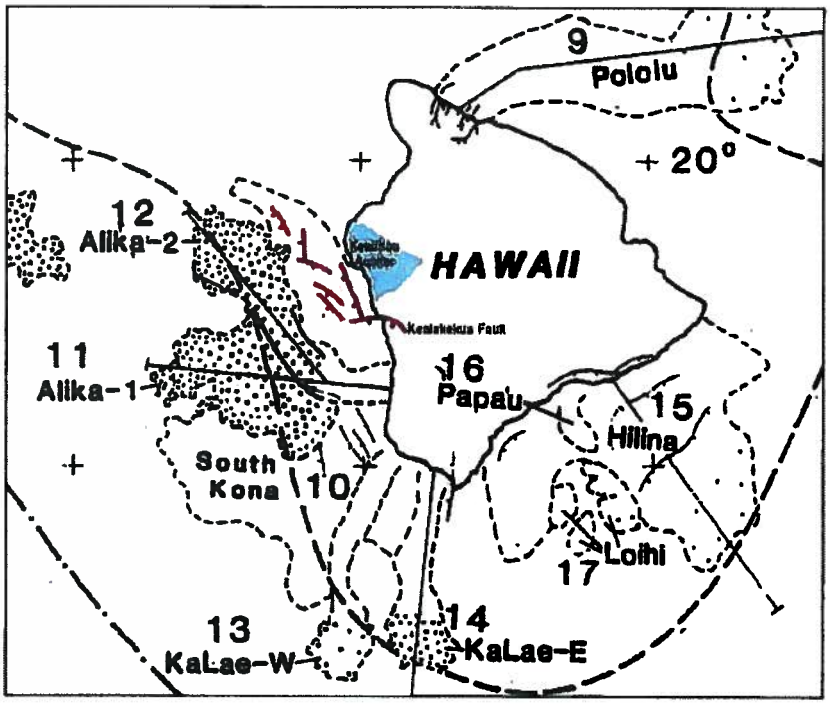
Major coastal land slumpage has been discovered, namely, Alika 1 and Alika 2 slides and the North Kona Slump.



From B.W. Eakins,et al.,2003



From W.W. Chadwick,Jr, et al.,1994



From J.G. Moore, et al, 1989, Notes by WWS 2014

A major fault, located inland of Kealakekua Bay, has been covered by younger lavas from Mauna Loa. Well 2753-03, located mauka of the fault scarp, taps high level ground-water. En echelon faulting, similar to the land surface west of Kilauea volcano, may also occur along the coast line to the north of Kealakekua Bay all the way to Kaloko.

Aquifer System South Boundary (see maps)

It appears that the south boundary of the KAS is arbitrary. There does not seem to be any outstanding hydro-geologic reason for the boundary line. Wells 3255-01 and 3255-02 are drilled into the high level aquifers with water levels exceeding 400 feet above sea level near the boundary line but there is no significant change in the subsurface geology, such as a mauka-makai rift zone to demark a boundary.

Hokulia-Halekii Well Complex (12)

Although these projects are located outside the KAS, they are important in defining the boundary between the high-level and basal aquifers. Irrigation wells, 3056-01 and 3156-01 have basal water levels 1.3' and 4.0' respectively. Well 3155-03, located about 2300 feet inland, or mauka, has a water level of +51' and produces fresh water (chlorides of 15 mg/l). The boundary between high-level and basal lens lies between these wells and appears to be the result of younger lavas flowing over a fault scarp which probably acts as an aquitard.

The DWS Halekii well (3155-02) , the Kalukalu well and the upper wells of Hokukano Ranch are all located in high level aquifer compartments with the maximum water level in well 3153-02 exceeding 1300' above sea level.

Findings

Our work, covering 40 years of investigation, has led us to create the findings listed in the first four items below.

1. *The Keauhou Aquifer System consists of four basic units:*
    a. *North sector – high level and basal*
    b. *South sector – high level and basal*

2. *Likely causes of high level ground-water occurrence:*
    a. *Fault scarps covered by younger lavas*
    b. *Trachyte lava flows*
    c. *Combinations of a and b*

3. *Multiple water levels in the high level aquifer region of KAS indicate a complex of aquifer compartments.*

4. *Cold water shoreline basal springs between Keahole Point and Kaiwi Point result from:*
    a. *Deep ocean temperature intrusion*
    b. *Highly permeable shallow lavas*
    c. *Tide fluctuations and their efficiency*

The bullet points listed below best describe the present operating status of the KAS.

- *The management programs of well spacing and pumping at the Huehue Ranch and Kohanaiki well fields have had no significant direct impact on the basal lens quality at the shoreline.*

- *The high level well pumping has had no direct impact on the basal lens in the north sector to date.*

- *Over pumping of the Kahaluu shaft and the Kahaluu wells in the south sector has resulted in dynamic salt water encroachment which is reversible when pumping is reduced.*

- *Water development in the north sector does not impact the south sector ground-water flow or quality. Efforts to provide a model simulation of the entire KAS are futile.*

- *The specific migration of high level ground-water flow to the ocean is not yet defined. Evidence from the Kamakana Bore (well 3959-01) and from well 3858-01, (thick, dense lavas, combined with artesian flow) provides some explanation (see Tom Nance presentation). Similar evidence is also found in the Huehue wells and in wells on the north slope of Hualalai.*

- *The high level ground-water system is complex with various water levels and has numerous compartments. Large quantities of high level ground-water in the south sector remain undeveloped.*

- *Sustainable yield assumptions based upon only a basal lens inaccurately describe the complexity of ground-water occurrence in the Keauhou Aquifer System. The recharge estimates by the USGS (J.A. Engott 2013) further reduce the present accuracy of sustainable yield estimates. The actual sustainable yield most probably lies between the two estimates.*

- *It is important to note that all pumped water is either discharged to the atmosphere by*
    - *evapo-transpiration;*
    - *infiltration from irrigation; or*
    - *shallow disposal of storm water and wastewater.*

  There is no discharge or runoff directly to sea in the north sector. Some extreme storm runoff does occur in the south sector.

Selected References

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- **Bowles, S.P., and Mink, J.A., 1980, *proposed Prototype Testing Program, Land Disposal by Injection Wells of Ocean Water Effluent at Seacoast Test Facility, Keahole Hawaii Island,* Manuscript Report.**
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- **Engott, J.A., 2013, *A Water-Budget Model and Assessment for the Island of Hawaii.* U.S. Geological Survey Scientific Investigations Report 2011-5078.**
- **Fischer, W.A., Davis, D.A., Sousa, T.M., *Fresh –Water Springs of Hawaii from Infrared Images,* USGS Hydrologic Investigations, Atlas HA 218.**
- **Hunt, C., 2008, *Result of Sampling of Wastewater Tracers At and Near Kealakehe WWTP, Kona, Hawaii,* March 13, 2008, USGS/DOH Cooperative Program.**
- **R.M. Towill Corportion, 1989, *Keahole to Kailua Development Plan-Executive Summary Draft.* Planning Department, County of Hawaii.**
- **Stearns, H.T and MacDonald, G.A, 1942, *Geology and Ground-Water Resources of Hawaii,* Bulletin 9, Hawaii Division of Hydrography.**
- **Waimea Water Services, 1996, *Final Progress (March1996) Report on Effluent Discharge, Reuse and Quality,* Manuscript Report, Public Works Department, County of Hawaii.**

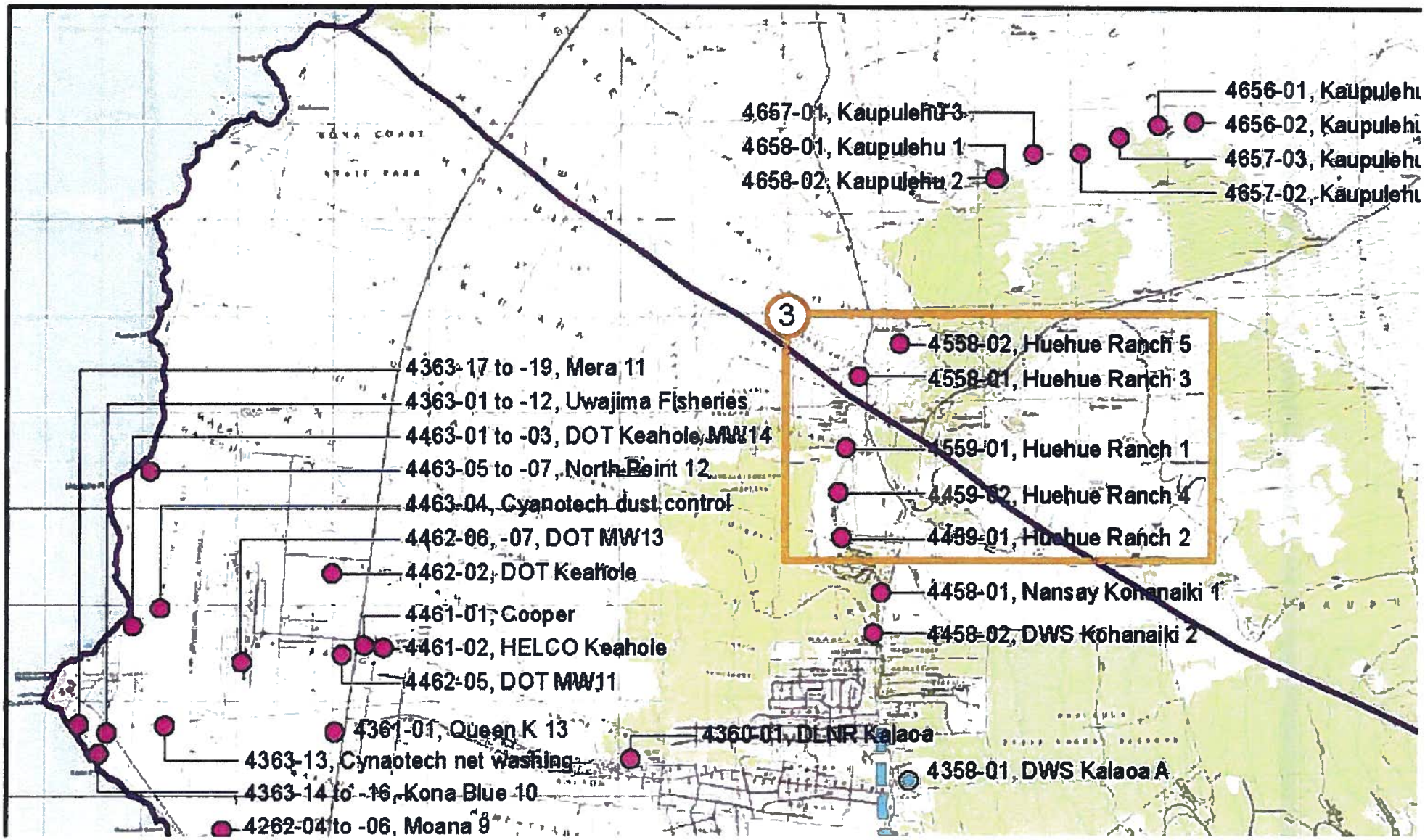
Appendix 1:

Huehue Well Field

1. Map of HR Wells 1-5

2. HR Wells 1-5 Water Chemistry Table

3. HR Wells Stress Test Report


4656-01, Kaupulehu
4656-02, Kaupulehu
4657-03, Kaupulehu
4657-02, Kaupulehu
4657-01, Kaupulehu 3
4658-01, Kaupulehu 1
4658-02, Kaupulehu 2
3
4558-02, Huehue Ranch 5
4558-01, Huehue Ranch 3
4559-01, Huehue Ranch 1
4459-02, Huehue Ranch 4
4459-01, Huehue Ranch 2
4458-01, Nansay Kohanaiki 1
4458-02, DWS Kohanaiki 2
4363-17 to -19, Mera 11
4363-01 to -12, Uwajima Fisheries
4463-01 to -03, DOT Keahole MW14
4463-05 to -07, North Point 12
4463-04, Cyanotech dust control
4462-06, -07, DOT MW13
4462-02, DOT Keahole
4461-01, Cooper
4461-02, HELCO Keahole
4462-05, DOT MW11
4361-01, Queen K 13
4360-01, DLNR Kalaoa
4363-13, Cynaotech net washing
4358-01, DWS Kalaoa A
4363-14 to -16, Kona Blue 10
4262-04 to -06, Moana 9

July, 2003

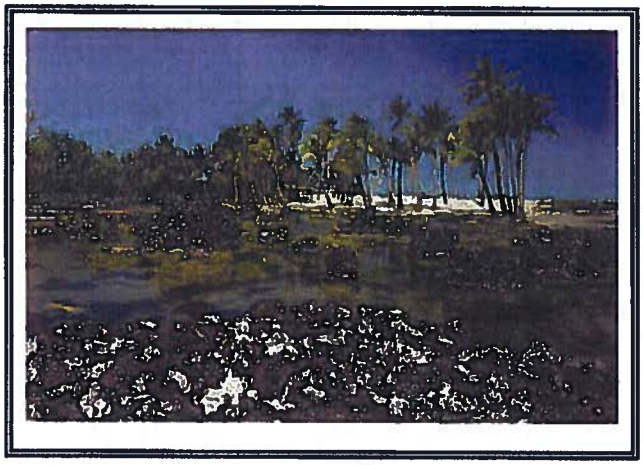
Kukio Resort - RO Plant at elevation 620 ft
Summary of Water Quality Data provided by IUS

Parameter	units	well 1	well 2	well 3	well 4	well 5	~~well 6~~
As	mg/L	<0.002	<0.002	<0.002	-	-	-
Ba	mg/L	<0.03	<0.1	<0.1	-	-	-
Cd	mg/L	<0.002	<0.005	<0.005	-	-	-
Cr	mg/L	<0.01	<0.01	<0.01	<0.01	-	-
Pb	mg/L	<0.02	0.030	0.030	-	-	-
Hg	mg/L	<0.0001	<0.0001	<0.0001	-	-	-
Se	mg/L	<0.002	<0.002	<0.002	-	-	-
Ag	mg/L	<0.005	<0.01	<0.01	-	-	-
F	mg/L	0.920	0.720		0.690	2.560	-
Nitrate N	mg/L	0.780	1.470	1.400	0.850	1.070	-
Turb	NTU	0.300	5.800	1.500	-	2.010	-
Mn	mg/L	0.020	0.050	0.040	-		-
Fe	mg/L	0.030	0.600	0.130	-		-
Na	mg/L	57.950	8.880	59.100	-		-
K	mg/L	12.170	12.400	6.740	27.500		-
Ca	mg/L	21.540	26.200	7.600	-		-
Mg	mg/L	79.300	74.900	76.500	-		-
Cl	mg/L	112.000	150.000	14.000	-		-
Sulfates	mg/L	95.000	53.800	266.000	-		-
sulfides	mg/L	0.040	0.050	0.200	-		-
TDS	mg/L	791.000	835.000	840.000	754.000		-
pH	pH units	8.030	8.000	8.100	8.400		-
Alk	mg/L CaCO3	395.000	359.000	318.000	423.000		-
Hard	mg/L CaCO4	401.000	385.000	334.000	466.000		-
silica	mg/L		90.300	64.000	84.000		-
conductivity			1220	967	1300		-

Huehue Ranch Well Field

Aquifer Stress Tests

November/December 2006



Prepared By:

waimea water services inc.

P.O. Box 326, Kamuela, HI 96743 Phone (808) 885-5941 Fax (808) 885-7851
e-mail waiono@wws-ius.com

February 2007

Summary Conclusions

The water quality (as measured by specific conductance, EC) of each well remained stable for each of the testing sequences. Although there were some trends of freshening showing in HR3, this data was found to be inaccurate when compared with the operator spot sampling taken (see Appendix A).

The test sequences of HR1-HR4, utilizing only the basal lens (HR 5 on standby), demonstrated the stability of water quality at production levels of 1.96 mgd and 2.3 mgd. Furthermore, water quality has generally remained constant in each well since pumping began in the early 1990's. The recent stress testing simply confirms this long-term observation.

It is reasonable to conclude that the HR well field is capable of sustaining a pumping rate of 2.5 mgd from the basal lens. This increase in the sustainable pumpage estimate from 1.96 to 2.5 mgd will be adequate to meet the needs of Kukio Resorts, as planned, including the additional demand of Maniniowale. Regardless, water conservation is needed to maintain adequacy.

Some improvement in instrumentation on HR3 is needed to insure accuracy of the records for long-term data collection. The SCADA system EC reporting should be confirmed with direct sampling periodically.

Background

The Huehue Ranch began its determination of groundwater resources in 1981, with a preliminary study by Island Resources. This survey was used to determine the location and feasibility of deep drilling to develop water in support of a 183-lot subdivision on mauka Huehue land.

An exploration well (HR1) was constructed at elevation 1565' in 1984-85. Initially, the well had a relatively low yield (150 gallons per minute) and produced a poor quality of water (765 milligrams per liter dissolved solids). This result indicated that a treatment plant would be needed to consider HR1 as a potable source. However, this venture proved the feasibility of developing basal groundwater as a supply for the proposed development.

Based upon this success, Huehue Ranch determined that it was also possible to develop its makai land near the shore at Kukio. In 1986, plans were made for a resort development at Kukio, assisted by water resource studies indicating brackish water could be developed to supply golf course irrigation. Water demands for the mauka and makai projects were estimated at 1.52 mgd (million gallons daily) for brackish irrigation and 1.96 mgd for the combined potable supply.

In 1988, HR1 was successfully deepened to increase its yield to 350 gpm. Following this improvement, the properties were sold, leading to a planned expansion of the HR well field beginning with HR2. Meanwhile, brackish water was developed makai via the construction of the KI wells 1-3 in 1990 and 1991. Upon completion of HR5, the properties were split, with the mauka land acquired by Makalei and the makai portion bought by Kukio Resorts, LLC. However, the financial collapse of Makalei's owner led to limited use of the HR well field, solely supplying a remaining golf course.

With the eventual purchase of the HR well field by Kukio Resorts, LLC., plans were laid to install a connecting pipeline down the mountain. The pipeline was to link the HR wells to a treatment plant providing potable water to the Kukio Resort. This strategy was formed to meet increased water demand, following the addition of the Maniniowale lands, which introduced a need above original potable estimate.

Recently, an additional potable supply of 0.5 mgd is needed. Kukio Resorts, LLC has continued to explore supply options to supply this increased demand. Kukio has debated the use of the concentrate reject water from the treatment plant to stretch the brackish irrigation supply. Increased pumping capacity of each HR well has been taken into serious consideration.

It has long been established that wells HR1-4 tap the basal lens, where fresh water floats on underlying salt water. This raises questions regarding the aquifer's long-term sustainable yield and its ability to maintain the quality of water produced from the basal lens. HR5's capabilities are considered individually, as it makes use of a separate resource, isolated from the salt water. It obtains water from within the rift zone of Hualalai volcano, where water is confined in dike compartments. Regardless, the quality

of each HR well has been altered by the hydrothermal activity within Hualalai, thus creating a necessity for softening to produce high quality drinking water.

In order to insure a long term adequacy of water supply, Kukio Resorts, LLC, decided to conduct a test of the HR well field under several different pumping combinations to explore the sensitivity of the basal aquifer to pumping stress.

Stress Testing: Basal and High Level Aquifers

The HR wells are spaced along a contour elevation of between 1550' and 1600' as shown in Figure 1. The wells HR2-HR5 have a nominal installed pump capacity of 570 gpm, each with slight differences in actual rate. These variances depend on depth of setting, pump condition, et cetera. Well HR1 has a nominal 350 gpm capacity due to a smaller diameter casing.

An initial round of stress testing involved HR1-HR4, to study the response of the basal aquifer. HR5, being in a dike-confined unit, was excluded. The basal wells were pumped concurrently for 16 hours each day, over a five-day period.

A second round of testing included the same wells, for an increased pump period (20 hours per day). This test was carried out to further stress the basal aquifer and to observe any degradation in water quality.

A final round of testing included wells HR1, 3, 4 and 5, each pumped for 20 hours per day for five days. HR2, being the southern most well, is closest to a nearby well on the lands of Kau. It was excluded to remove possible the influence by neighboring pumpage. This third test was performed not only to show an increase in the total yield by sustained pumping, but also to observe whether HR5 had a negative influence on nearby HR3.

The tests were monitored continuously for flow rate (GPM) and water quality as measured by specific conductance (EC) instrumentation. This monitoring was performed remotely via the newly completed SCADA (supervisory control and data acquisition) system. In addition, to insure accuracy of the recorded quality data, each well was checked via handheld conductivity instruments. It is noted that the starting EC SCADA value for each test shows a lag in excess of 150 minutes, before reaching a quality similar to the handheld instrument. This appears to be a consequence of the instrument installation, possibly due to air entrainment or temperature. This spurious lag has been ignored in the interpretation of results.

The testing was performed with a combination of wells for 16 and 20 hour days to simulate productions of 1.96 mgd and 2.36 mgd respectively. These numbers were not quite achieved to due slight differences in pump capacities. Also, the 16-hour test was intended to run 5 days, but was cut short due to an electric company power failure.

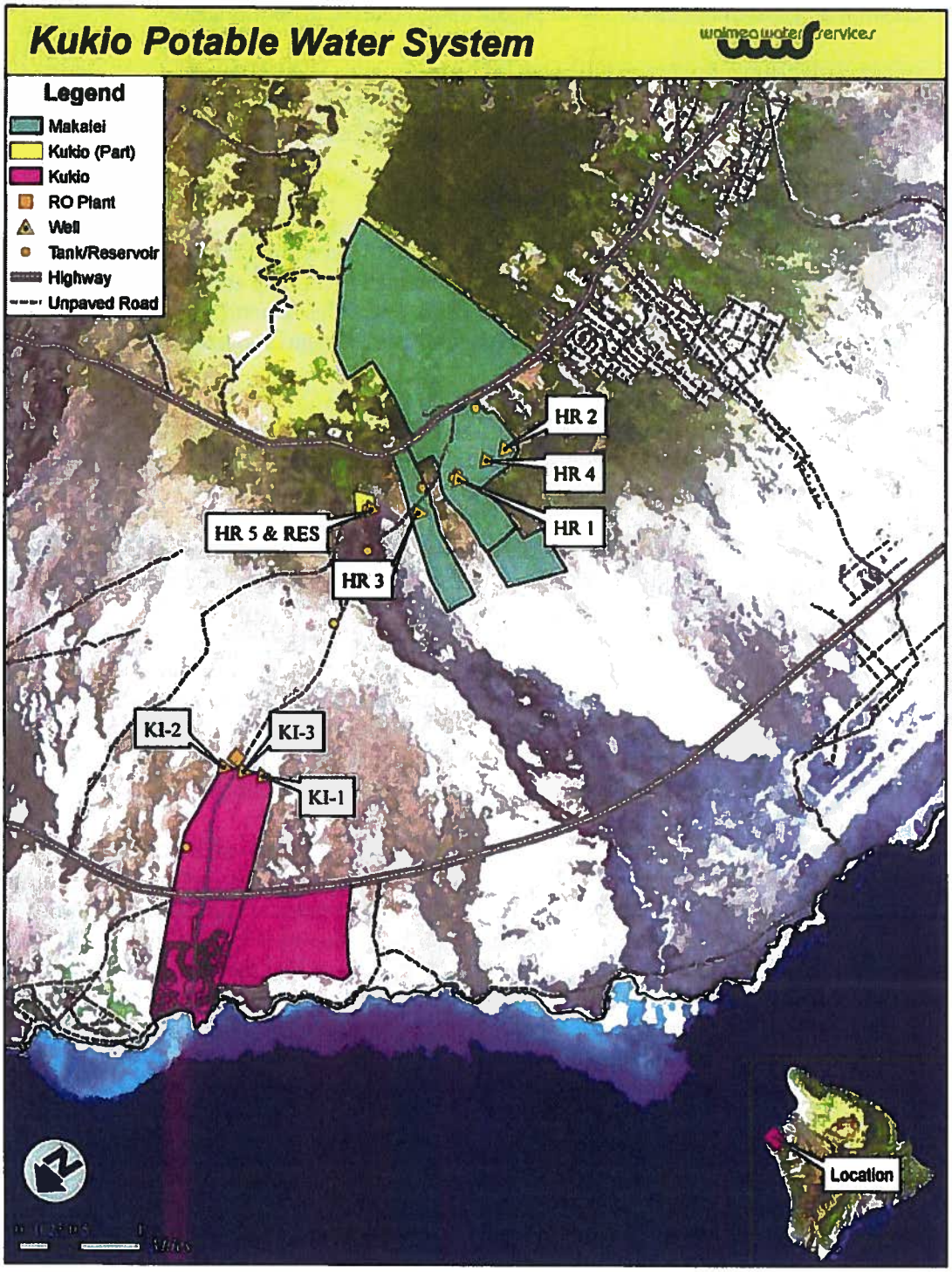


Figure 1. Well Layout for Kukio Potable System

Round 1: 16-hour test

The following figures display water quality for each well over the 5-day test period. The first graph shows the EC (conductance) in micro-mhos/cm (aka micro-siemens) by test day. The second graph shows pumping days superimposed in order to identify any changes in quality for the test period. The salinity of each well is expressed as total dissolved solids in mg/L and is calculated as 50% of the EC reading. Since the main purpose of the stress test was to identify any increases, the readings are not converted.

Data graphs are presented in order, from the southern to northern most basal wells.

List of Subsequent Figures

HR2 – Figures 2 & 3

As can be seen, there were no identifiable increases in salinity after 200 minutes of pumping for the duration of the test.

HR4 – Figures 4 & 5

Although the results show a baseline change in quality, the salinity reaches a steady value after 200 minutes.

HR1 – Figures 6 & 7

Here again, a baseline shift in quality is observed, with no real change after 200 minutes of pumping.

HR3 – Figures 8 & 9

Well water shows a progressive improvement and was the freshest well from the beginning. The data shows a 20 percent improvement in quality during the 5-day test. However, this result is believed to be an artifact of the SCADA instrumentation, as it contradicts the handheld operational data.

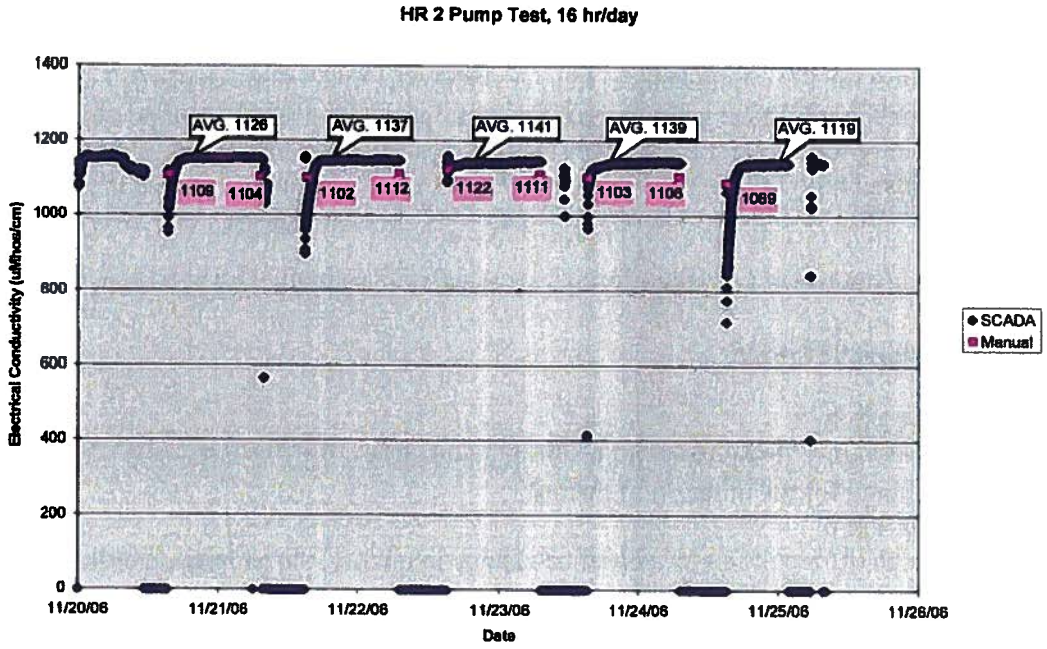


Figure 2. HR2 Conductivity vs. Pumping Day

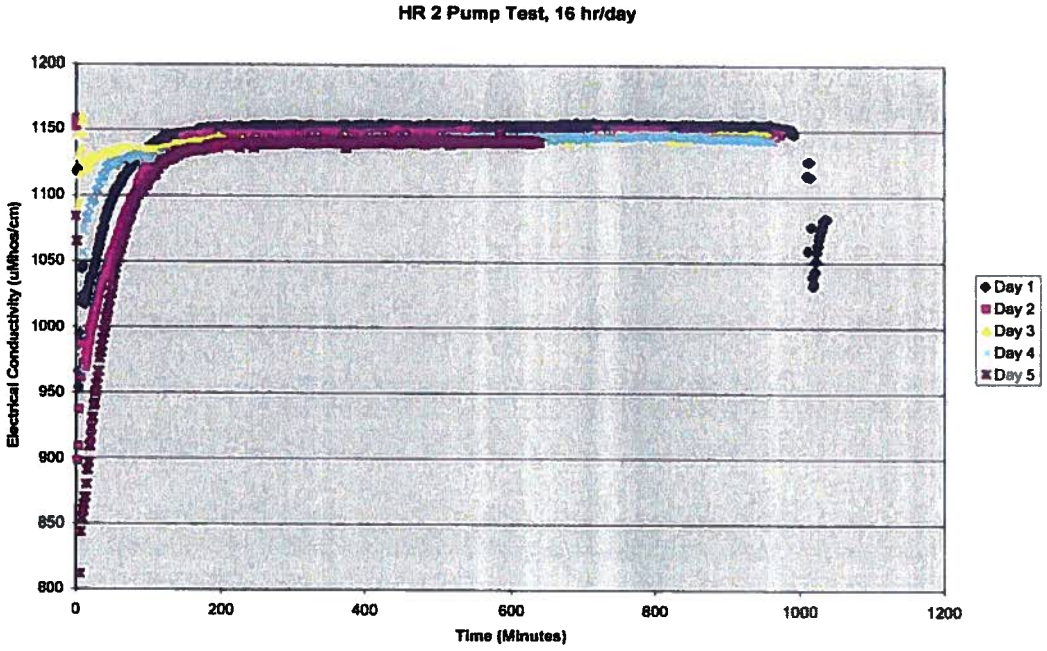


Figure 3. HR2 Conductivity vs. Pumping Time

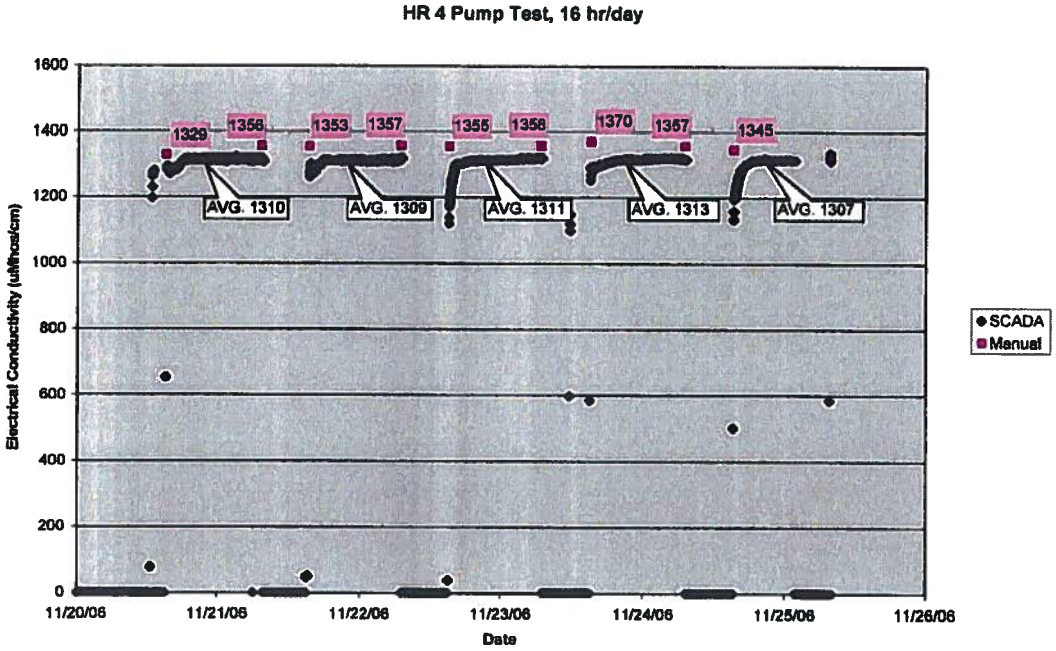


Figure 4. HR4 Conductivity vs. Pumping Day

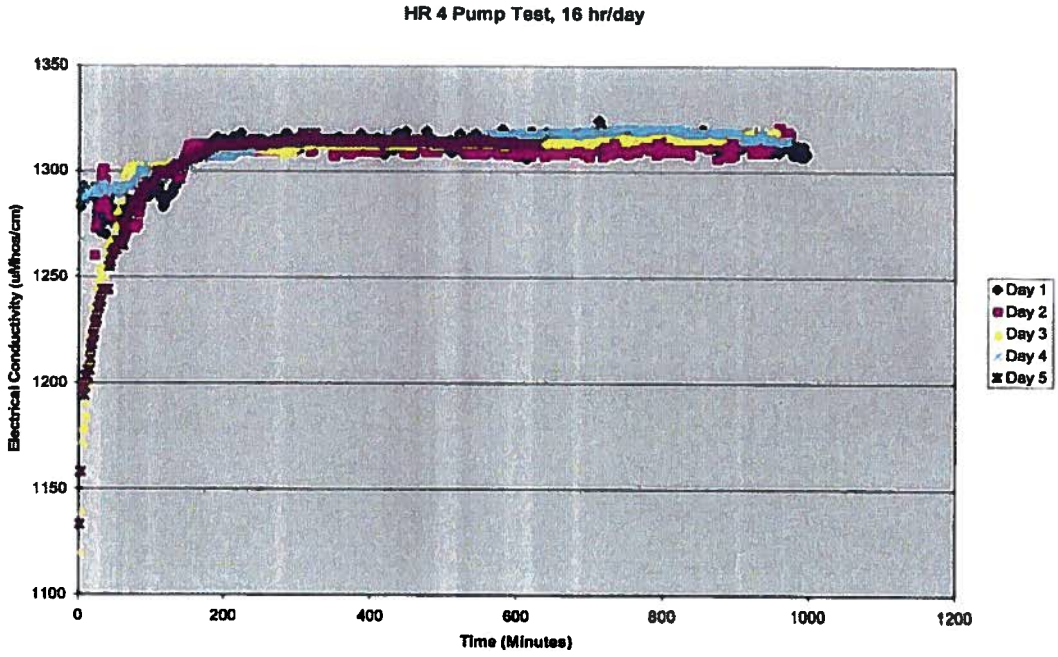


Figure 5. HR4 Conductivity vs. Pumping Time

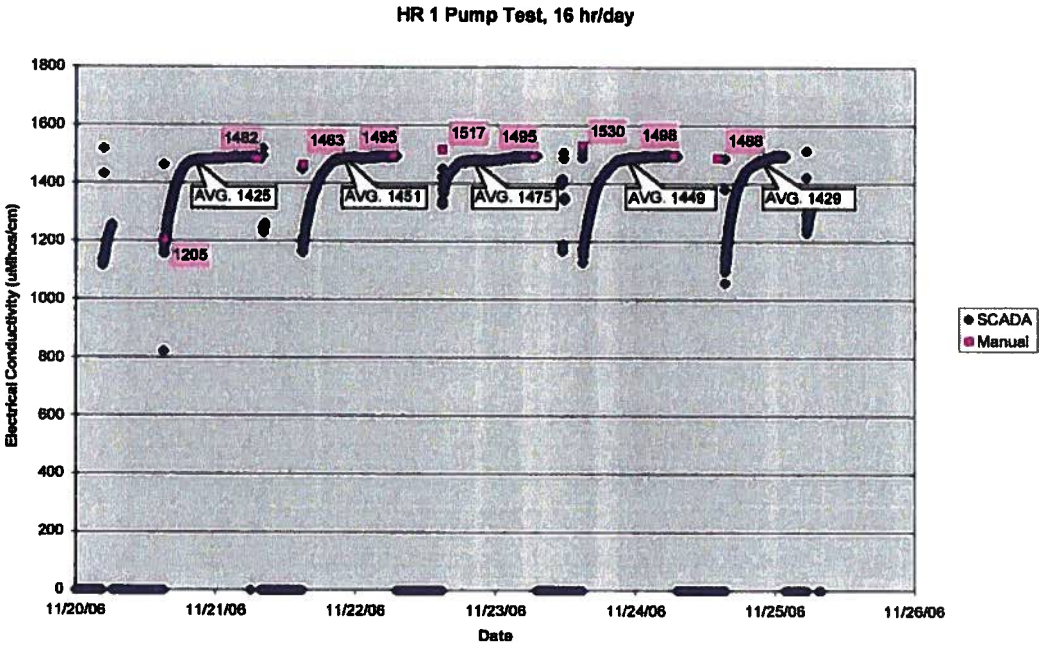


Figure 6. HR1 Conductivity vs. Pumping Day

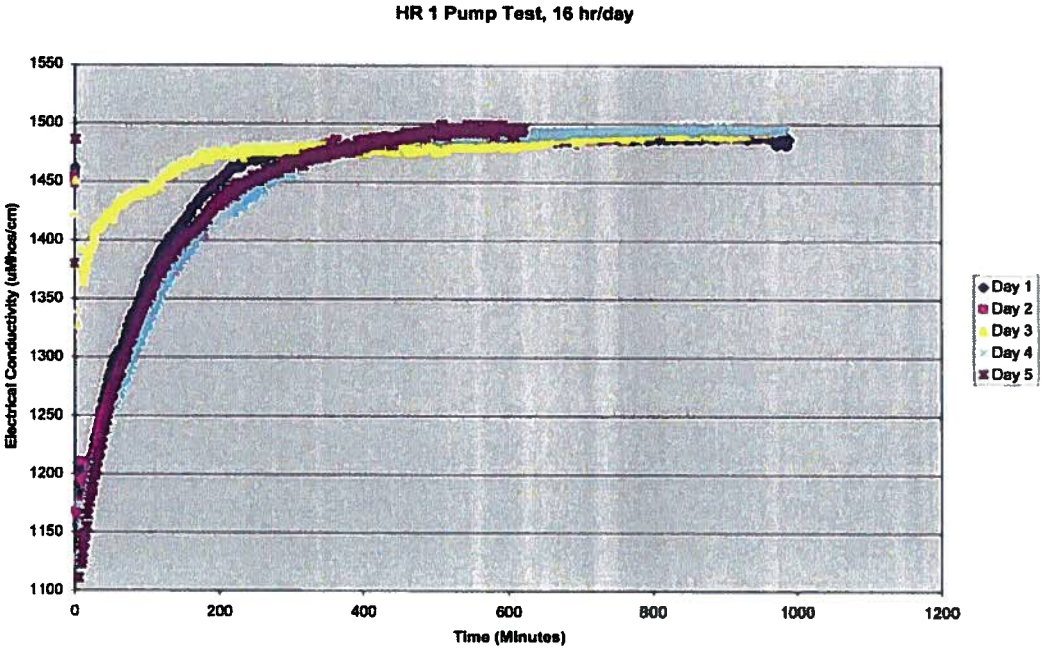


Figure 7. HR1 Conductivity vs. Pumping Time

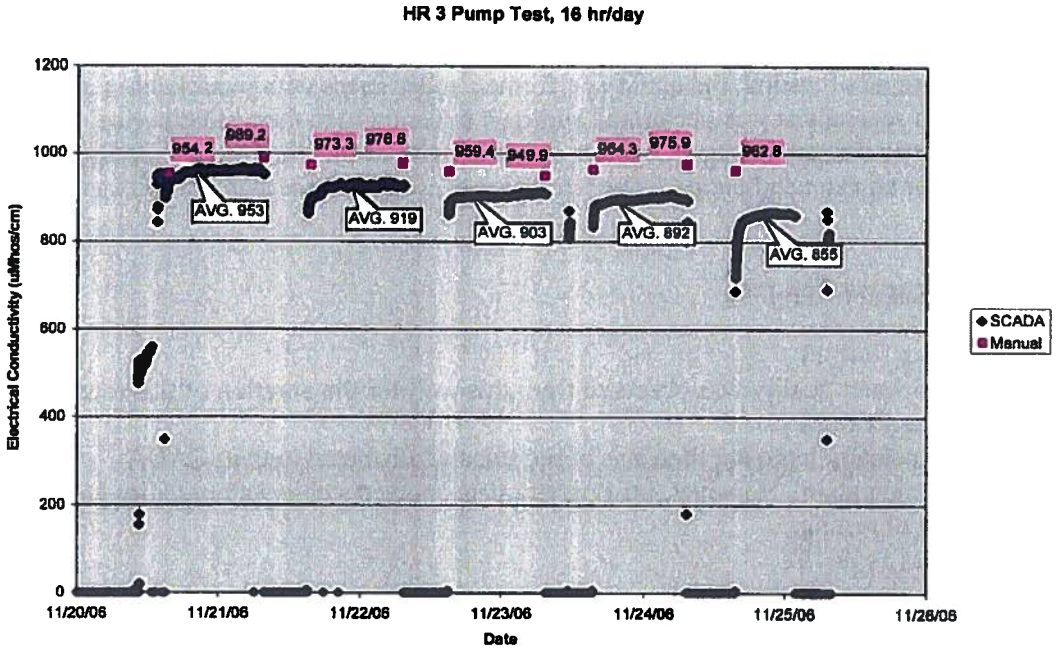


Figure 8. HR3 Conductivity vs. Pumping Day

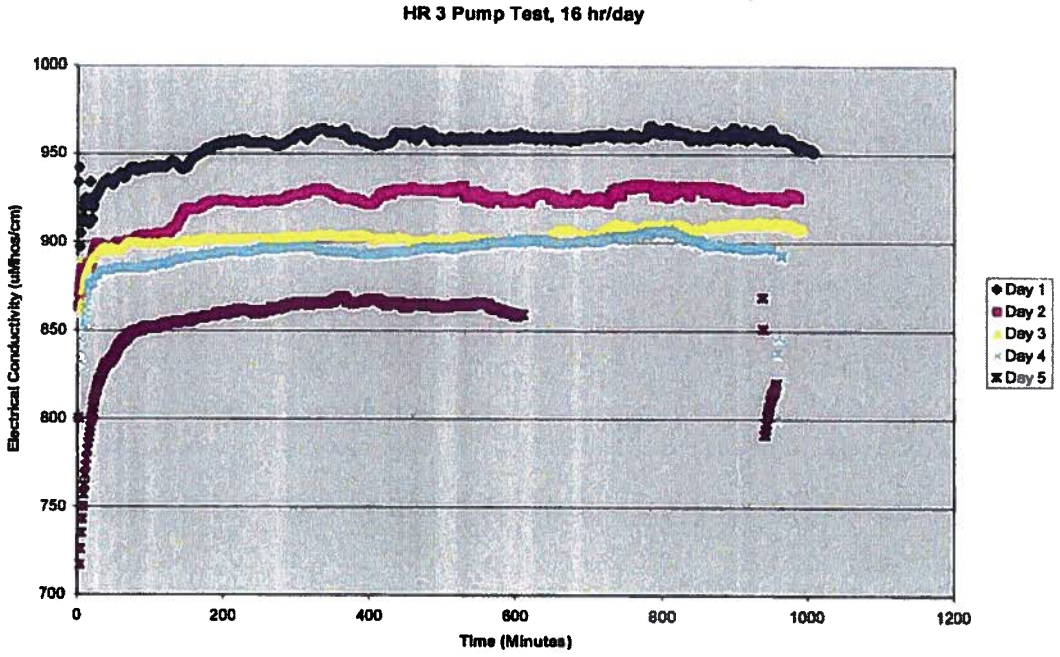


Figure 9. HR3 Conductivity vs. Pumping Time

Round 2: 20-hour test

For the first round of testing, the quality performed under stress with remarkable stability. In response, a second test was performed adding 4 hours daily to the testing period. This 20-hour test was designed to again explore the sensitivity of the basal lens, operating the same wells for an extended period. The results are presented in the same fashion as above.

List of Subsequent Figures

HR2 – Figures 10 & 11
Stable water quality was observed from this well for the duration of this round.

HR4 – Figures 12 & 13
An especially large lag time was observed, and attributed to the SCADA instrumentation. However, the operator data showed stable water quality for this round of testing.

HR1 – Figures 14 & 15
Water quality in the well appeared to decrease very slightly.

HR3 – Figures 16 & 17
Data collected from the SCADA system again shows freshening of the well water. This again is in contradiction to the handheld data, which showed a minute increase in water conductivity. The operator data is much more credible and is used in the final interpretation of results.

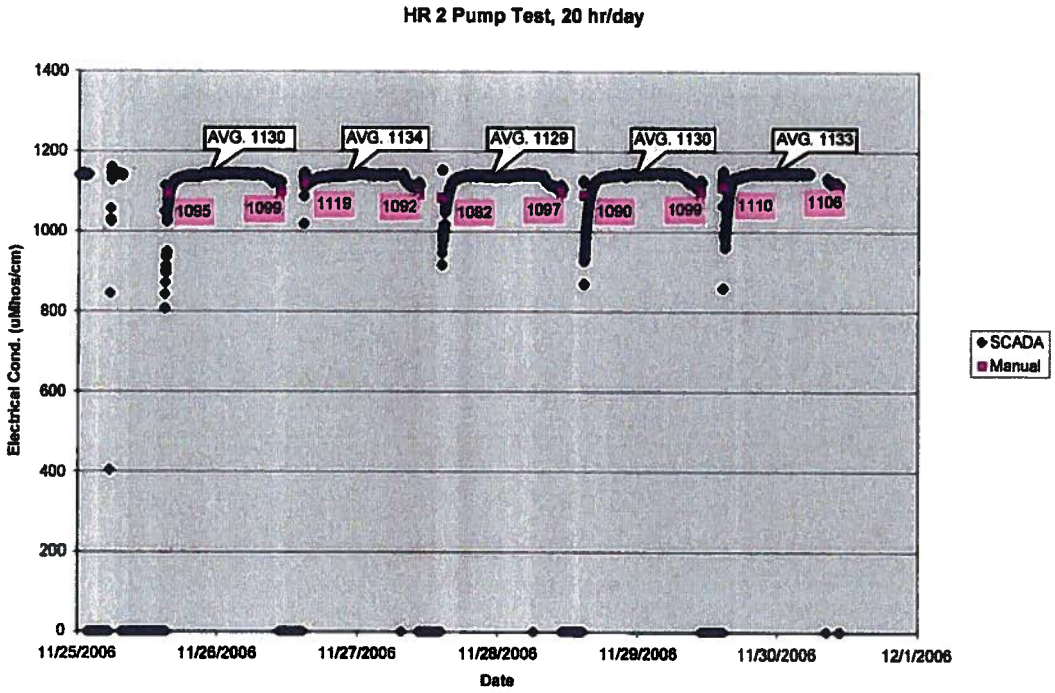


Figure 10. HR2 Conductivity vs. Pumping Day

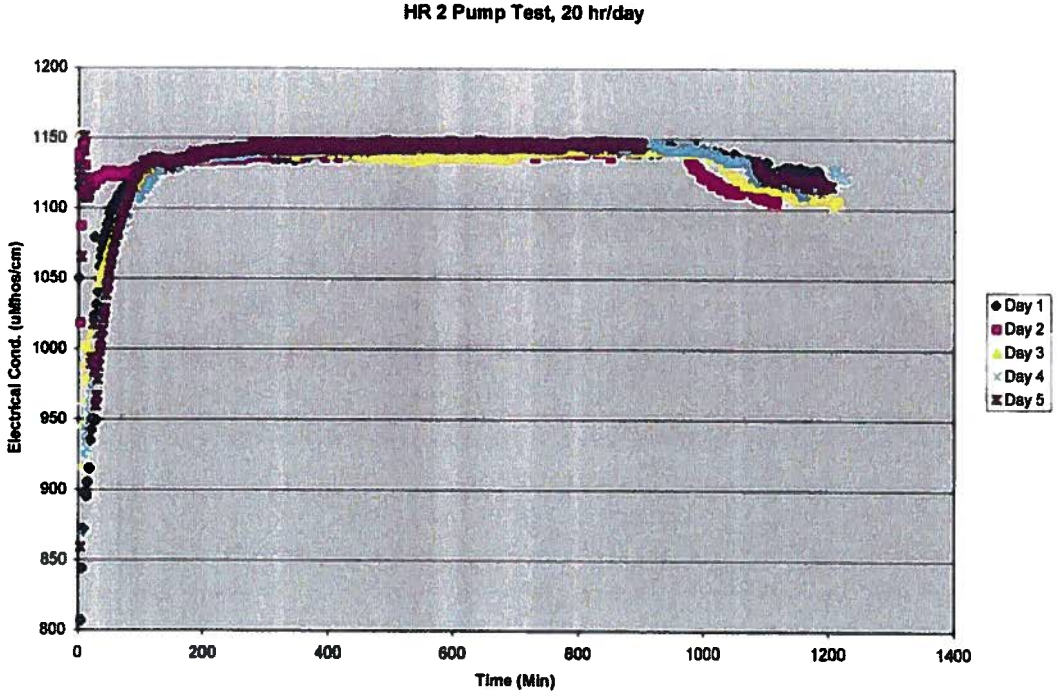


Figure 11. HR2 Conductivity vs. Pumping Time

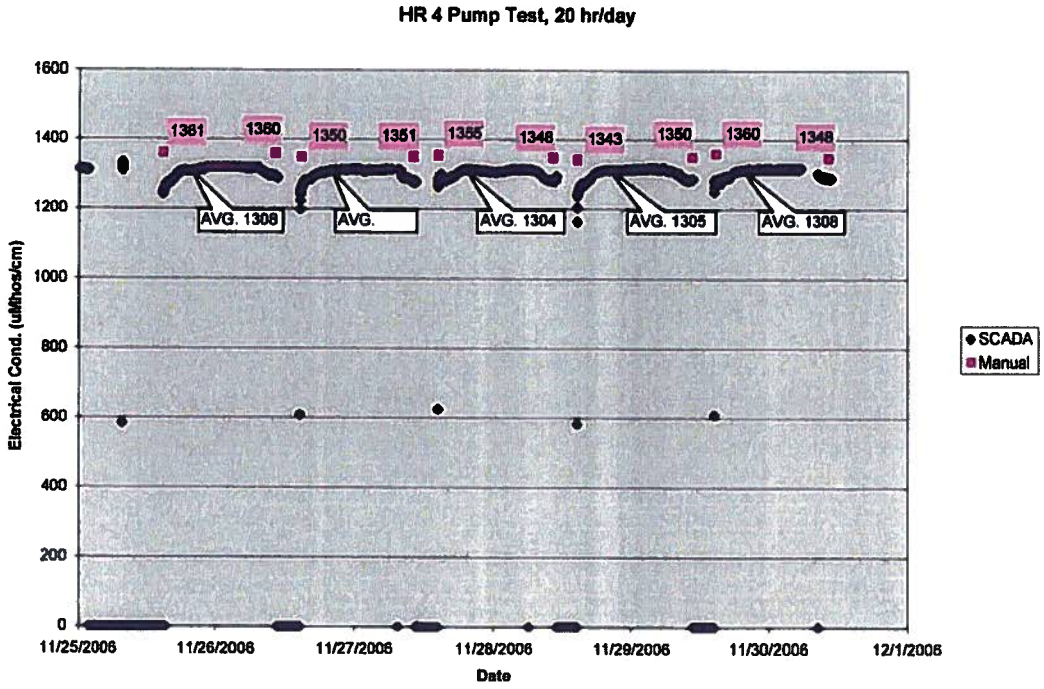


Figure 12. HR4 Conductivity vs. Pumping Day

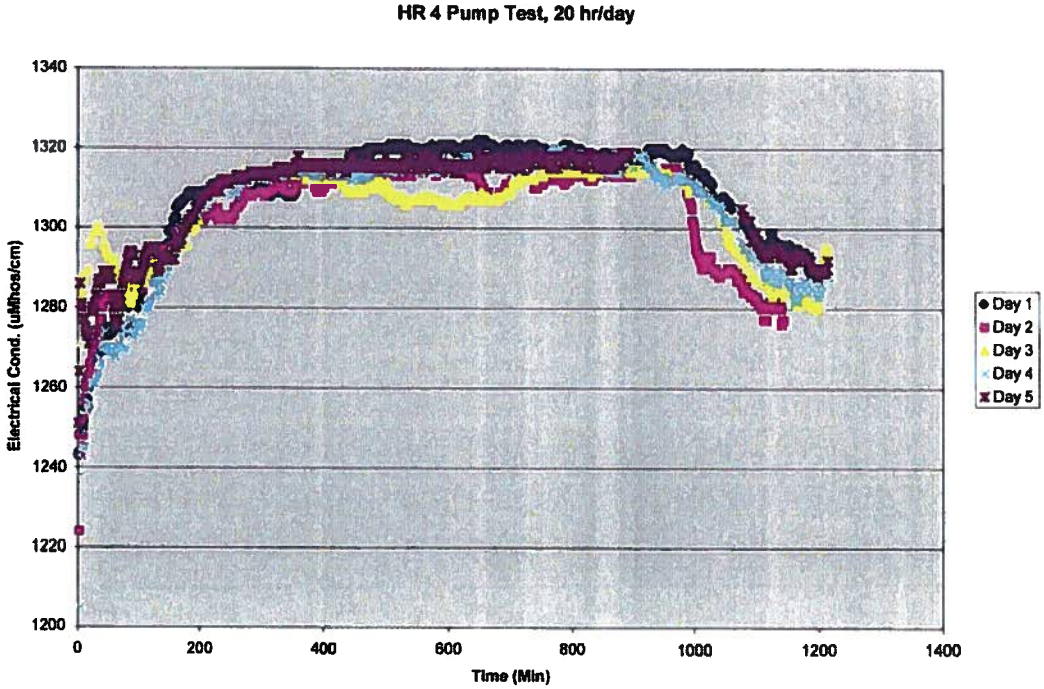


Figure 13. HR4 Conductivity vs. Pumping Time

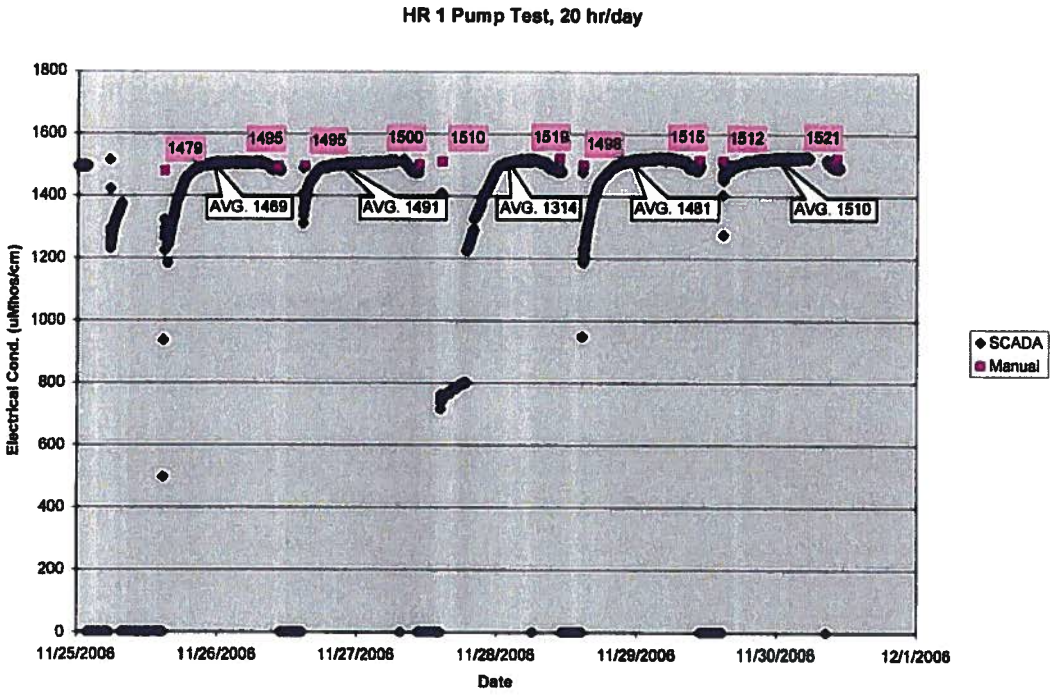


Figure 14. HR1 Conductivity vs. Pumping Day

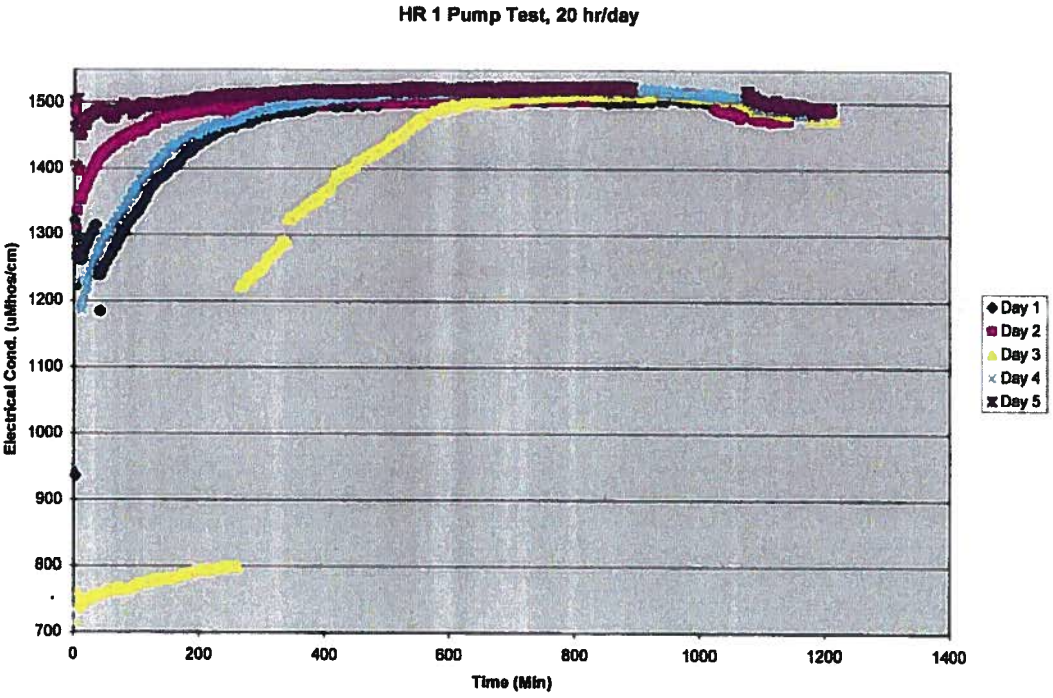


Figure 15. HR1 Conductivity vs. Pumping Time

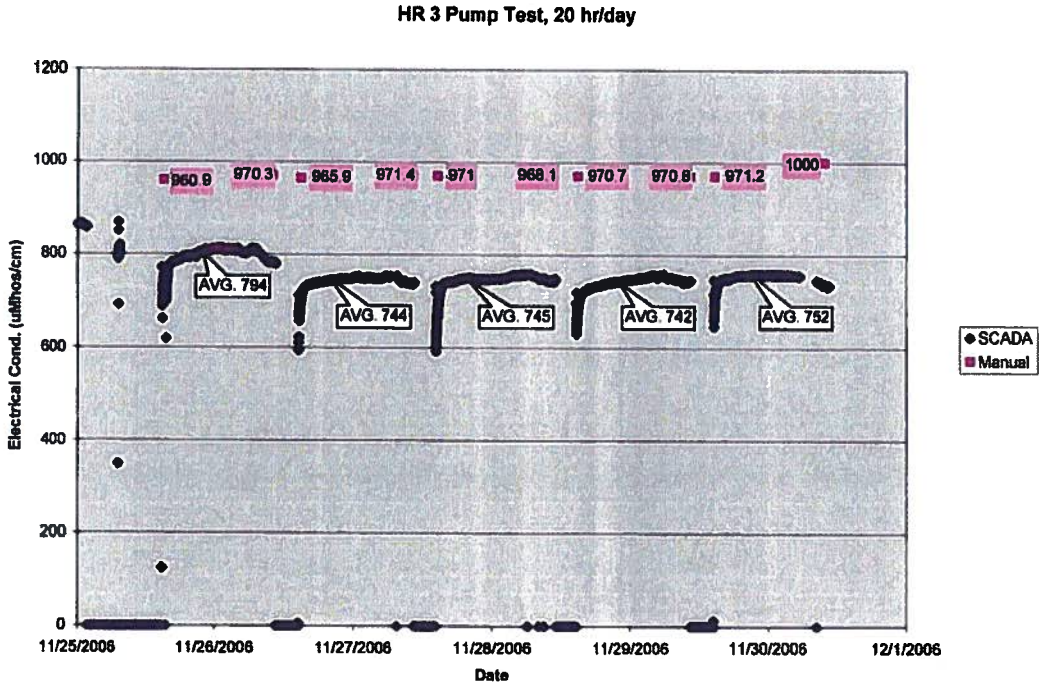


Figure 16. HR3 Conductivity vs. Pumping Day

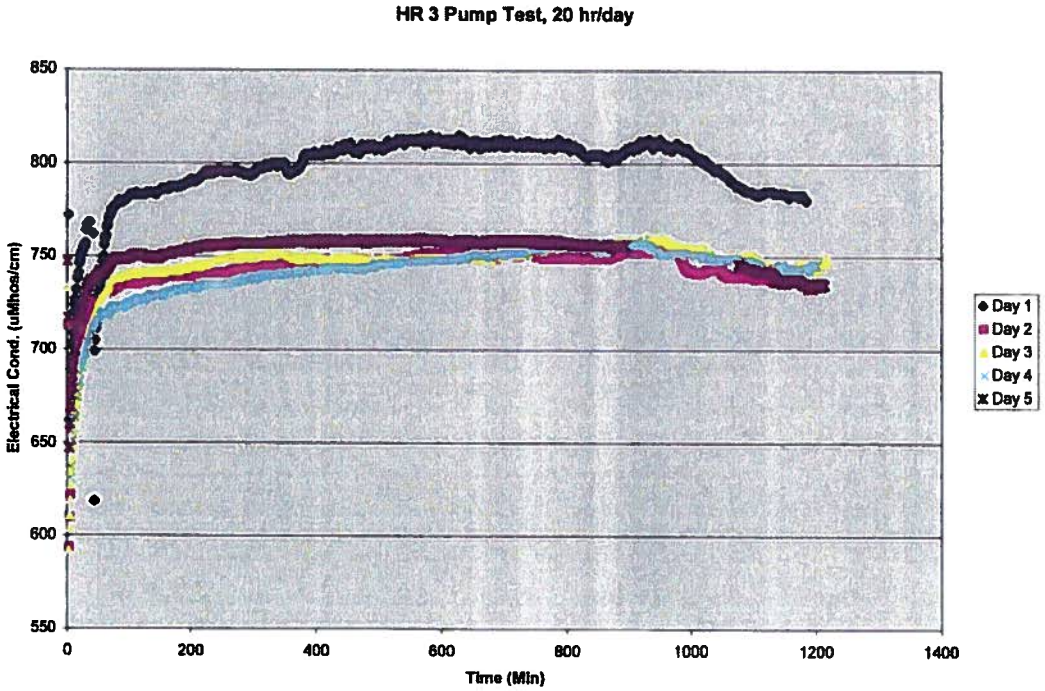


Figure 17. HR3 Conductivity vs. Pumping Time

Round 3: 20-hour test (Part 2)

For the final round of testing, HR5 was included. Here, the basal lens would continue to be tested, while further demonstrating the impact of pumping on water level of the HR5 compartment. These results were then compared to the performance of the water level in a basal well. The sequence again started with the southern most well, with HR2 now in standby mode. Note, under the standards of operation set forth by the state Department of Health, the reliable potable supply must be provided with the largest pumping unit on standby. In this case, any of the HR wells except HR1 can be considered as a standby unit.

Here again the test results are presented, first sequentially and then superimposed.

List of Subsequent Figures

HR4 – Figures 18 & 19

As seen with the 16-hour tests, the quality was stable after 200 minutes for each day of the test.

HR1 – Figures 20 & 21

HR1, both the deepest well and the lowest pumping capacity, remained stable for the test period. It repeated its performance from the first round, with an EC of slightly more than 1500 micro-mhos (TDS of 750 mg/L).

HR3 – Figures 22 & 23

HR3 continued to improve in quality, according to the SCADA system, despite the increased pumping period. Here again, the operator checks independent of the SCADA monitor showed no improvement in quality.

HR5 – Figures 24 & 25

HR5 has always produced some of the poorest quality, just slightly above that of HR1. The quality of the water produced remained stable, as expected, with poor quality related to the influence of the Hualalai rift zone.

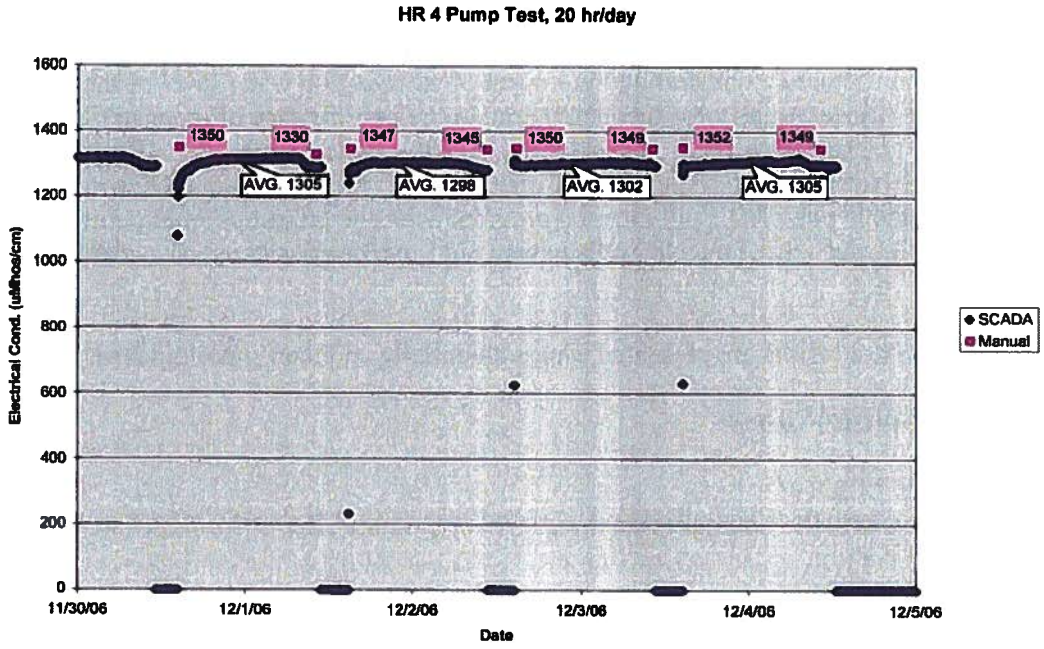


Figure 18. HR4 Conductivity vs. Pumping Day

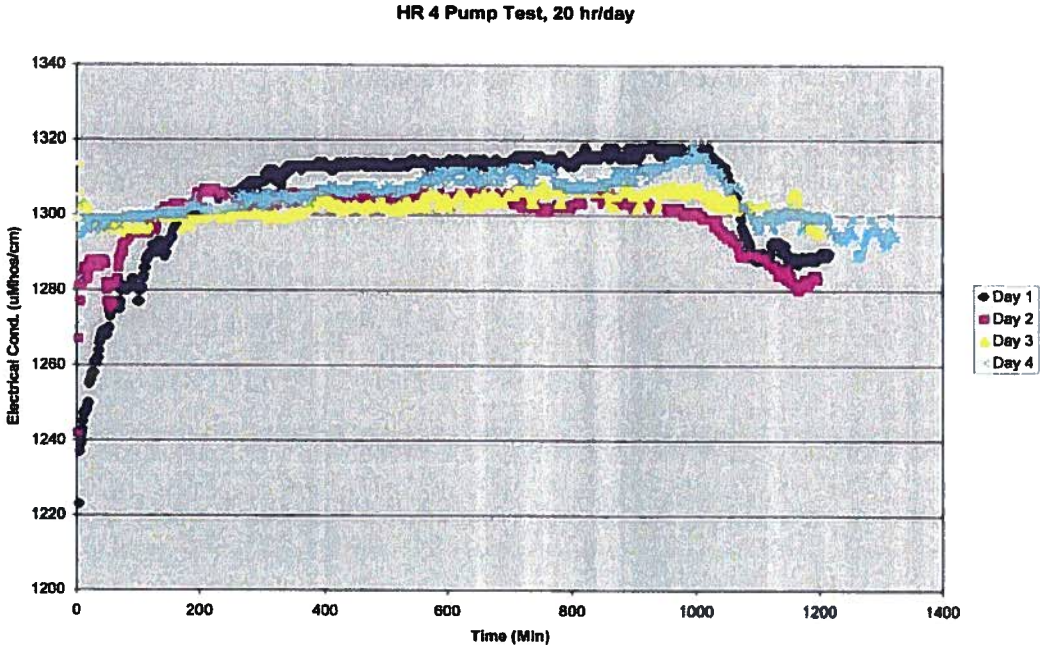


Figure 19. HR4 Conductivity vs. Pumping Time

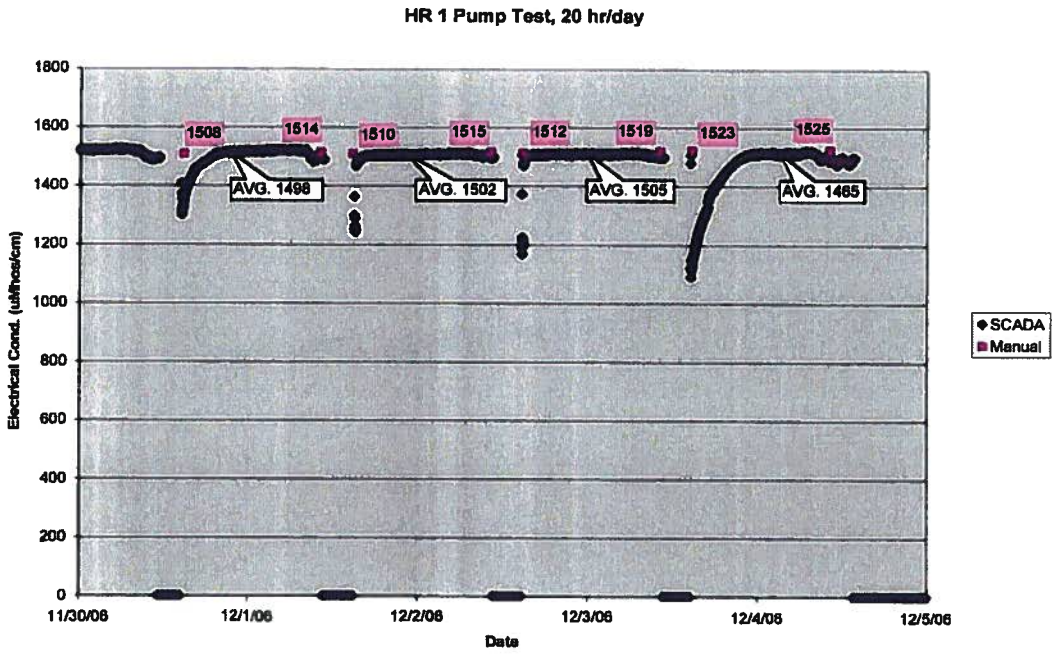


Figure 20. HR1 Conductivity vs. Pumping Day

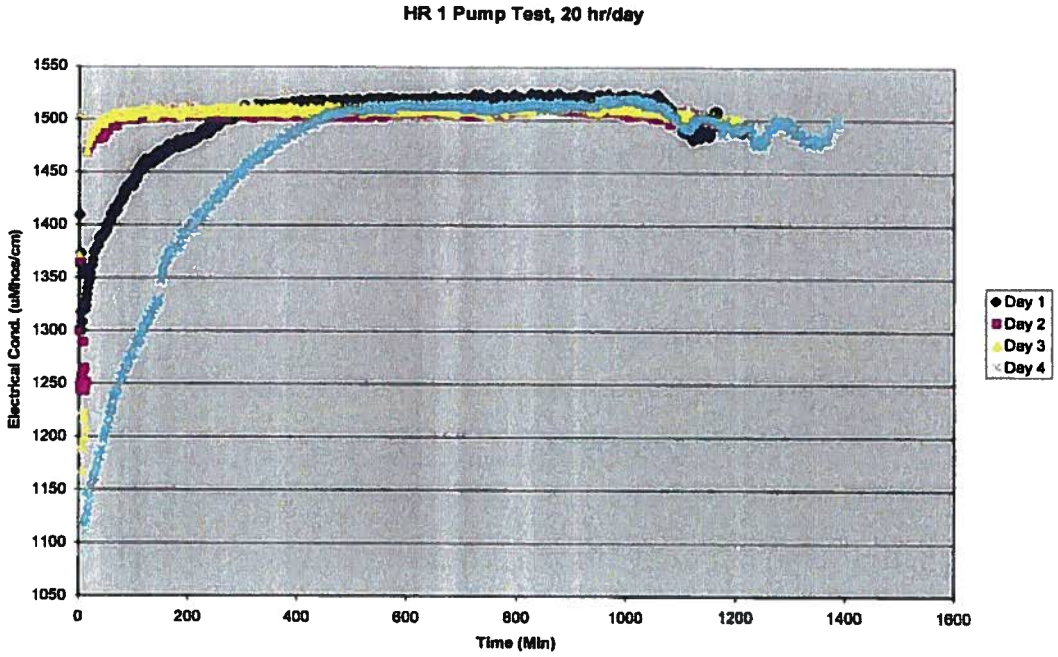


Figure 21. HR1 Conductivity vs. Pumping Time

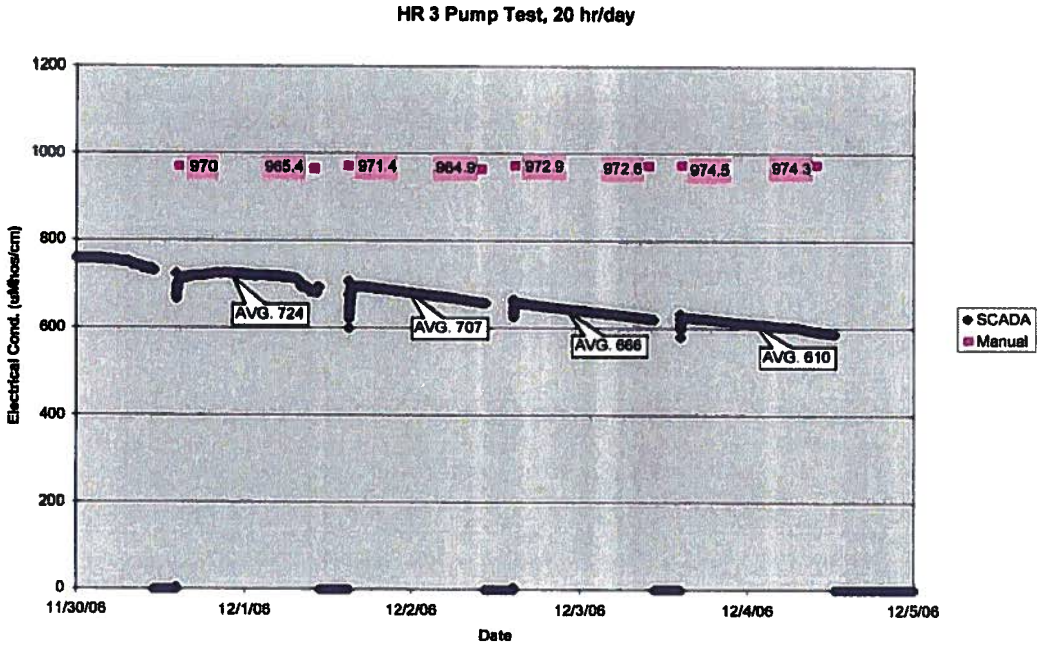


Figure 22. HR3 Conductivity vs. Pumping Day

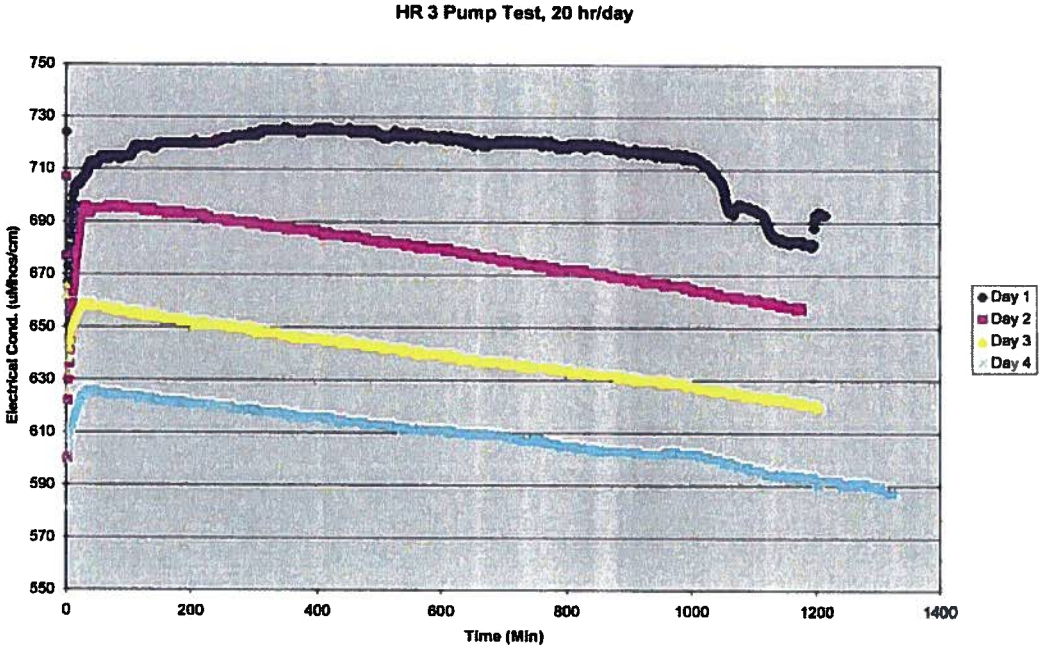


Figure 23. HR3 Conductivity vs. Pumping Time

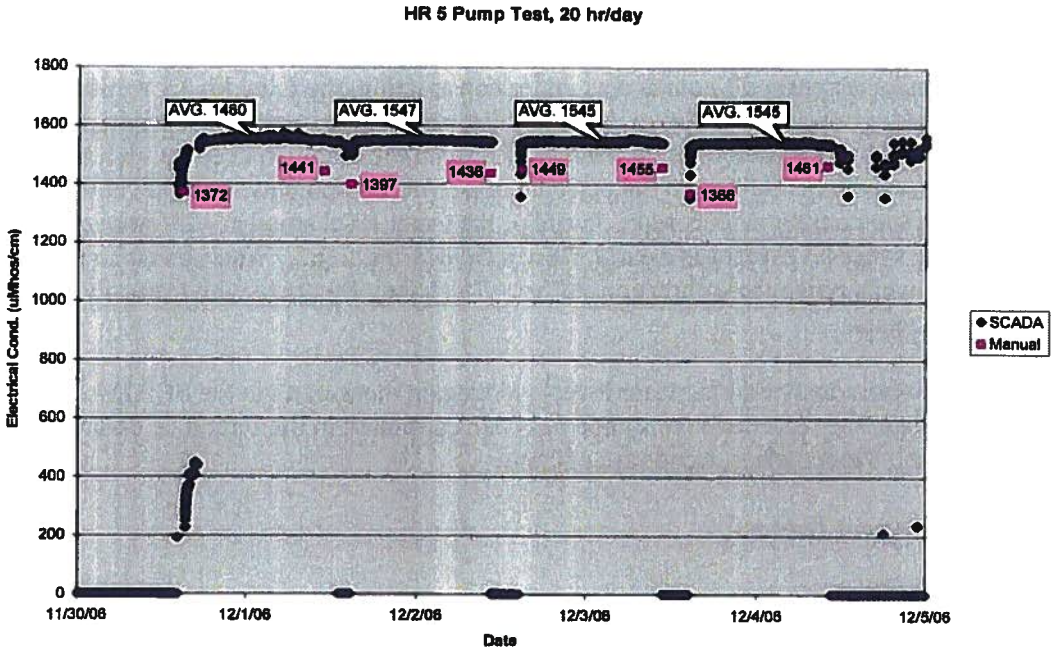


Figure 24. HR5 Conductivity vs. Pumping Day

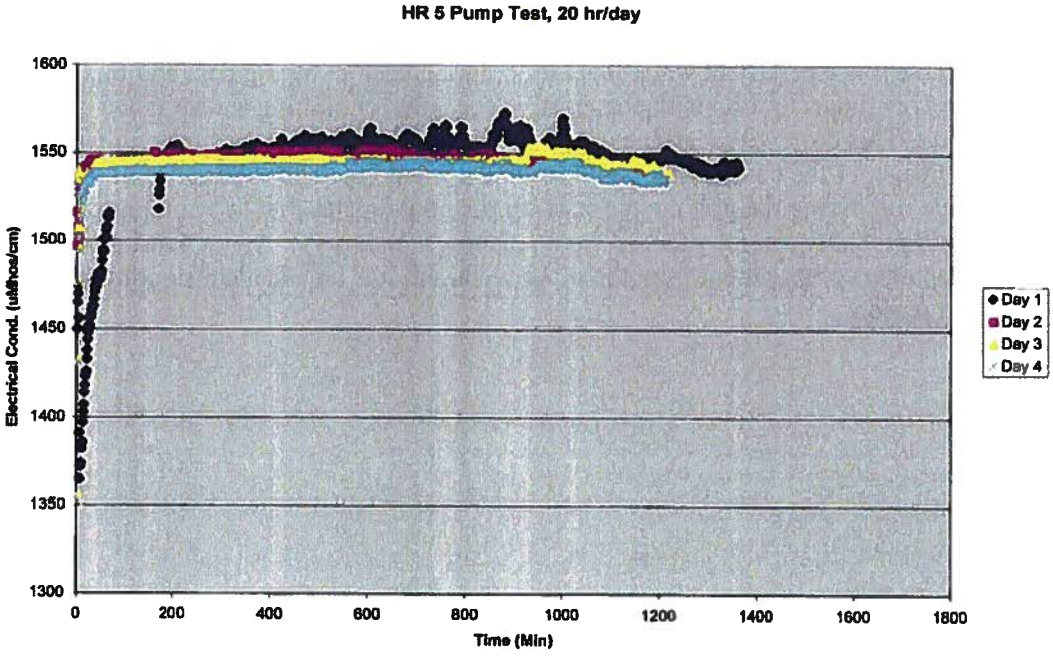


Figure 25. HR5 Conductivity vs. Pumping Time

Water level trends

When the mauka (upper) golf course was under construction, the brackish KI wells provided drinking water to the Kukio development. At the time, water for the initial irrigation was being supplied directly from HR5 around the clock, to keep up with the golf course grow-in. In addition to the periodic quality measurements, water level was monitored with a continuous recorder. Initially, the water level stood at +23' above sea level, and the water level records clearly show a dewatering trend. Water levels in the basal HR1-4 wells range from elevation +5' to + 7', as they fluctuate with time of year and between years.

During the 20-hour test periods, water levels were again measured via the SCADA system. To date, the recorded levels have not been calibrated to the reference datum of mean sea level. Nonetheless, trends are evident.

List of Subsequent Figures

HR4 – Figures 26 & 27

The water level change during the test period only reflects actual well drawdown at the start of each day, as the water level recovers immediately to its original level once the pump is stopped. This is typical performance for an unconfined basal lens.

HR5 – Figures 28 & 29

HR5 water levels behave quite differently as shown by the graphs below. Note that there is a persistent water level drop during each pumping day, and that the level continues to drop with consecutive each day, exhibiting a clear dewatering effect. This drop will continue unless the recharge to the compartment equals the pumpage, or the compartment will resume dewatering. The experience of the cycle run during the golf course start-up period indicates that this compartment could probably run for years without reaching a boundary. Again, HR5 penetrates a separate compartment from the other wells and it is an excellent standby unit for that reason.

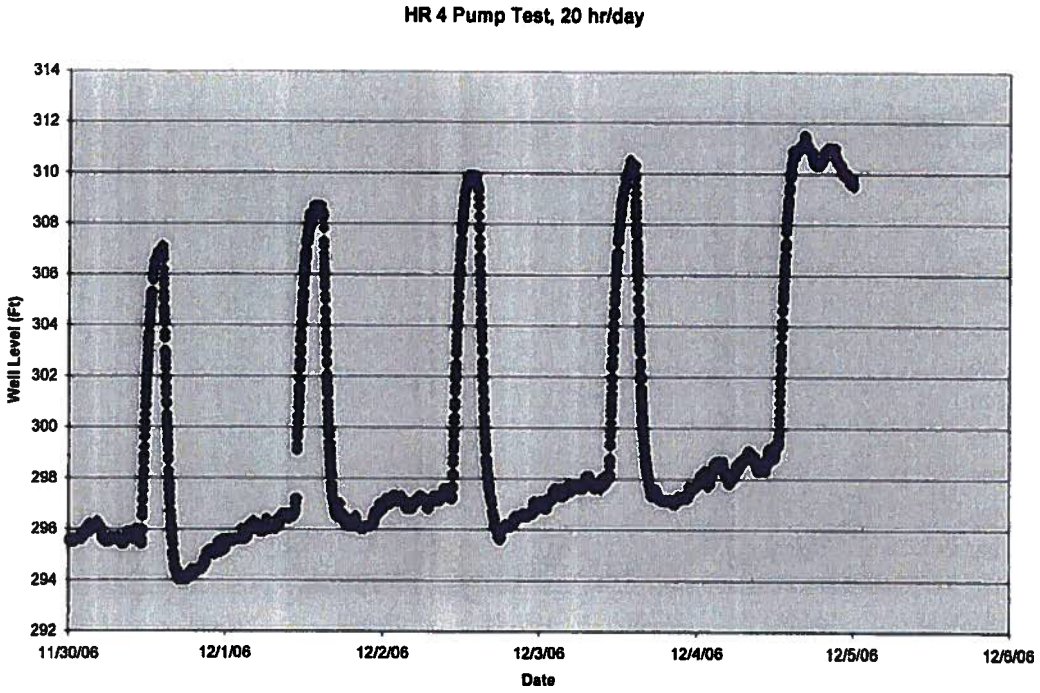


Figure 26. HR4 Water Level vs. Pumping Day

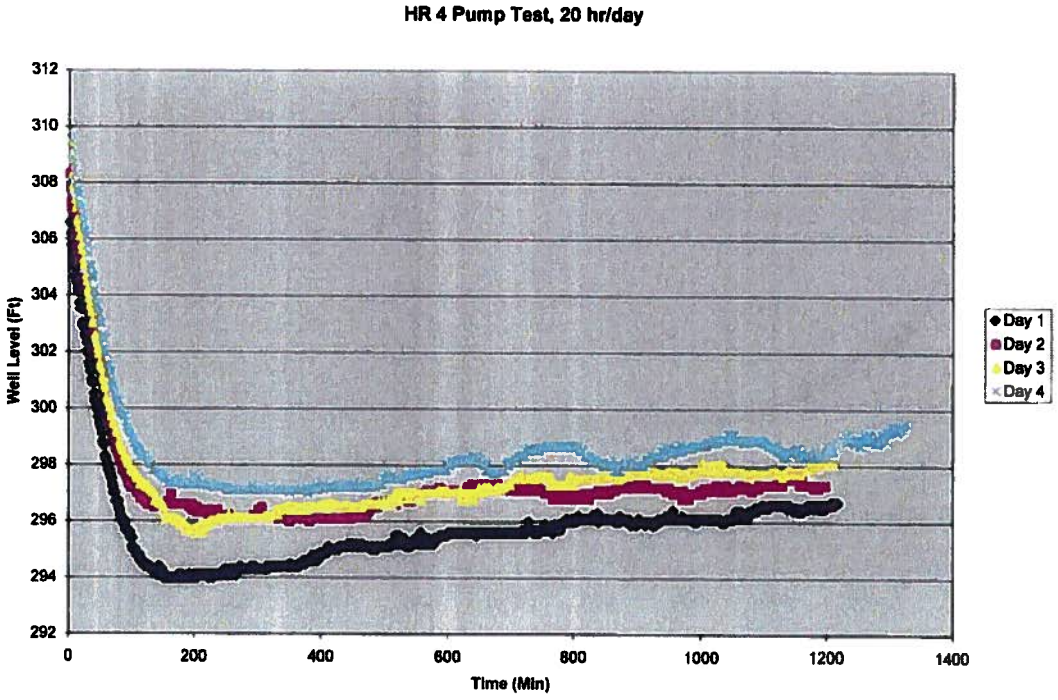


Figure 27. HR4 Water Level vs. Pumping Time

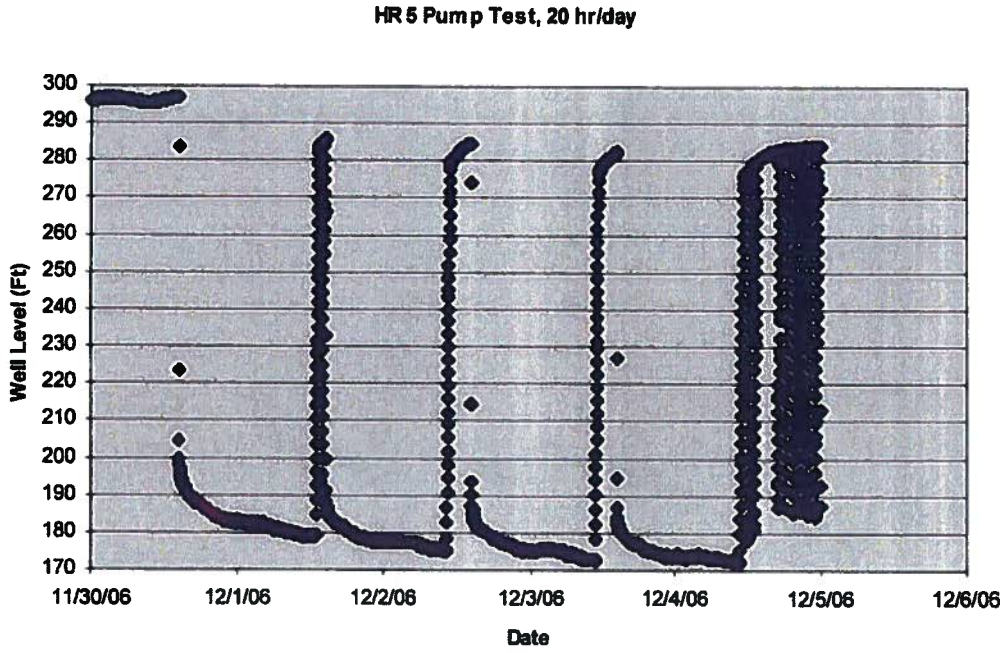


Figure 28. HR5 Water Level vs. Pumping Day

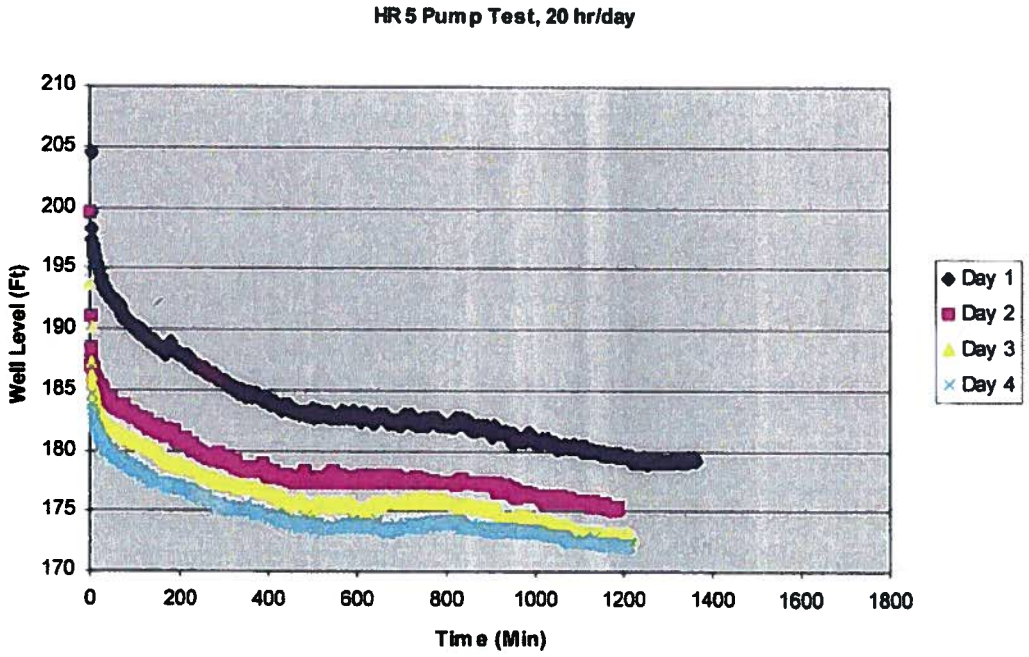


Figure 29. HR5 Water Level vs. Pumping Time

Appendix A: Operations Water Quality Data

HR#3										
	Date	**Time**	**Meter**	**EC**	**Level**	**Handheld EC**	**Handheld TDS**	**GPM**	**Run Hours**	**REMARKS**
Start	11/25/2006	3:15pm	67058300	0.77	10.2	960.9	668.7	590		leak in level line
Stop	11/26/2006	10:08am	67715200	0.78	10.2	970.3	673.3	590	20	
Start	11/26/2006	2:57pm	67746800	0.71	10.5	965.9	670.4	590		leak in level line
Stop	11/27/2006	10:30am	68435900	0.74	10.2	971.4	674.3	590	20	
Start	11/27/2006	2:45pm	68469000	0.69	10.5	971	673.8	590		leak in level line
Stop	11/28/2006	10:45am	69188500	0.75	10.2	968.1	669.6	590	20	
Start	11/28/2006	2:51pm	69201600	0.68	10.2	970.7	670.5	590		leak in level line
Stop	11/29/2006	10:35am	69901100	0.75	10.3	970.8	673.7	590	20	
Start	11/29/2006	2:49pm	69907600	0.71	10.3	971.2	673.5	590		leak in level line
Stop	11/30/2006	10:00am	70589300	0.75	10.2	1000	695.3	590	20	
Start	11/30/2006	2:49pm	70648100	0.7	10.4	970	677.4	590		leak in level line
Stop	12/1/2006	10:00am	71348000	0.69	10.3	965.4	669.7	590	20	
Start	12/1/2006	2:49pm	71372300	0.68	10.2	971.4	674.9	590		leak in level line
Stop	12/2/2006	10:00am	72049200	0.66	10.6	964.9	669.3	590	20	
Start	12/2/2006	2:49pm	72056400	0.65	10.7	972.9	675.4	590		leak in level line
Stop	12/3/2006	10:00am	7276220	0.62	10.6	972.6	674.6	590	20	
Start	12/3/2006	2:49pm	72781200	0.62	10.7	974.5	676.3	590		leak in level line
Stop	12/406	10:00am	73465100	0.59	10.6	974.3	676.3	590	20	

Appendix A (Cont'd): Operations Water Quality Data

HR#4										
	Date	**Time**	**Meter**	**EC**	**Level**	**Handheld EC**	**Handheld TDS**	**GPM**	**Run Hours**	**REMARKS**
Start	11/25/2006	3:00pm	59664500	1.25	296.6	1361	958.6	595		
Stop	11/26/2006	10:24pm	60350500	1.28	291.9	1360	959.9	595	20	
Start	11/26/2006	2.44pm	60367600	1.25	300	1350	951.2	595		
Stop	11/27/2006	10:15am	61062900	1.27	232.2	1351	951.4	595	20	
Start	11/27/2006	2.29pm	61079500	1.28	301.8	1355	954.9	595		
Stop	11/28/2006	10:30am	61800800	1.77	293.3	1348	949.6	595	20	
Start	11/28/2006	2.41pm	61814700	1.24	304.3	1343	948.4	595		
Stop	11/29/2006	10:47am	62530400	1.28	294	1350	951.6	595	20	
Start	11/29/2006	2.56pm	62534300	1.28	305.4	1360	958.9	595		
Stop	11/30/2006	10:20am	63237600	1.28	295.5	1348	949.5	595	20	
Start	11/30/2006	2.34pm	63273500	1.24	304.3	1350	950.7	595		
Stop	12/1/2006	10.00am	63967400	1.28	296.2	1330	937.7	595		
Start	12/1/2006	3.00pm	64001100	1.28	304.3	1347	949.8	595		
Stop	12/2/2006	10.37am	64703100	1.28	297	1345	947.5	595		
Start	12/2/2006	2.50pm	64716800	1.29	305	1350	951.8	595		
Stop	12/3/2006	10.18am	65414300	1.29	297.8	1349	950.5	595		
Start	12/3/2006	2.36am	65432300	1.29	308.3	1352	952.7	595		
Stop	12/4/2006	10.24am	66141000	1.29	298.1	1349	950.5	595		

Appendix A (Cont'd): Operations Water Quality Data

HR#1										
	Date	Time	Meter	EC	Level	Handheld EC	Handheld TDS	GPM	RUN HOURS	REMARKS
Start	11/25/2006	2:50pm	85280700	1.28	213	1479	1047	310		
Stop	11/26/2006	10:17am	85644600	1.48	208.8	1495	1061	310	20	
Start	11/26/2006	2:51pm	85657300	1.37	212.4	1495	1058	310		
Stop	11/27/2006	10:36am	86021800	1.47	208.5	1500	1063	310	20	
Start	11/27/2006	2:34pm	86030600	0.75	212.1	1510	1072	310		
Stop	11/28/2006	10:39am	86412400	1.48	208.9	1519	1080	310	20	
Start	11/28/2006	2:46pm	86922800	1.19	212.6	1498	1061	310		
Stop	11/29/2006	10:40am	86798800	1.49	208.9	1515	1075	310	20	
Start	11/29/2006	2:40pm	86803200	1.4	213.1	1512	1070	310		
Stop	11/30/2006	10:10am	87170400	1.49	208.9	1521	1080	310	20	
Start	11/30/2006	2:40pm	87193000	1.34	212.2	1508	1070	310		
Stop	12/1/2006	10:10am	87561600	1.49	208.4	1514	1074	310	20	
Start	12/1/2006	2:40pm	87574700	1.46	212.2	1510	1070	310		
Stop	12/2/2006	10:10am	87942700	1.49	208.1	1515	1075	310	20	
Start	12/2/2006	2:40pm	87947300	1.47	211.7	1512	1074	310		
Stop	12/3/2006	10:10am	88319400	1.49	208	1519	1079	310	20	
Start	12/3/2006	2:40pm	88333400	1.17	211.3	1523	1082	310		
Stop	12/4/2006	10:10am	88699900	1.49	208.4	1525	1083	310	20	

Appendix A (Cont'd): Operations Water Quality Data

HR#2										
	Date	Time	Meter	EC	Level	Handheld EC	Handheld TDS	GPM	RUN HOURS	REMARKS
Start	11/25/2006	3:15pm	86565300	0.95	134.2	1095	762.8	560		
Stop	11/26/2006	10:35am	87217800	1.11	130.6	1099	767.6	560	20	
Start	11/26/2006	2:37pm	87223400	1.13	144.3	1119	779.9	560		
Stop	11/27/2006	10:22am	87887700	1.13	129.8	1092	763.1	560	20	
Start	11/27/2006	2:22pm	87895500	0.91	167.8	1082	755	560		
Stop	11/28/2006	10:45am	88574600	1.1	130.4	1097	765.6	560	20	
Start	11/28/2006	2:35pm	88588200	0.85	159.3	1090	757.9	560		
Stop	11/29/2006	10:47pm	89273000	1.11	129.9	1099	768.3	560	20	
Start	11/29/2006	2:30am	89277500	1.1	149.9	1110	777.7	560		
Stop	11/30/2006	10:25pm	89944100	1.1	130.8	1106	772.7	560	20	

HR#5										
	Date	Time	Meter	EC	Level	Handheld EC	Handheld TDS	GPM	Run Hours	REMARKS
Start	11/30/2006	3.00pm	257425000	1.33	195.3	1372	965.6	610		
Stop	12/1/2006	10.50am	258179000	1.42	183.4	1441	1017	610	20	
Start	12/1/2006	2.40pm	258282000	1.38	195.7	1397	1003	610		
Stop	12/2/2006	10.20am		1.42	179.7	1436	1015	610	20	
Start	12/2/2006	2.45pm	259818000	1.41	185.2	1449	1024	610		
Stop	12/3/2006	10.37am	259837000	1.41	178	1455	1030	610	20	
Start	12/3/2006	2.31pm	259045000	1.23	189.6	1366	960.2	610		
Stop	12/4/2006	10.04am	260580000	1.41	177.2	1461	1034	610	20	

Appendix 2:

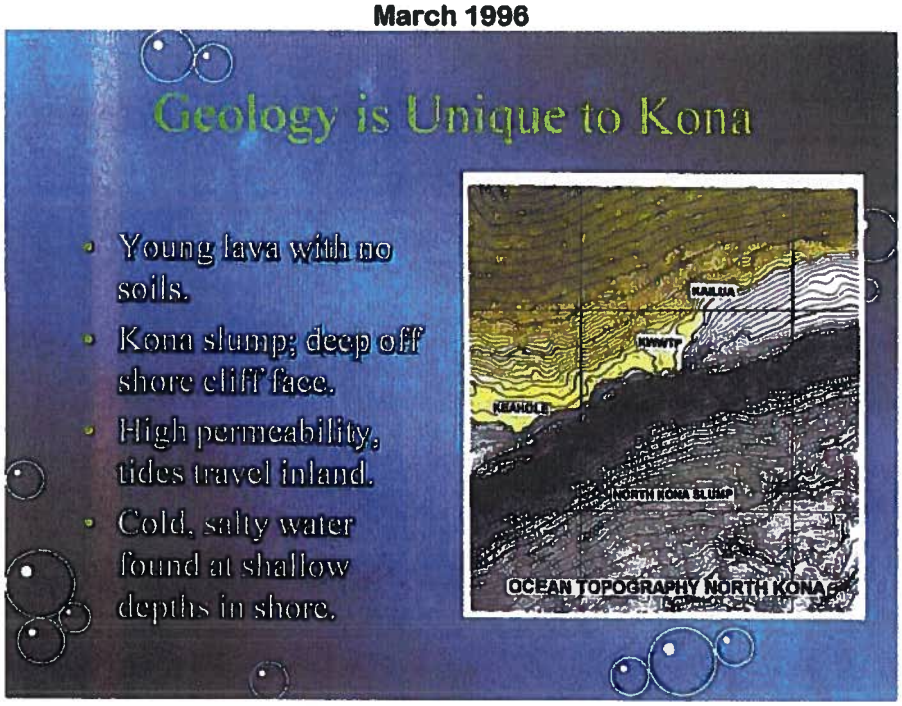
Selected Figures from the 1996 Kealakehe WWTP Report

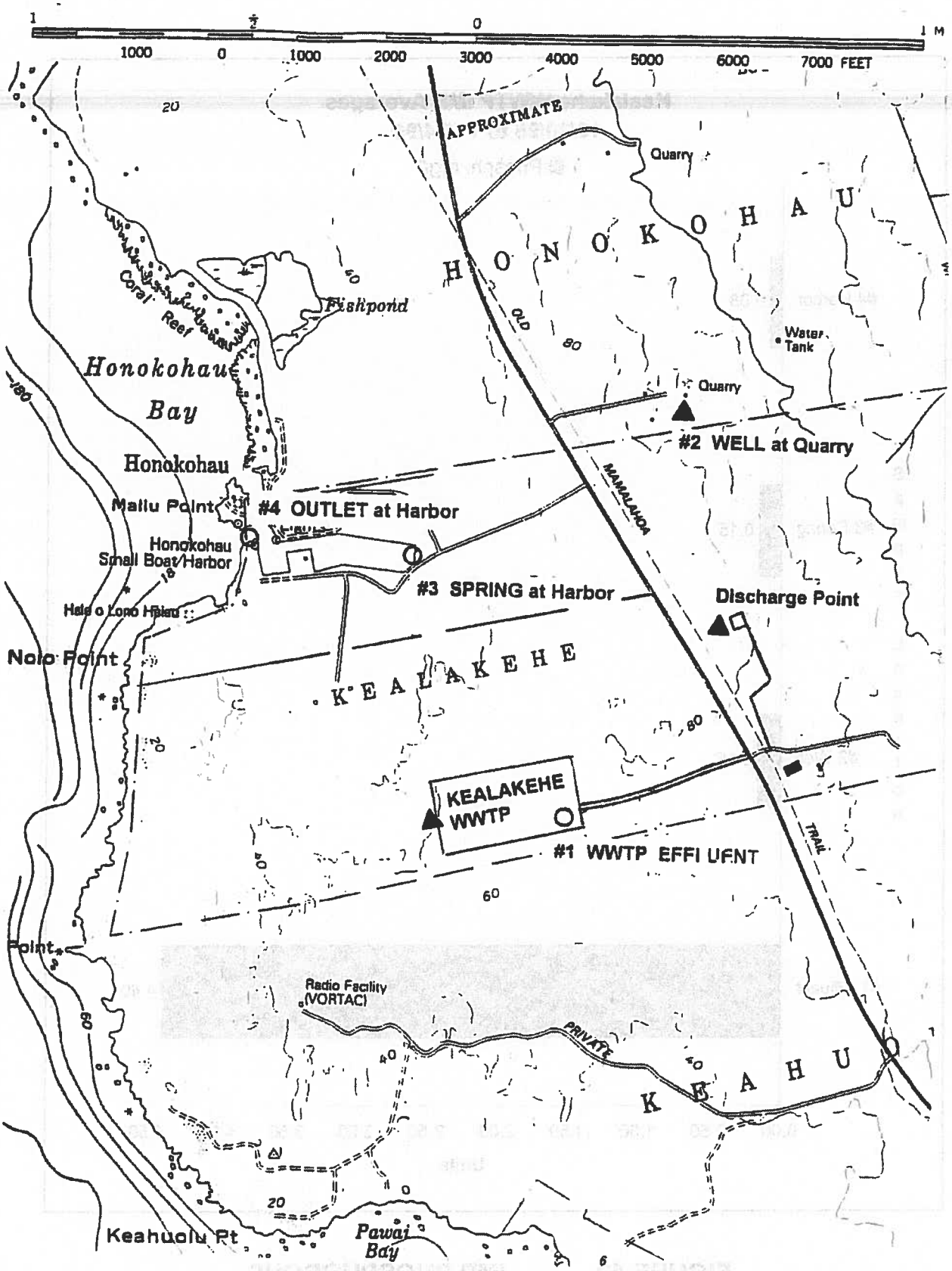
Kealakehe WWTP Effluent Reuse and Management Project

FINAL PROGRESS (MARCH 1996) REPORT
ON
EFFLUENT DISCHARGE,
REUSE,
AND QUALITY

by:
Waimea Water Services Inc.

March 1996





KWWTP EFFLUENT IDENTIFIER MONITOR POINTS

FIGURE 17

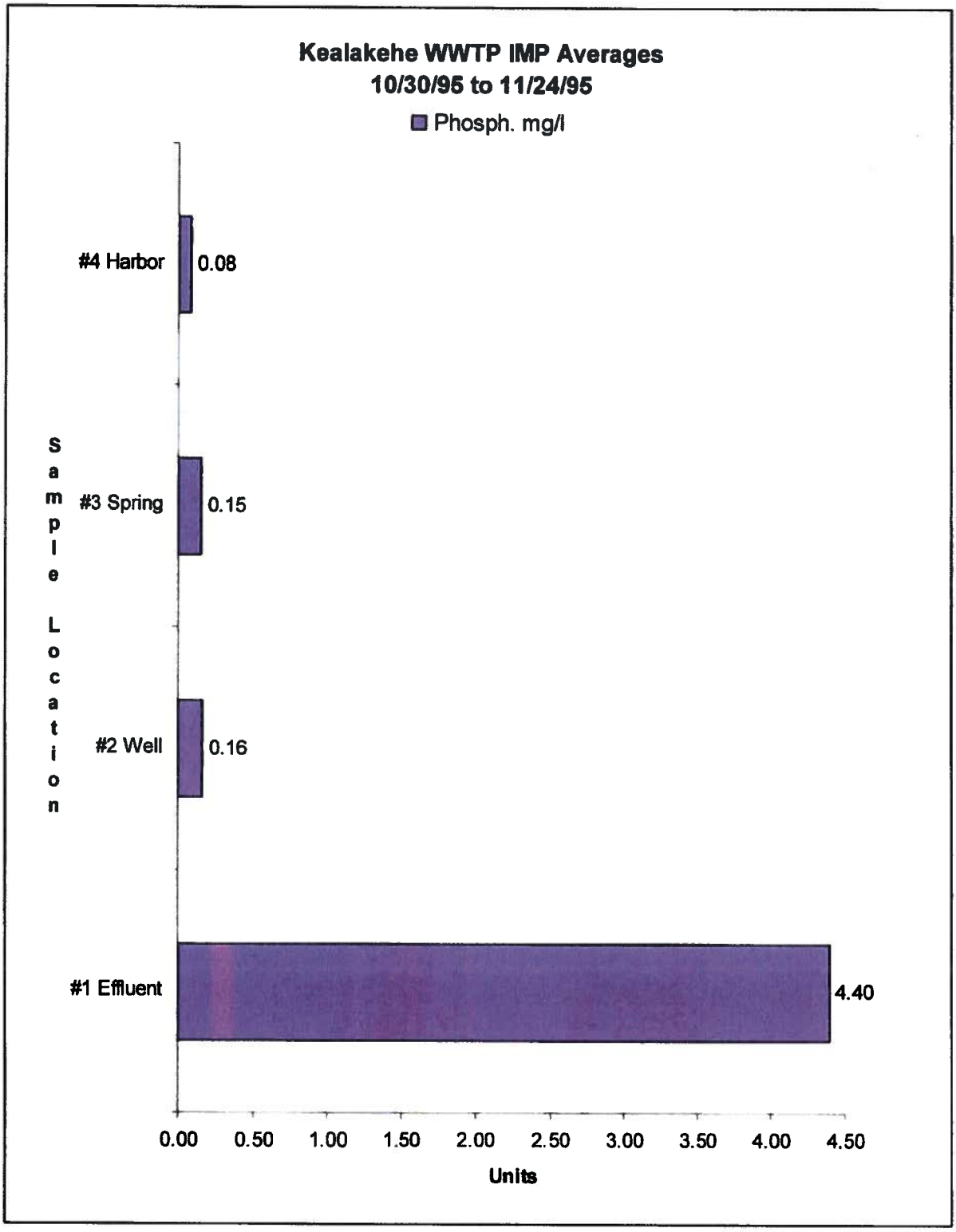


FIGURE 19 IMP PHOSPHOROUS

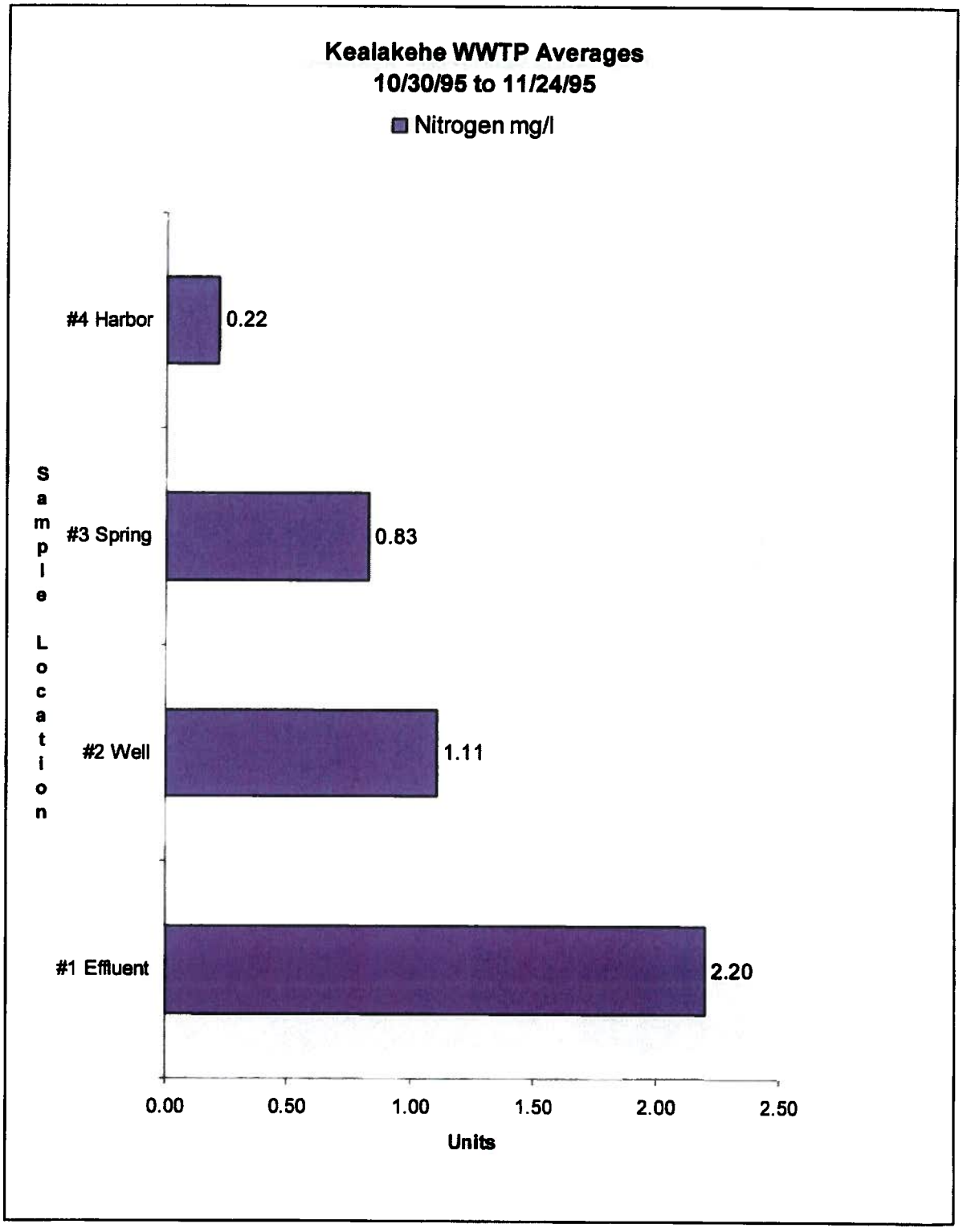


FIGURE 20 IMP NITROGEN

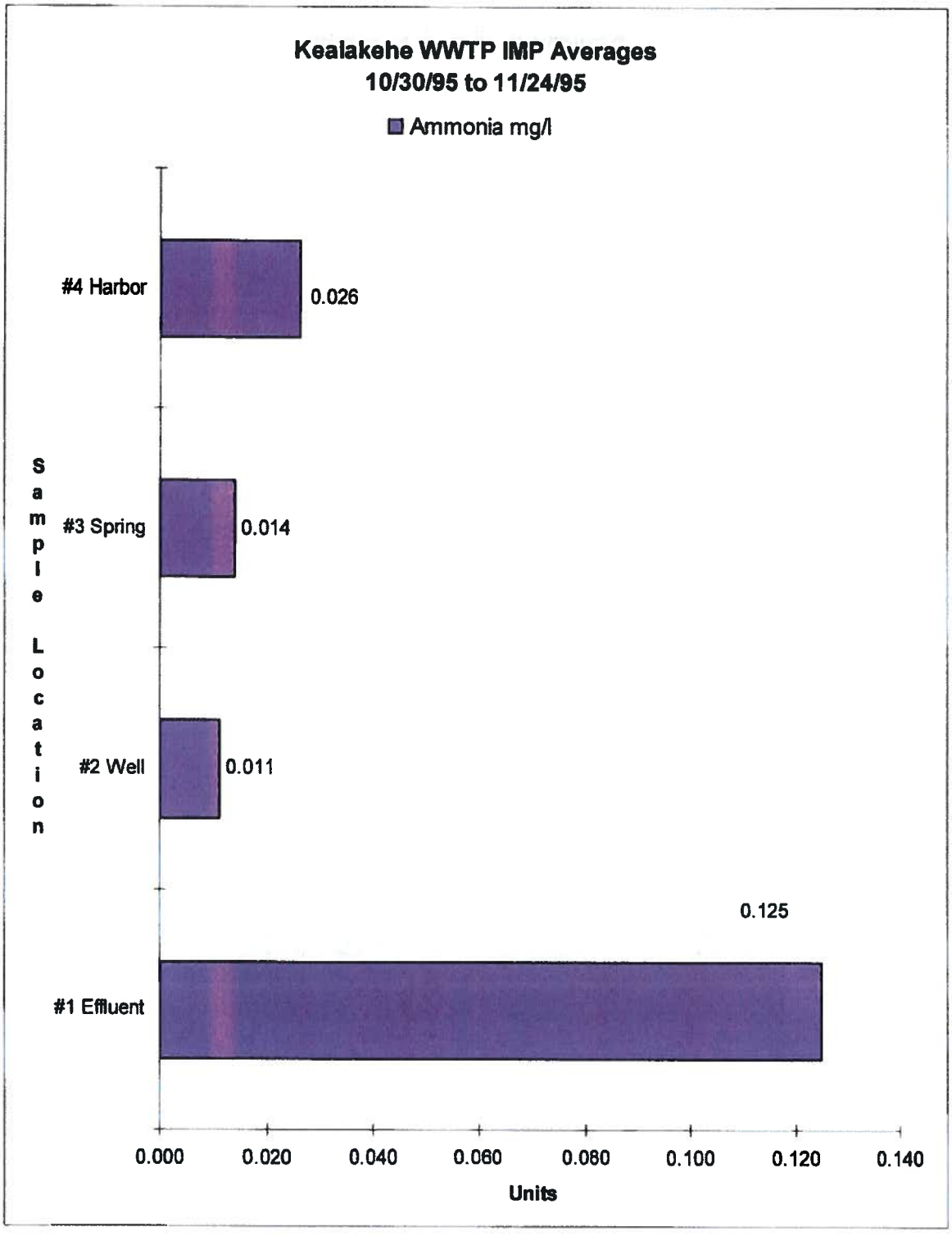


FIGURE 21 IMP AMMONIA

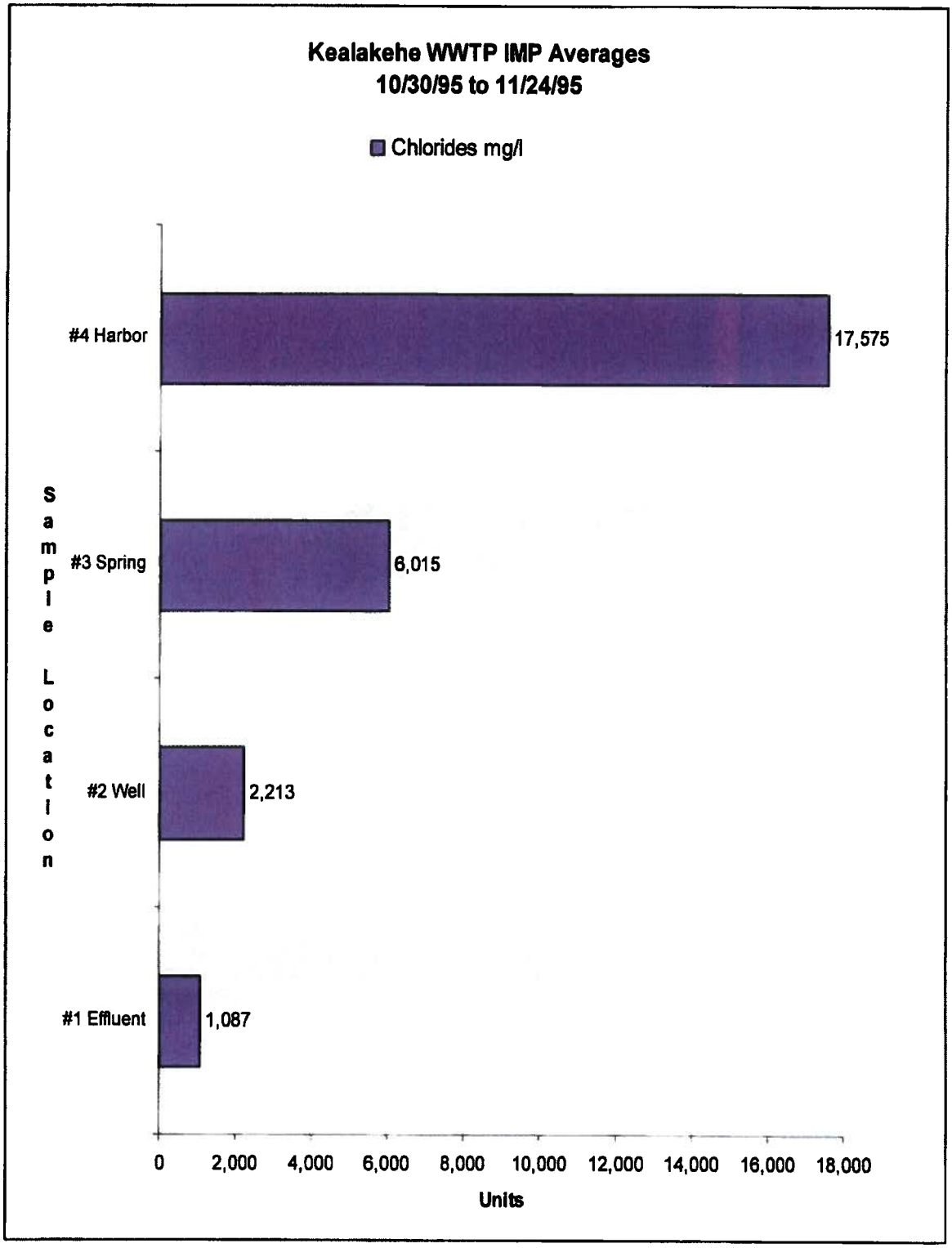


FIGURE 22 IMP CHLORIDES

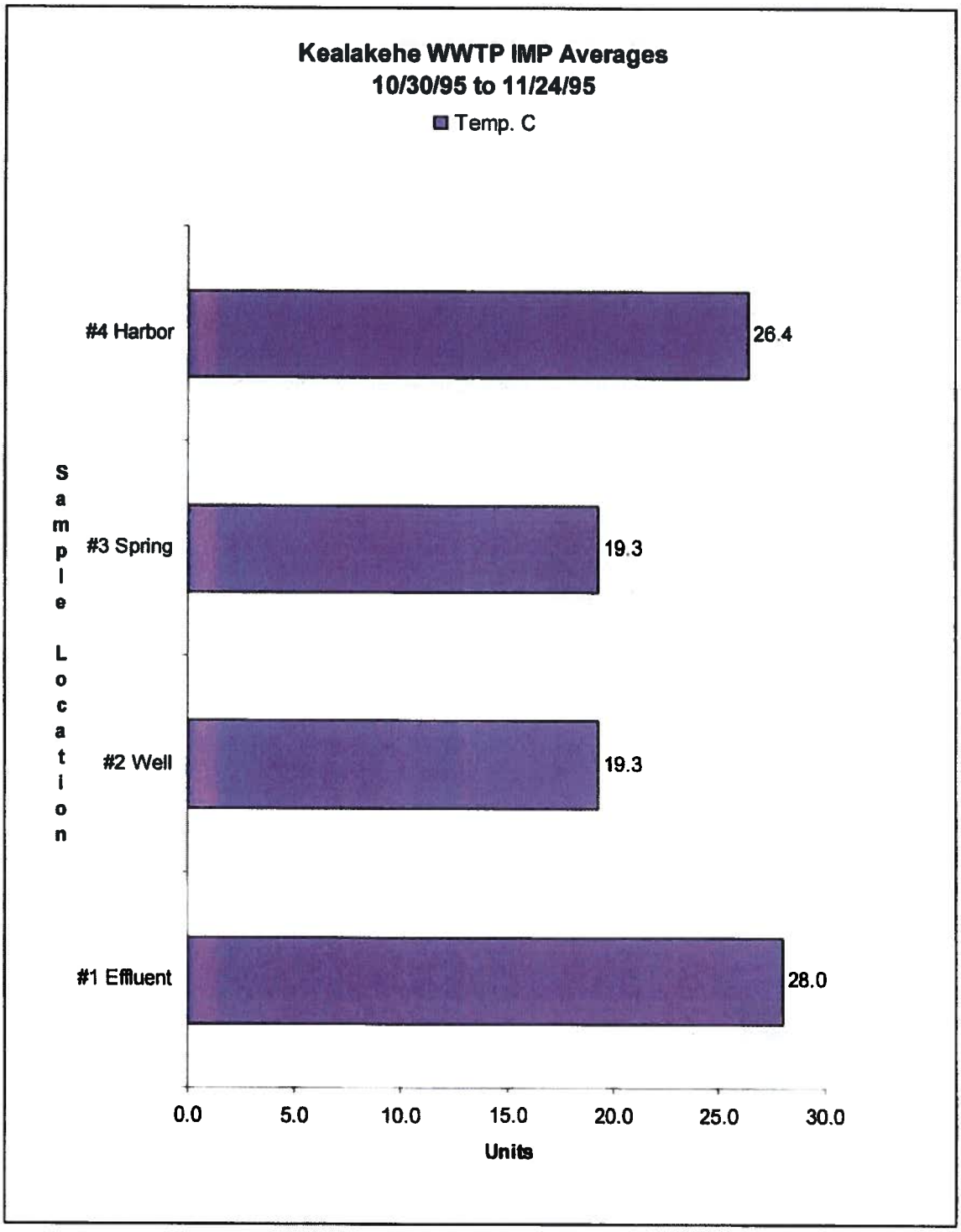


FIGURE 23 IMP TEMPERATURE

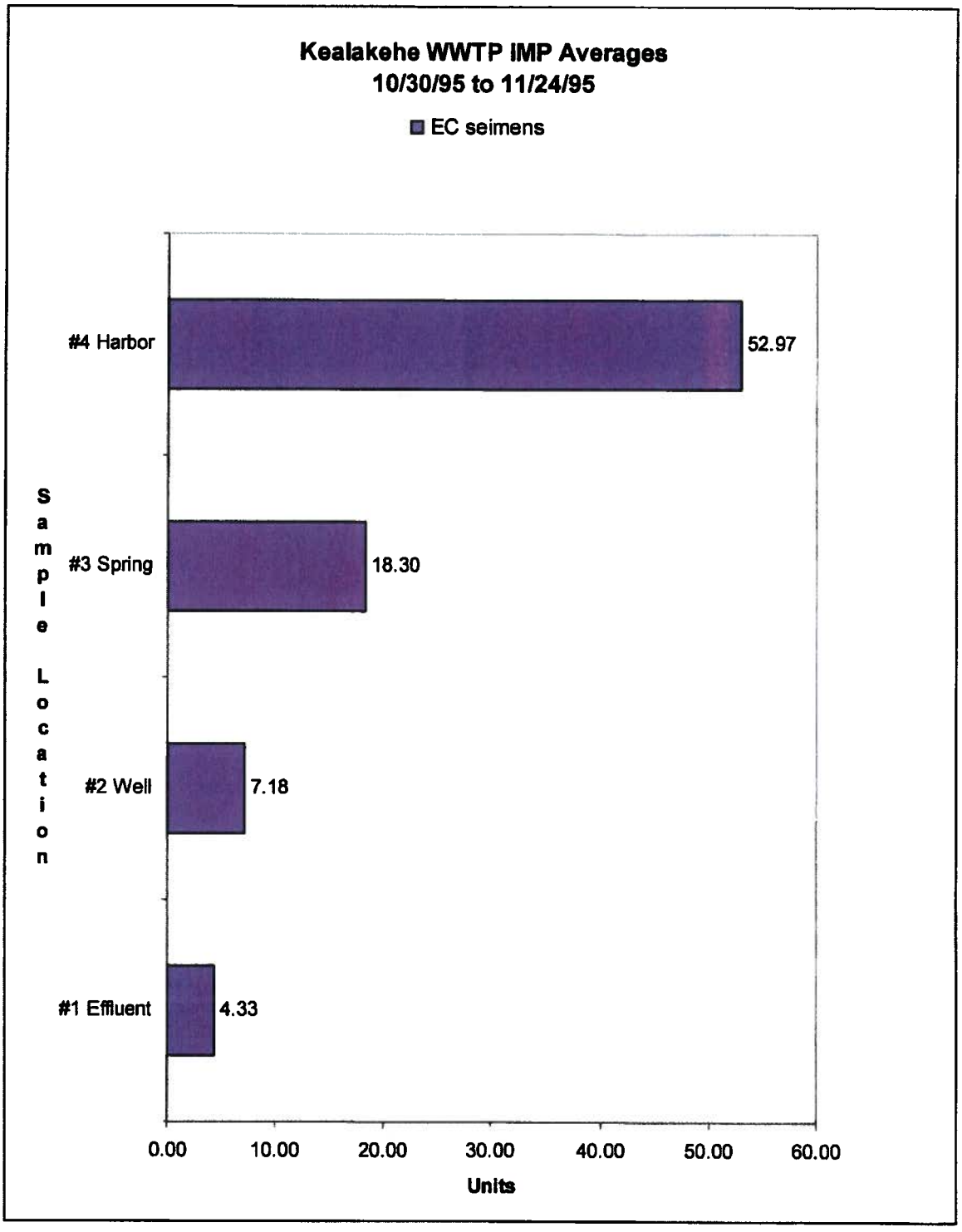
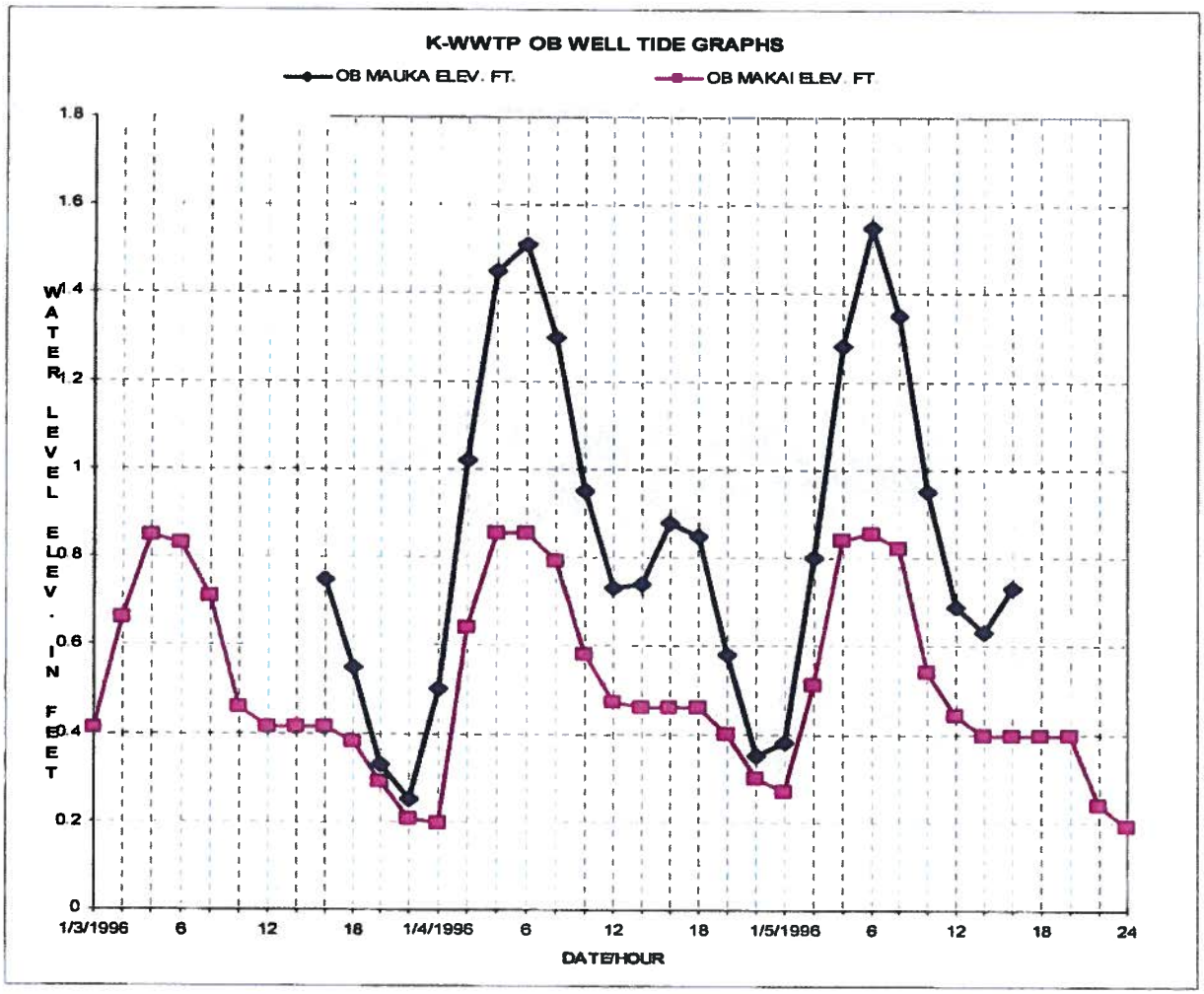
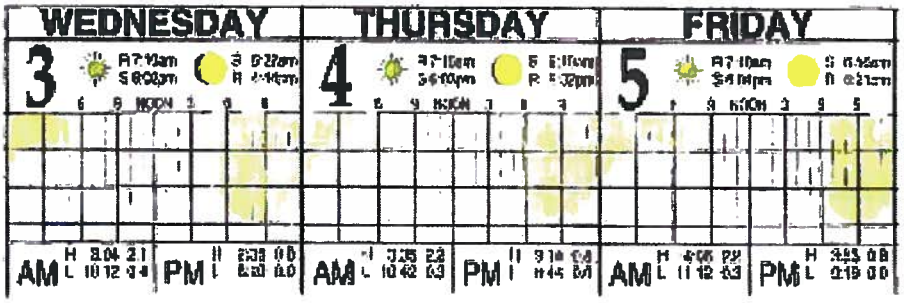


FIGURE 24 IMP EC GRAPH



DATE/HOUR



Place	Differences			
	Time		Height	
	High water	Low water	High water	Low water
Hawaii				
Mahukona	-0 26	-0 17	+0.1	0.0
Kawaihae	-0 04	-0 09	0.0	0.0
Kailua-Kona	-0 26	-0 22	+0.1	0.0
Napoopoo, Kealakekua Bay	-0 16	-0 12	+0.1	0.0
Honaunau	-0 26	-0 16	+0.5	+0.1
Hilo	-1 04	-0 59	+0.5	+0.1

FIGURE 27 MAUKA & MAKAI OB WELL TIDAL GRAPHS

KEALAKEHE WWTP - PLANT OPERATIONS DATA				AM READINGS			Pond #6 or influent							
DATE	Pond #6 Temp F	Pond #6 pH	Effluent Nitrate(NO3) mg/l	Influent Conductivity EC	Effluent Conductivity EC	Influent Chlorides mg/l	Effluent Chlorides mg/l	Chloride Difference mg/l	Effluent Phosphates in %	NTU #5	NTU #6	Influent Flow/day gallons	Effluent Flow/Day gallons	Flow Diff. Gallons gallons
12-Sep-95	84	6.9	2.2	4110	4510	600	1150	550				0.946	1.1	-0.154
13	84	6.9	3.6	4418	4830	650	1050	200				0.975	1.014	-0.039
14	84	6.9	3.4	3960	4250	750	1150	400				0.954	0.978	-0.024
15	84	6.9	3.5	4000	4300	800	1150	350				0.957	0.805	0.152
16												1.025	0.776	0.249
17	83	6.9	3.5	3950	4400	850	1200	350				1.029	0.746	0.283
18	84	6.9	3.1	3725	4300	800	1150	350				1.024	0.691	0.333
19	84	7	1.5	2988	3400	700	1150	450				1.026	0.788	0.238
20	84	7	1.9	2890	3930	600	1050	450				1.009	0.744	0.265
21	83	6.9	2	2850	3910	650	1100	450				0.959	0.436	0.523
22												0.959	0.856	0.103
23												1.065	0.798	0.267
24	84	6.9	2.1	2950	3440	750	1150	400				1.077	0.804	0.273
25	84	6.8	1.7	2900	4080	700	1100	400	0.077			1.033	0.814	0.219
26	82	6.9	1.4	2970	4430	600	1050	450	0.115			0.985	0.756	0.229
27	82	6.9	1.7	3300	4500	600	1100	500	0.06			0.983	0.774	0.209
28	82	7	1.2	3850	4450	800	1200	400	0.073			0.982	0.768	0.214
29														
30														
10/1/1995	82	6.9	1.4	2950	4220	700	1150	450	0.067			1.021	0.782	0.239
2	82	6.9	1.5	2860	4100	600	1100	500	0.075			1.008	0.787	0.221
3	82	6.9	1.7	2570	4530	600	1050	450	0.074			1.025	0.423	0.602
4	82	6.9	1.6	2610	4320	650	1100	450	0.070			1.07	0.961	0.109
5												1.086	0.91	0.176
6												1.098	0.883	0.215
7												1.092	0.815	0.277
8	82	6.9	1.2	2690	4490	600	1100	500	0.077			1.111	0.951	0.16
9	82	6.9	1.1	2700	4400	650	1050	400	0.085			1.105	0.378	0.727
10	81.5	6.9	0.4	2610	4330	600	1050	450	0.087			1.054	1.134	-0.08
11	81.5	6.9	1.5	2720	4560	650	1100	450	0.086			0.956	0.928	0.028
12	82	6.9	1.4	2680	4440	650	1100	450	0.085			0.978	1.012	-0.034
13												0.93	0.602	0.328
14												0.979	0.723	0.256
15	82	6.9	1.4	2720	4410	700	1100	400	0.088			0.989	0.782	0.207
16	82	6.9	1.5	2680	4460	650	1100	450	0.079			0.938	0.766	0.172
17	81	6.9	1.1	2850	4490	650	1050	400	0.090			0.972	0.758	0.214
18	81	6.9	1.4	2850	4450	600	1050	450	0.110			0.972	0.752	0.22
19	81	6.9	1.4	2890	4460	650	1100	450	0.111			0.924	0.726	0.198
20												0.96	0.733	0.227
21												0.995	0.742	0.253
22	81	7	2	2690	4410	700	1100	400	0.077			0.97	0.743	0.227
23	81	6.9	2	2710	4380	650	1080	430	0.062			0.959	0.751	0.208
24	81	6.9	2.3	3380	4380	700	1100	400	0.052			0.955	0.749	0.206
25	81	7	1.8	2760	4350	600	1100	500	0.106			0.958	0.741	0.217
26	81	7	2	2120	4410	650	1100	450	0.079			0.953	0.742	0.211
27												0.954	0.743	0.211
28												0.979	0.786	0.193
29	81	6.9	1.9	2690	4400	650	1100	450	0.081			0.925	0.737	0.188
30	81	6.9	2	2710	4390	600	1050	450	0.079			0.895	0.728	0.167
31	80	6.9	1.1	2750	4380	700	1150	450	0.095			0.929	0.498	0.431

KEALAKEHE WWTP - PLANT OPERATIONS DATA | AM READINGS | Pond #6 or Influent

DATE	Pond #6 Temp F	Pond #6 pH	Effluent Nitrate(NO3) mg/l	Influent Conductivity EC	Effluent Conductivity EC	Influent Chloride mg/l	Effluent Chloride mg/l	Chloride Difference mg/l	Effluent Phosphotes in %	NTU #5	NTU #6	Influent Flow/day gallons	Effluent Flow/Day gallons	Flow Diff. Gallons
11/1/1995	80.6	6.9	0.9	2720	4330	650	1050	400	0.099	8.7	19.8	0.943	0.841	0.102
2	80.6	6.9	1.6	2690	4520	700	1100	400	0.156	8.1	17.4	0.918	0.778	0.14
3												0.927	0.746	0.181
4												0.995	0.789	0.206
5	80.6	7	1.2	2660	4440	650	1150	500	0.095	6.3	15.2	1.044	0.824	0.22
6	80.6	7	1	2620	4360	650	1100	450	0.117	6	14.7	0.956	0.805	0.151
7	80.6	7	1.1	2620	4220	600	1100	500	0.101	4.1	12.6	0.978	0.782	0.196
8	80.6	7	2	2460	4220	650	1150	500	0.104	4.2	12.2	0.993	0.794	0.199
9	80.6	6.9	1.4	2490	4310	650	1150	500	0.102	4.1	13.1	1.041	0.8	0.241
10												1.011	0.79	0.221
11												1.069	0.841	0.228
12	80.6	6.9	1.1	2660	4420	650	1100	450	0.111	4.1	12.6	1.126	0.907	0.218
13	80.6	6.9	1.3	2640	4300	700	1150	450	0.101	4.3	14.2	1.017	0.898	0.119
14	80.6	6.9	1	2600	4390	650	1150	500	0.099	4.1	12.8	0.919	0.856	0.063
15	80.6	6.9	1.2	2680	4450	700	1150	450	0.11	4.3	13.2	1.028	0.804	0.224
16	80.6	6.9	1.2	2650	4420	650	1100	450	0.095	4.8	4	0.971	0.795	0.176
17												0.932	0.74	0.192
18												1.017	0.793	0.224
19	81	6.9	1.6	2660	4440	650	1050	400	0.11	8	4	1.027	0.822	0.205
20	81	7	1.2	2680	4410	650	1050	400	0.098	7.7	4.8	1.03	0.806	0.224
21	81	7	0.9	2600	4390	700	1100	400	0.095	8.2	3.6	1.044	0.821	0.223
22	81	6.9	2.2	2600	4220	600	1150	550	0.105	10	4	1.016	0.786	0.23
23	81	6.9	1.2	2692	4340	650	1150	500	0.093	10	4.5	0.957	0.775	0.182
24	81	7	2.4	2700	4200	700	900	200	0.098	7.5	4.2	0.918	0.753	0.165
25	81	7	2.2	2600	4220	700	1100	400	0.095	7.5	4.5	0.974	0.804	0.17
26	81	7	2.1	2630	4310	650	1100	450	0.101	8	4.5	1.057	0.836	0.221
27	81	7	1.9	3440	4000	700	1050	350	0.092	8	4.5	0.986	0.858	0.128
28	80.6	6.8	3.3	3440	4230	700	850	150	0.097	8.1	6.1	0.995	0.848	0.147
29	82	6.7	3.1	2800	4240	650	800	150	0.121	5.6	4.2	0.911	0.763	0.148
30	77	6.7	2.8	2840	4200	600	700	100	0.11	10.3	6.81	0.969	0.77	0.199
12/1/1995	76	6.8	3.1	2810	4230	650	700	50	0.103	8	4.5	0.966	0.788	0.178
2	79	7.01	1.5	2610	4100	700	1100	400	0.143	8.2	6	1.007	0.776	0.231
3	79	7.03	2.7	2420	3860	500	750	250	0.092	8	4.8	1.002	0.768	0.234
4	78	7.01	1.8	3100	4160	600	750	150	0.091	17.5	10.1	0.973	0.833	0.14
5	79	7.14	3	2190	4200	400	750	350	0.184	15.2	5.6	0.926	0.772	0.153
6	79	7	3.2	2360	4140	500	850	350	0.142	17.72	7.6	0.893	0.764	0.129
7	79	7	3	2370	4180	550	850	300	0.142	15.1	5	0.878	0.752	0.126
8	78	7.07	2.8	2460	4210	500	750	250	0.142	30.1	9.4	0.887	0.786	0.101
9	79	7.2	1.7	2230	4130	450	700	250	0.162	9.5	5.1	0.867	0.755	0.112
10	78	7	3.1	2460	4060	400	650	250	0.126	13.2	8.7	0.854	0.745	0.109
11	80	7.03	2.7	2160	4120	500	700	200	0.138	9.5	5.2	0.883	0.771	0.112
12	79	6.99	1.3	2740	4170	600	900	300	0.129	13.6	6.7	0.859	0.739	0.12
13	79	7.06	3	2650	4150	500	900	400	0.095	15.2	7	0.864	0.721	0.143
14	78	6.9	2.7	2980	4140	550	900	350	0.151			0.871	0.737	0.134
15	78	7.01	2.5	2430	4150	550	900	350	0.121			0.882	0.712	0.17
16	89	6.8	2.3	2540	4060	500	850	350	0.146			0.864	0.721	0.143
17	78	7.03	2.1	2370	3850	600	800	200	0.133			0.883	0.751	0.132
18	79	7.2	2.7	2480	4120	600	850	250	0.141			0.86	0.751	0.109
19	77	7.01	1.5	3140	4140	550	900	350	0.126			0.829	0.757	0.072
20	79	7	0.6	2430	4210	600	1050	450	0.108			0.801	0.72	0.081
21	79	7.02	1.1	2540	4200	600	1100	500	0.09			0.828	0.739	0.089
22	77	6.99	1.7	2530	4150	600	900	300	0.112			0.827	0.722	0.105
23	78	7	1.5	2490	4200	600	1050	450	0.101			0.863	0.739	0.124
24	78	7	1.1	2400	4160	600	1100	500	0.112			0.855	0.735	0.12
25	78	7	1.3	2600	4220	650	1050	400	0.099			0.857	0.768	0.089
26	78	7	1.2	2440	4200	600	1050	450	0.11			0.77	0.77	0
27	79	7	1.1	2390	4150	650	1100	450	0.12			0.923	0.775	0.148
28	79	7	1.3	2420	4240	650	1050	400	0.116			0.919	0.73	0.189
29	77	7	0.7	2410	4230	650	1100	450	0.114			0.933	0.803	0.13
30	77	7.02	1.4	2440	4280	600	1050	450	0.116			0.817	0.94	-0.123
31	78	7	1.2	2460	4240	600	1050	450	0.111			0.885	0.807	0.078

KEALAKEHE WWTP - PLANT OPERATIONS DATA				AM READINGS		Pond #6 or Influent								
DATE	Pond #6 Temp F	Pond #6 pH	Effluent Nitrate (NO3) mg/l	Influent Conductivity EC	Effluent Conductivity EC	Influent Chloride mg/l	Effluent Chloride mg/l	Chloride Difference mg/l	Effluent Phorphetes in %	NTU #5	NTU #6	Influent Flow/day gallons	Effluent Flow/Day gallons	Flow Diff. Gallons gallons
1-Jan-96	76	7	1.3	2840	4190	650	1100	450	0.109			0.91	1.03	-0.22
2	76	7	1.1	2480	4240	650	1050	400	0.114			0.882	0.98	-0.098
3	77	6.99	1.4	2230	3760	600	1050	450	0.148			0.879	0.91	-0.031
4	79	7.01	1.5	2170	3950	500	1050	550	0.116			0.88	0.888	-0.008
5	77	7	1.5	2130	4160	650	1050	400	0.171			0.847	0.84	0.007
6	77	6.9	1.4	2340	4120	600	1100	500	0.127			0.842	0.838	0.004
7	77	7.9	1.3	2380	4140	600	1050	450	0.119			0.825	0.844	-0.019
8	77	7	1.1	2400	4200	650	1100	450	0.124			0.76	0.815	-0.055
9	77	7	0.9	2400	4220	600	1050	450	0.118			0.8	0.796	0.004
10	77	7.01	1.3	2390	4160	600	1050	450	0.132			0.773	0.744	0.029
11	77	7.03	0.9	2390	4160	650	1150	500	0.105			0.748	0.722	0.026
12	77	7.01	1.3	2400	4220	650	1050	400	0.127			0.821	0.704	0.117
13	77	7.01	1.6	2390	4160	600	1100	500	0.113			0.78	0.795	-0.015
14	77	7	1.4	2400	4210	650	1100	450	0.119			0.782	0.762	0.02
15	77	7	0.6	2390	4140	600	1000	400	0.105			0.773	0.768	0.006
16	77	7	0.2	2350	4130	550	950	400	0.105	23	13	0.831	0.796	0.036
17	75	7.03	1.5	2430	4150	600	1050	450	0.102	21	12	0.856	0.79	0.066
18	73	7.02	1.4	2340	4140	550	1100	550	0.135	22	12	0.86	0.805	0.055
19	77	7	1.8	2330	4200	550	1000	450	0.106	22	11	0.839	0.813	0.026
20	77	7	1.4	2230	4220	550	1050	500	0.105			0.857	0.857	0
21	77	7	1.3	2300	4200	600	1050	450	0.111			0.857	0.87	-0.013
22	77	7.24	1.4	2750	3720	650	1100	450	0.372	13	9	0.849	0.879	-0.03
23	79	7.1	0.4	2890	4060	650	1100	450	0.161	16	9	0.823	0.85	-0.027
24	79	7.07	0.4	3520	4180	700	1050	350	0.123	18	10	0.826	0.841	-0.015
25	77	7	0.7	3250	4060	700	1050	350	0.203	17	9	0.825	0.857	-0.032
26	77	7.01	0.6	3300	4100	700	1000	300	0.191	18	9	0.786	1.368	-0.582
27	75	7	0.7	3142	4020	680	1050	370	0.11	17	9	0.807	1.19	-0.383
28	77	7.01	0.7	3220	4080	700	1100	400	0.161	17	10	0.816	1.01	-0.194
29	77	7	0.7	2780	4000	650	1100	450	0.112	12	8	0.746	0.898	-0.152
30	78	7	0.6	2900	4080	650	1100	450	0.133	13	10	0.805	0.962	-0.057
31	76	7	0.9	2210	3880	600	1100	500	0.1	10	6	0.835	1.092	-0.257
1-Feb-96	75	7	0.9	2000	4000	600	1000	400	0.122	12	10	0.761	0.848	-0.087
2	76	7	0.7	2522	4070	650	1050	400	0.126	13	9	0.744	1.385	-0.641
3	77	7	1.8	2380	4040	630	1050	420	0.119	10	9	0.778	1.106	-0.328
4	76	7	0.7	2114	4000	600	1050	450	0.119	16	14	0.779	0.962	-0.183
5	75	7	0.8	2600	3960	600	1050	450	0.118	15	14	0.747	0.87	-0.123
6	76	7	0.8	2500	3740	600	1050	450	0.13	19	16	0.77	0.846	-0.076
7	77	7	0.7	2690	3800	600	1050	450	0.124	18	15	0.709	0.815	-0.106
8	77	7	0.5	2870	3860	650	1100	450	0.11	15	12	0.701	0.826	-0.125
9	78	7	0.7	2545	3872	600	1050	450	0.12	17	14	0.709	0.838	-0.129
10	77	7	0.7	2640	3946	600	1050	450	0.121	17	14	0.702	0.868	-0.166
11	76	7	0.8	2660	3740	600	1050	450	0.115	15	14	0.634	0.834	-0.2
12	73	7	0.7	2600	3780	650	1100	450	0.121	16	13	0.624	0.772	-0.148
13	73	7	0.4	2730	4080	650	1100	450	0.14	17	21	0.563	0.734	-0.171
14	73	7	1.8	2340	3900	650	1100	450	0.123	20	22	0.608	0.78	-0.172
15	72	7.03	2	2850	3680	700	1100	400	0.105	17	20	0.631	0.813	-0.182
16	72	7.05	0.9	2630	3810	650	1100	450	0.128	17	21	0.605	0.835	-0.23
17	72	7.1	1.8	2660	4020	650	1100	450	0.178	17	20	0.671	0.881	-0.21
18	74	7	1	2770	4030	600	1100	500	0.11	17	21	0.627	0.875	-0.248
19	74	7	0.9	2810	4020	600	1100	500	0.102	18	20	0.587	0.862	-0.275
20								0						0
21								0						0
22								0						0
23								0						0
24								0						0
25								0						0
26								0						0
27								0						0
28								0						0

Impact of the Use of High Level Groundwater on the Basal Lens in the Keauhou Aquifer

Prepared by:
Tom Nance, PE
Hydrologist
Water Resource Engineer
Tom Nance Water Resource Engineering
560 N. Nimitz Hwy. - Suite 213
Honolulu, Hawaii 96817

Impact of the Use of High Level Groundwater on the Basal Lens in the Keauhou Aquifer

Prepared for:

Hawaii Island Economic Development Board
P. O. Box 2159
Kamuela, Hawaii 96738

Prepared by:

Tom Nance Water Resource Engineering
560 N. Nimitz Hwy. - Suite 213
Honolulu, Hawaii 96817

July 2014

EXECUTIVE SUMMARY

Using monitoring data of North Kona groundwater that TNWRE has compiled, this report addresses whether or not impacts to basal groundwater have occurred as a result of pumping the six high level groundwater wells located above Mamalahoa Highway from Kalaoa to Waiaha. High level pumpage began in 1994 and is now at about 4.0 to 4.5 MGD (Figures 2 and 3 in the report).

The TNWRE monitoring data which address this question consists of continuous water level recording in the Kamakana well and time series salinity profiles in the Kamakana, Kaloko-2, Ooma Mauka, and Ooma Makai wells. The report presents and evaluates this data. Based on the water levels at the Kamakana Well and the salinity profiles at all four wells, no impact to basal groundwater as a result of high level groundwater pumpage has been identified to date.

A key unresolved issue is whether or not the high level groundwater actually drains into the nominally downgradient basal lens in the area between Keahole Point and Kailua Town. Evidence gathered to date suggests that at least some, if not most, of the high level groundwater actually flows at depth beneath the basal lens to discharge into the marine environment offshore. The anomalous characteristics of the basal lens suggest this: very low water levels relative to the actual ocean level; very high salinity; temperatures significantly lower than the high level groundwater; and increasing salinity in wells under modest pumping rates. The more compelling evidence is provided by the discovery of fresh water under artesian pressure at depth below the basal lens in the Keopu and Kamakana deep monitor wells. If leakage of high level groundwater into the basal lens is limited to the modest amounts that evidence collected to date suggests, then the foreseeable future increases in pumpage of high level groundwater will have little or no impact on the basal lens.

With the unresolved issue of high level groundwater leaking into or passing beneath the basal lens, monitoring for potential impacts to basal groundwater going forward should be continued and even expanded. This expansion should include deepening the Kaloko-2 well so that possible changes to the thickness of the basal lens at this location can be tracked.

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INTRODUCTION

This report has been prepared in response to a petition by the National Park Service (NPS) to the State Commission on Water Resource Management to designate the Keauhou Aquifer as a Groundwater Management Area. The petition asserts that present or planned future use of groundwater from the Keauhou Aquifer will reduce the flow of basal groundwater through Kaloko Honokohau (KAHO) National Historical Park, thereby causing harm to KAHO's anchialine ponds and its nearshore marine environment.

This report contains data from monitoring and production wells as compiled by Tom Nance Water Resource Engineering (TNWRE) to assess whether or not an impact to the basal lens has occurred due to ongoing groundwater use. It also presents an opinion as to whether or not the present level of monitoring can provide sufficient information to evaluate groundwater impacts as the future use of groundwater increases over present levels.

GROUNDWATER OCCURRENCE AND USE IN THE KEAUHOU AQUIFER

Prior to 1990, it was commonly assumed that all groundwater in the Keauhou Aquifer was basal, that is a lens of fresh and brackish water floating on saline groundwater beneath it and in dynamic equilibrium with the ocean along the shoreline. At that time, the Hawaii County Department of Water Supply (DWS) was operating six basal wells, all located in the southern part of the aquifer (shown in red on Figure 1 and listed in Table 1) and was pumping about eight (8) million gallons per day (MGD). Groundwater use by others everywhere else in the aquifer was quite modest. It amounted to pumping brackish wells at Keauhou to supplement the supply of a treated wastewater used to irrigate the Kona Country Club golf courses and use of saline groundwater for aquaculture at NELHA at Keahole Point.

In 1990, first at Keauhou Well 2 (State No. 3355-01) and soon after at the Kalaoa Well (No. 4358-01), high level groundwater was discovered. High level groundwater stands much higher above sea level than basal groundwater. Unlike basal groundwater which is subject to increasing salinity if it is overpumped, the subsurface geologic control which creates the high level groundwater also protects it from salinity intrusion in response to pumping.

As shown on Figure 2, use of high level groundwater in the Keauhou Aquifer began in 1994 with the Kalaoa Well and now includes six wells pumping between 4.0 and 4.5 MGD. All six of these wells are in the northern part of the aquifer in the area from Kalaoa to Waiaha (their locations are shown in blue on Figure 1). Use of high level groundwater has enabled DWS to reduce pumping its basal wells (Figure 3). Prior to this, DWS' basal pumpage at eight or more MGD was causing salinity issues.

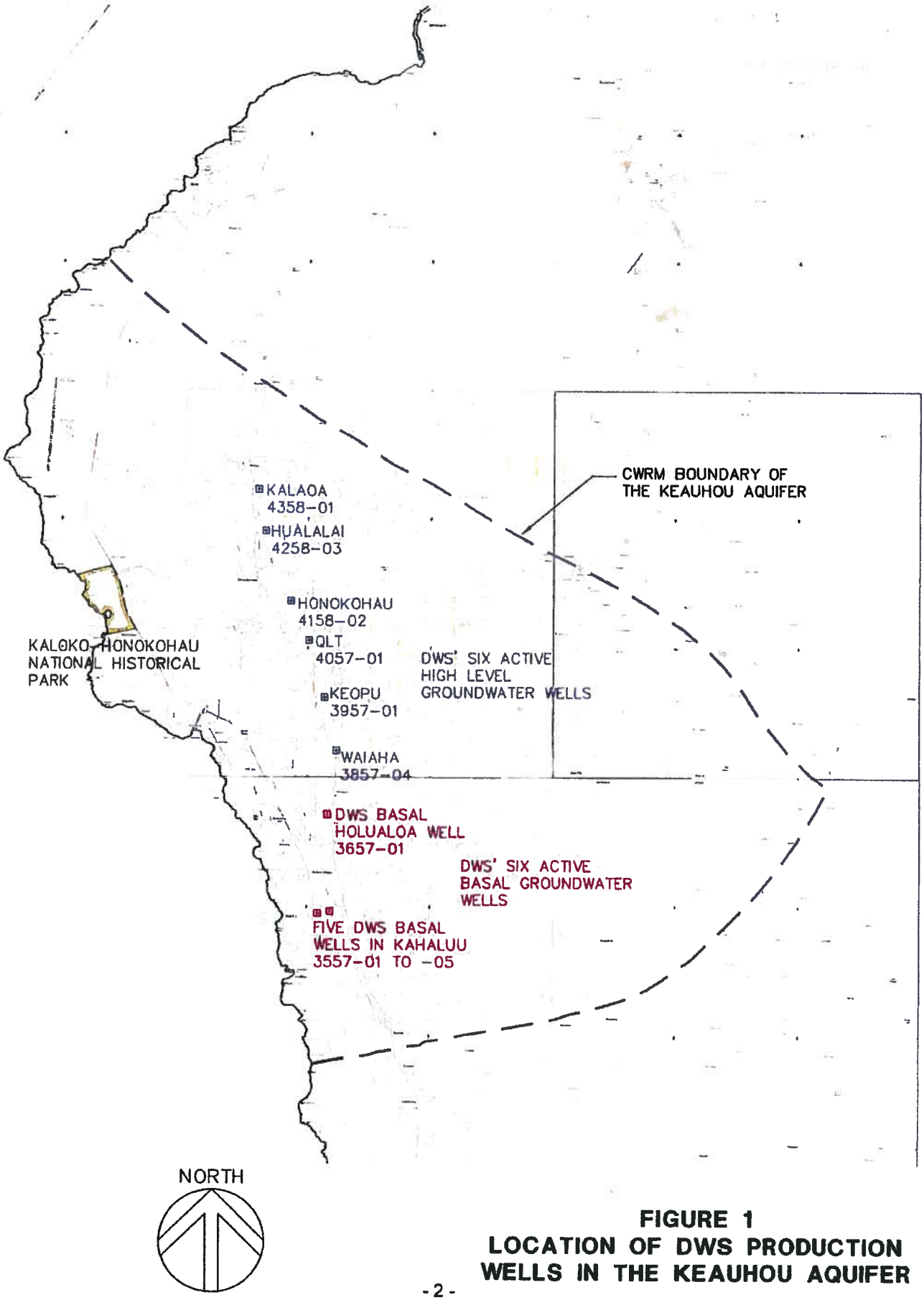


FIGURE 1
LOCATION OF DWS PRODUCTION WELLS IN THE KEAUHOU AQUIFER

Table 1

Pumpage by DWS Basal and High Level Wells

Well		Average Annual Pumpage (MGD)		
State No.	Name	1990	1994	2013
Basal Wells				
3557-05	Kahaluu Shaft	4.737	5.614	4.234
3557-01	Kahaluu A	0.807	0.777	0.686
3557-02	Kahaluu B	0.992	1.050	0.514
3557-03	Kahaluu C	0.491	0.713	0.747
3557-04	Kahaluu D	0.672	0.952	0.330
3657-01	Holualoa	0.491	0.324	0.000
	Total for Basal Wells	8.190	9.430	7.040
High Level Wells				
4358-01	Kalaoa	--	0.168	0.889
4057-01	QLT	--	--	1.299
4158-02	Honokohau	--	--	1.648
4258-03	Hualalai	--	--	0.000
3857-04	Waiaha	--	--	0.529
3957-01	Keopu	--	--	0.415
	Total for High Level	0.000	0.168	4.251

Note: All pumpage data provided by DWS.

Figure 2. Average Pumpage of High Level Groundwater by DWS from Kalaoa to Keopu and Years Each of the High Level Wells was Brought On Line

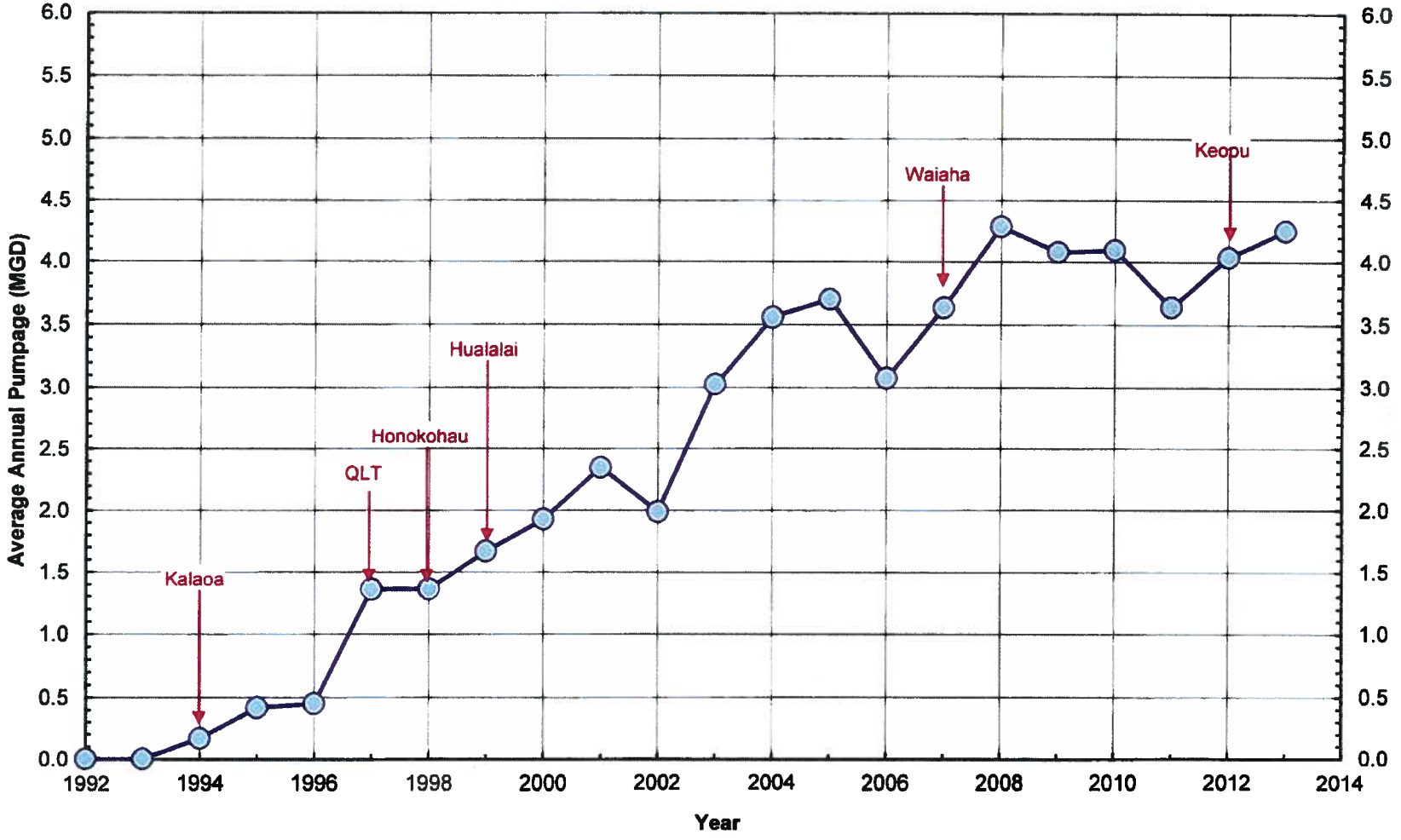
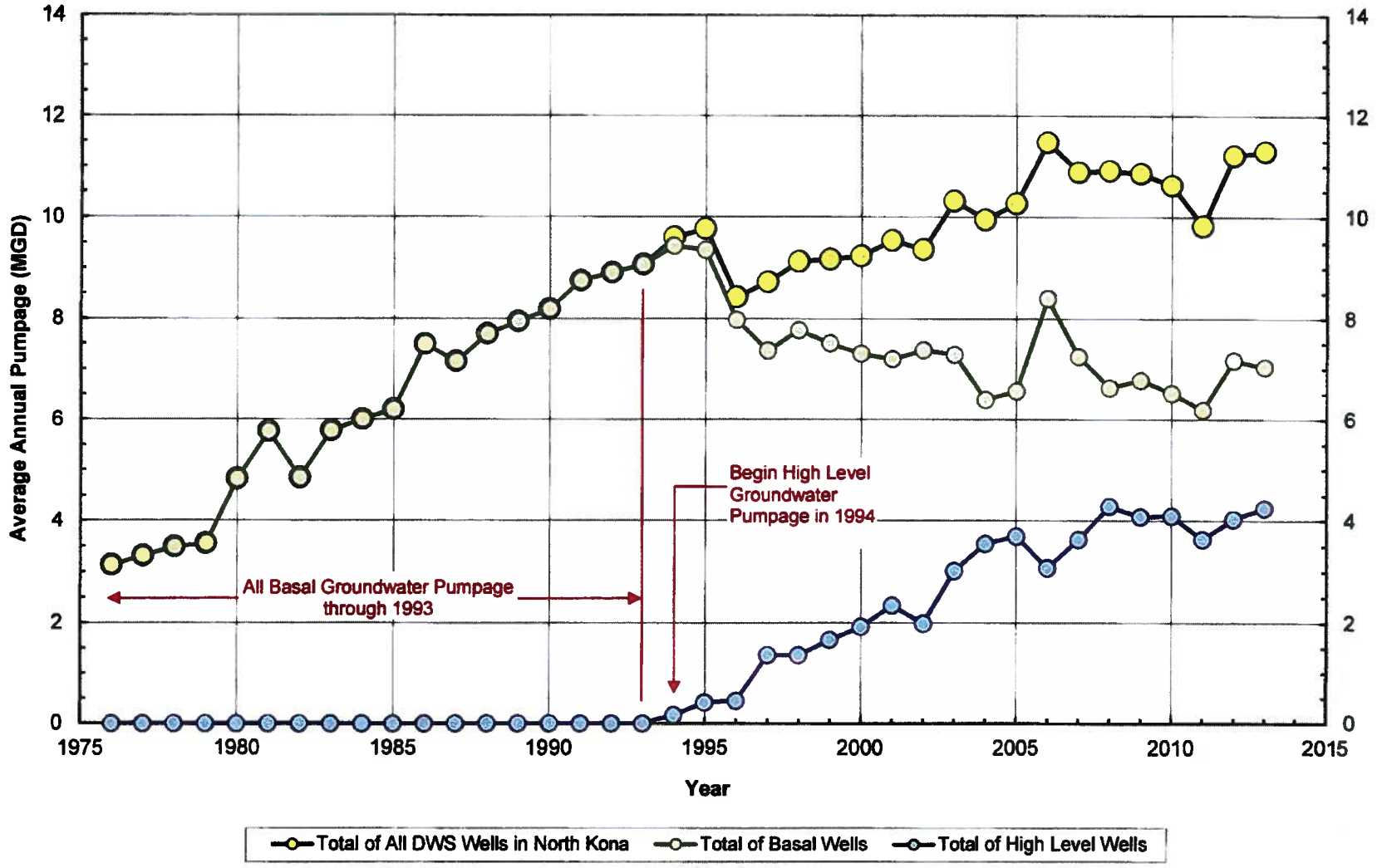


Figure 3. Pumpage of DWS Wells in North Kona from 1976 through 2013



HYDROLOGIC CONNECTION BETWEEN INLAND HIGH LEVEL GROUNDWATER AND THE NOMINALLY DOWNGRADIENT BASAL LENS

The subsurface geology that creates the high level groundwater is not known for certain, but the most likely explanation appears to be a series of poorly permeable lava flows that are in aggregate at least tens and possibly hundreds of feet thick. The information presented in the paragraphs below are the basis for this statement.

Findings of Two Deep Monitor Wells

Two deep monitor wells, Keopu (No. 3858-01) and Kamakana (No. 3959-01), have encountered fresh water under artesian pressure at depth below the basal lens and the saline groundwater below the lens (the locations of these two wells are shown on Figure 4). The comparative salinity and temperature profiles before and after encountering the fresh water at depth in the Kamakana Well illustrate this (Figures 5 and 6). Of particular note is the temperature decline and then reversal with depth in the saline groundwater zone. In combination with the unvarying salinity 500 to 950 feet below sea level, these data identify the strata confining the freshwater at depth (Figure 7). These results suggest that at least some, if not most, of the high level groundwater is flowing beneath the confining layers to the ocean at depth offshore rather than into and through the basal lens.

Anomalous Temperature, Salinity, and Water Levels of Basal Groundwater Between Keahole Point and Kailua Town

If all or even most of the high level groundwater is flowing into the nominally downgradient basal lens, this flow would constitute, by far, the largest component of recharge to the basal lens. It would be expectable that water levels in the lens would be at least two to three feet above the actual ocean level, that salinities would be of at least irrigation (brackish) quality, that salinities would be stable under at least moderate rates of pumping, and that basal water temperatures would be similar to the temperatures of the high level groundwater. In fact, basal groundwater between Keahole Point and Kailua Town exhibits none of these characteristics. Instead, occurrence of the basal groundwater can be characterized as follows:

- Based on a density analysis of the salinity profile in the Kamakana Well (Figure 5 prior to encountering fresh water at depth), the water level in the basal lens at this location is no more than 0.4 feet above the actual ocean level.

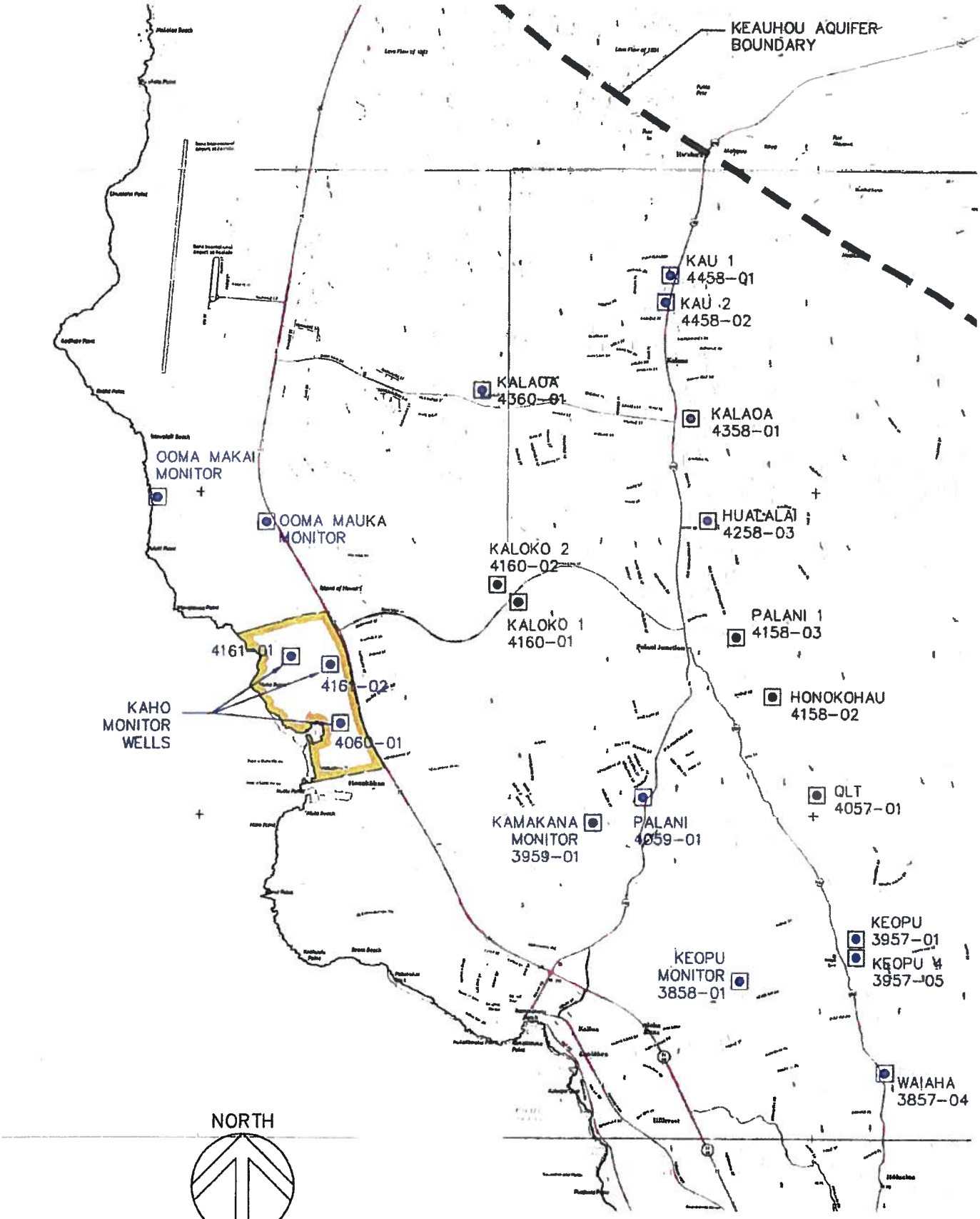


FIGURE 4
WELL LOCATIONS FROM KEAHOLE POINT TO KAILUA TOWN

Figure 5. Salinity and Temperature Profile through the Water Column
of the Kamakana Monitor Well on April 3, 2010
Prior to Encountering Fresh Water at Depth

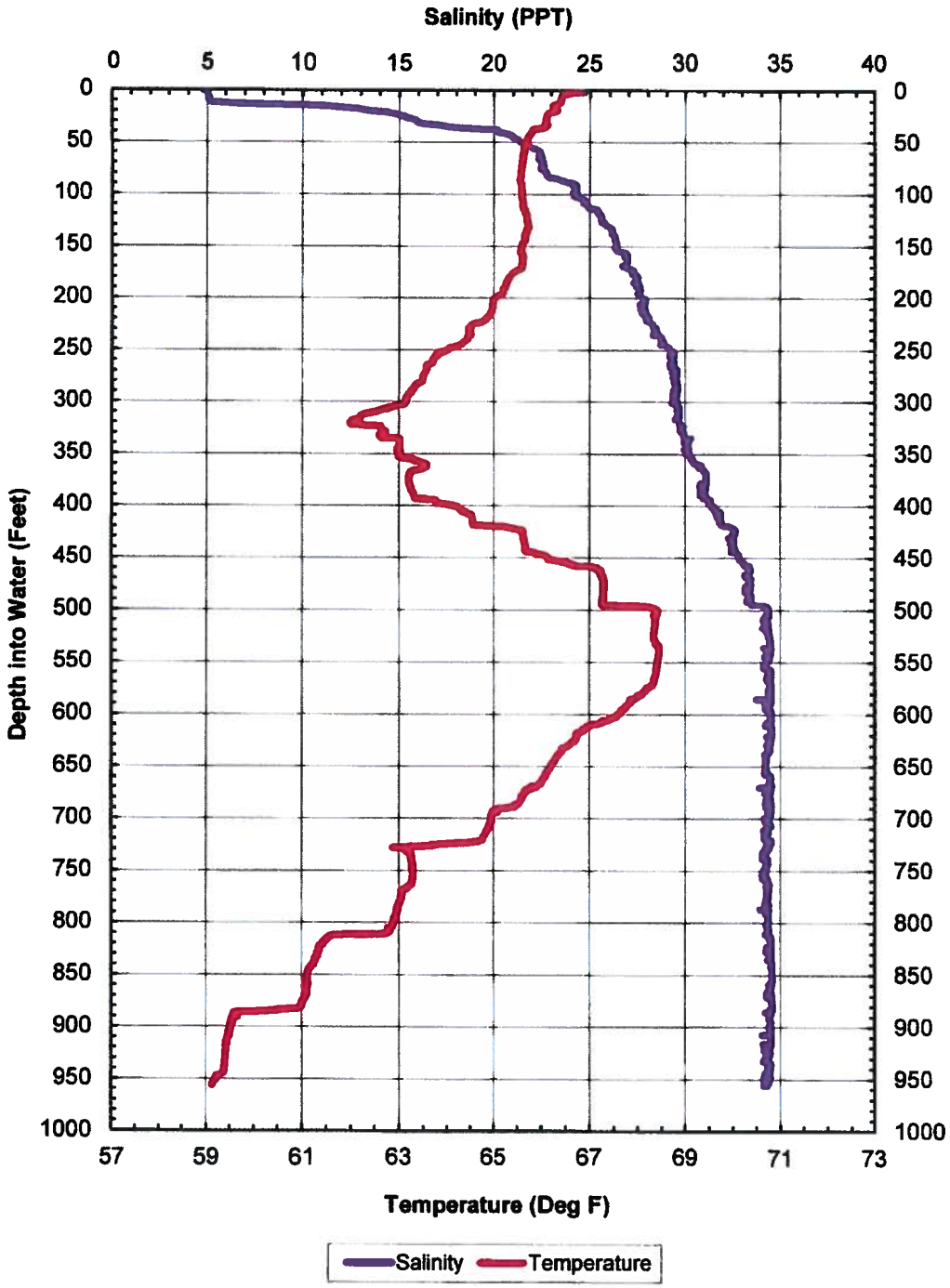


Figure 6. Profile through the Water Column of the Kamakana Monitor Well on May 12, 2010 After Encountering Fresh Water at Depth

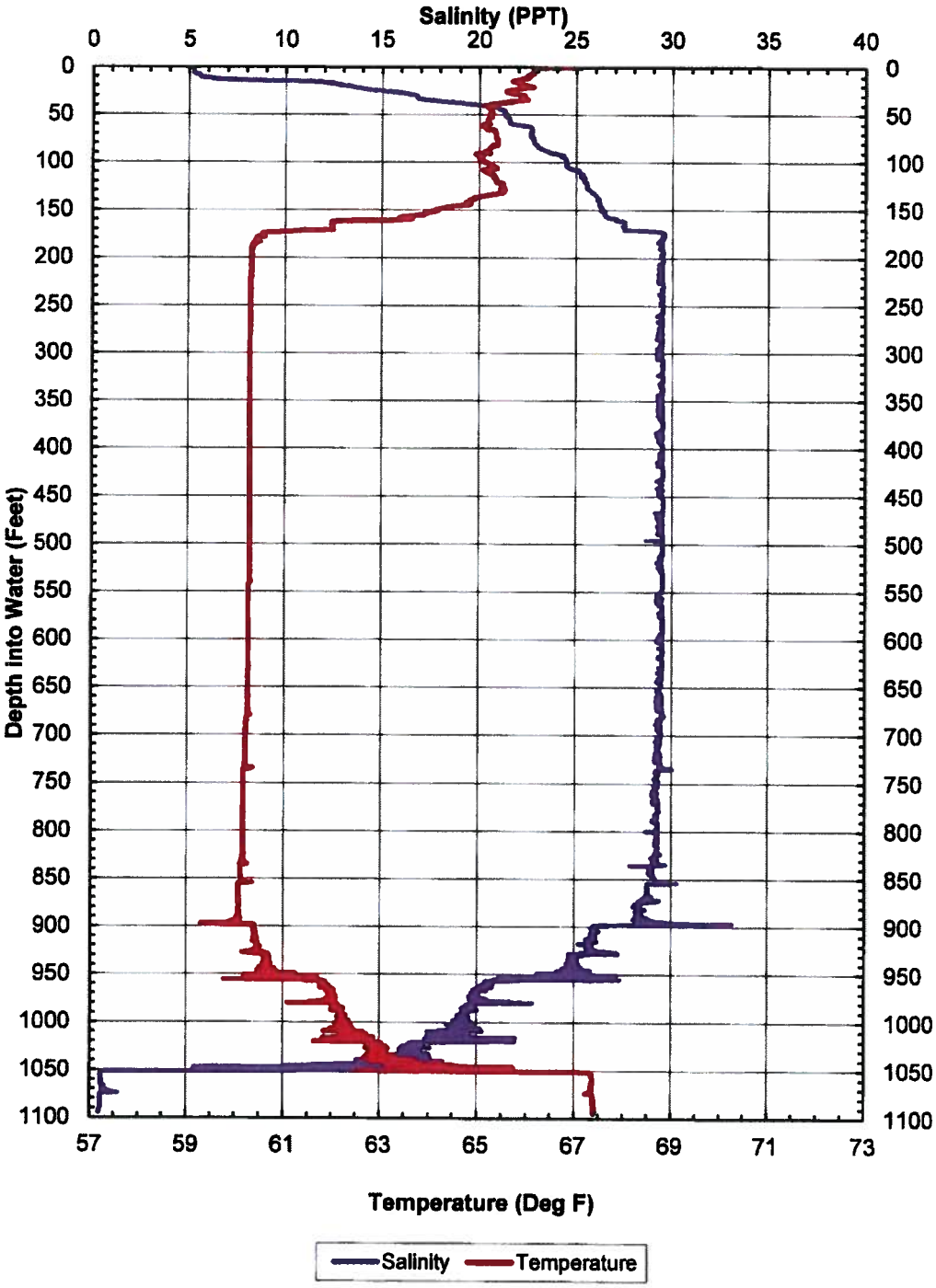
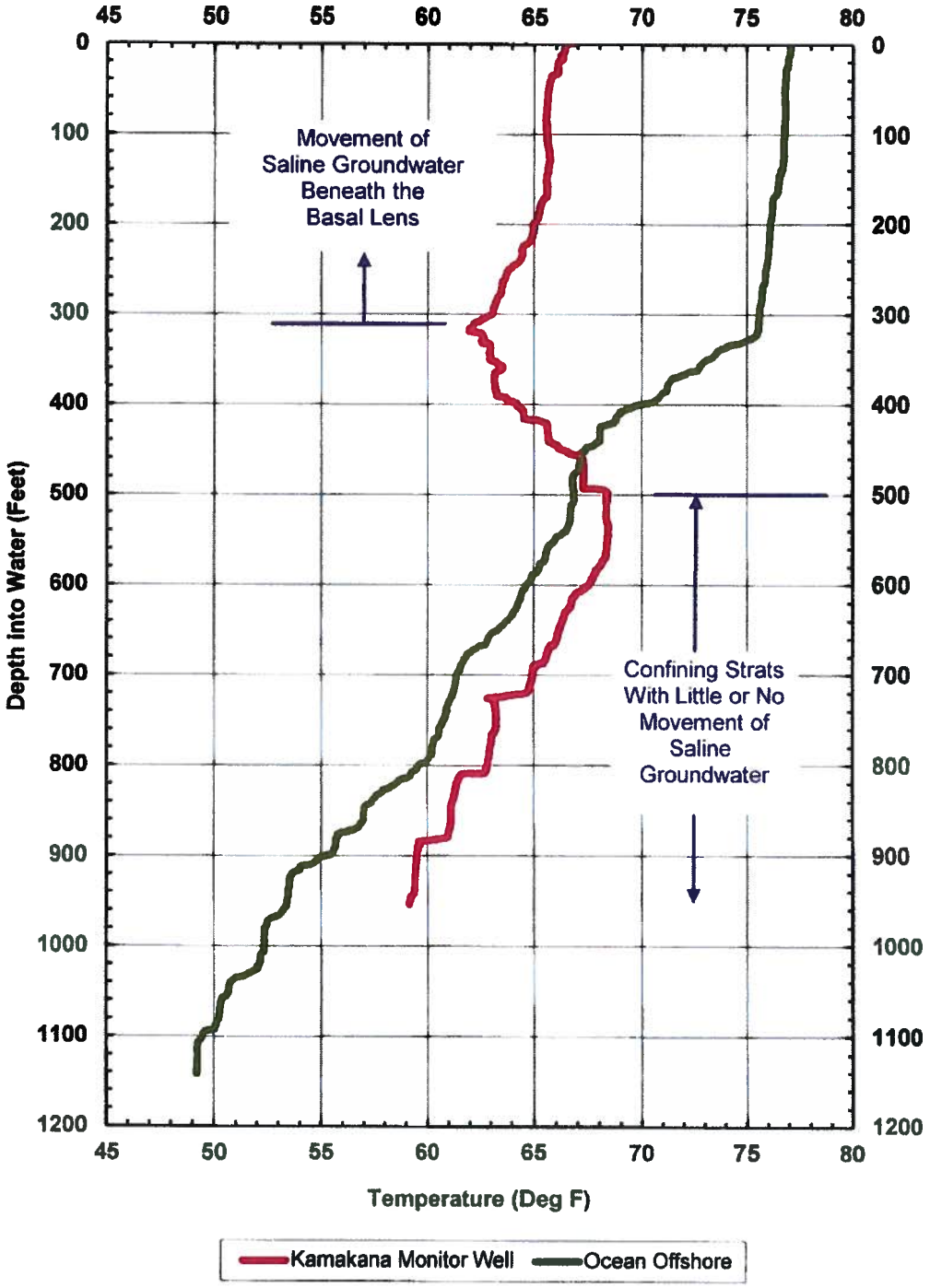


Figure 7. Temperature in Saline Groundwater Below the Basal Lens at the Kamakana Monitor Well



- There are no successful salinity-dependent production wells in the basal lens between Keahole Point and Kailua Town. The very high and unstable salinity at very modest pumping rates in Palani Well (No. 4059-01), which is located 2.6 miles in from the shoreline, is a prime example of this. Results of the Kaloko 1 and Kaloko 2 Wells (No. 4160-01 and -02) are similar examples
- Temperatures at the top of the basal lens are significantly colder than the high level groundwater and these temperatures decrease with depth (Table 2 and Figure 8).

Significance of the Natural Discharge of High Level Groundwater into or Beneath the Basal Lens

If recharge to basal groundwater included substantial leakage from the upgradient high level groundwater, then pumpage from the array of high level groundwater production wells shown on Figures 1 and 4 would ultimately reduce the flow in the basal lens, causing at least some decline in basal water levels and a gradual increase in salinity. In this case, a monitoring well network would be critical to detecting and quantifying the impact on the basal lens.

The discovery of fresh water at depth in the two deep monitor wells (Keopu and Kamakana) and characteristics of basal groundwater between Keahole and Kailua Town suggest that some or perhaps even most of the high level groundwater is not leaking into the basal lens but is instead flowing beneath the lens and discharging offshore along this section of the Keauhou Aquifer. If this interpretation ultimately proves to be the case, a monitoring well network would presumably document that little or no change to basal groundwater as a result of pumping the high level wells has occurred.

MONITORING WELL DATA COMPILED BY TNWRE

As shown on Figures 1 and 4, all six of DWS' active high level wells are located above Mamalahoa Highway and in a linear array from Kalaoa to Waiaha. Any impact to basal groundwater as a result of pumping these high level wells would most obviously occur in the area between Keahole Point to Kailua Town. If the high level groundwater is flowing into the basal lens, high level pumping would reduce the flowrate in the basal lens. Although the basal flowrate is not measurable directly, a reduction in its flowrate should be identifiable as a progressive lowering of the basal water level and/or as a progressive increase in salinity. Both would reflect a shrinking of the lens in response to a lesser flowrate through it. The sections following present monitoring data compiled by TNWRE which provide insight on whether such changes have been detected.

Table 2

Comparative Basal and High Level
Groundwater Temperatures

High Level

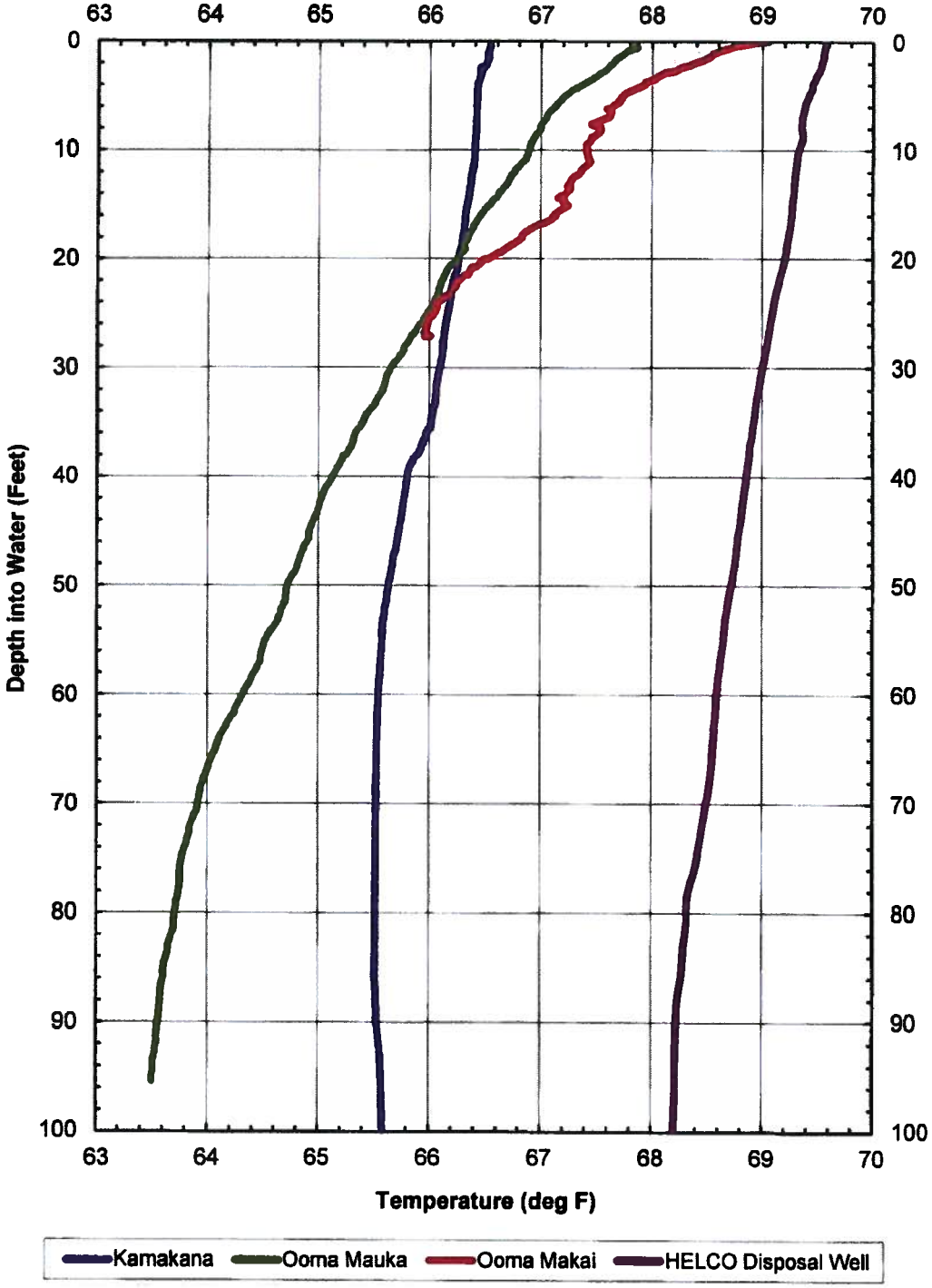
State No.	Name	Temperature (of)
3857-04	Waiaha	70.0
3858-01	Keopu Monitor's	69.8
3957-01	Keopu	70.0
4057-01	QLT	68.0
4158-02	Honokohau	70.3
4258-03	Hualalai	69.8
4358-01	Kalaoa	73.9

Basal

State No.	Name	Temperature (of)
3959-01	Kamakana	66.1
4059-01	Palani	67.5
4160-02	Kalako 2	64.7
--	Ooma Mauka	67.1
--	Ooma Makai	68.4

o:_14-26

Figure 8. Temperature Profiles In Basal Groundwater Between Keahole Point and Kailua Town



Continuous Water Level Recording of Basal Groundwater at the Kamakana Monitor Well

As shown on Figure 4, the Kamakana Monitor Well (State No. 3959-01) is located directly downgradient of DWS' Honokohau and QLT Wells (Nos. 4158-02 and 4057-01, respectively). These are the two most actively used of DWS' six high level production wells (refer back to Table 1 for their use rates). As such, the Kamakana Well is ideally situated to document a declining basal water level, should that be occurring. Water level recording in the Kamakana Monitor Well was begun in August 2011. Except for a 29-day period in August-September 2012, the record is continuous through April 2014. There are three issues which complicate an interpretation of this record. First, as can be expected for basal groundwater in a highly permeable formation, there is a substantial water level response to the ocean's semi-diurnal tide. Second, there are also substantial changes to the ocean's mean water level due to large scale meteorological events and these are reflected in corresponding changes in the mean groundwater levels. Third, the datum for the elevation benchmark used to measure water levels in the Kamakana Well is not from the same datum used by NOAA for its tide gage in Kawaihae Harbor. As described below, these complications can be sorted out to determine if the basal groundwater level has declined with respect to the actual ocean level over the recording period of the Kamakana Well.

- Figure 9 is a comparative plot of the Kamakana water level data and the ocean level as measured by NOAA at Kawaihae Harbor (Figure 9). Except for the obvious disconnect in elevation datums, the data are difficult to interpret as presented in this manner.
- The semi-diurnal ocean tide in both the NOAA and Kamakana data can be filtered out by calculating their respective moving 24-hour averages (24-MAV), making it easier to see that most of the changes in the mean groundwater level are the result of the changes in the mean ocean level (Figures 10 and 11).
- When these water levels are averaged over identical periods (either as averages of the data itself or as averages of the 24-MAVs), the data establish that no decline in the basal water level relative to the actual ocean level has occurred over the August 2011 through April 2014 period. In fact, there has been a slight and gradual rise of the basal water level relative to the ocean level over this period (tally below).

Comparative Mean Water Levels

Year	Kamakana Well (Feet MSL)	Kawaihae Tide (Feet MSL)	Height Difference (Feet)
2011 (Aug. thru Dec.)	3.2085	0.0913	3.1172
2012	3.1552	0.0187	3.1365
2013	3.2844	0.0986	3.1858
2014 (thru 4/30)	3.2352	-0.00.12	3.2364

Figure 9. Water Level in the Kamakana Monitor Well in Comparison to the Ocean Tide at Kawaihae Harbor

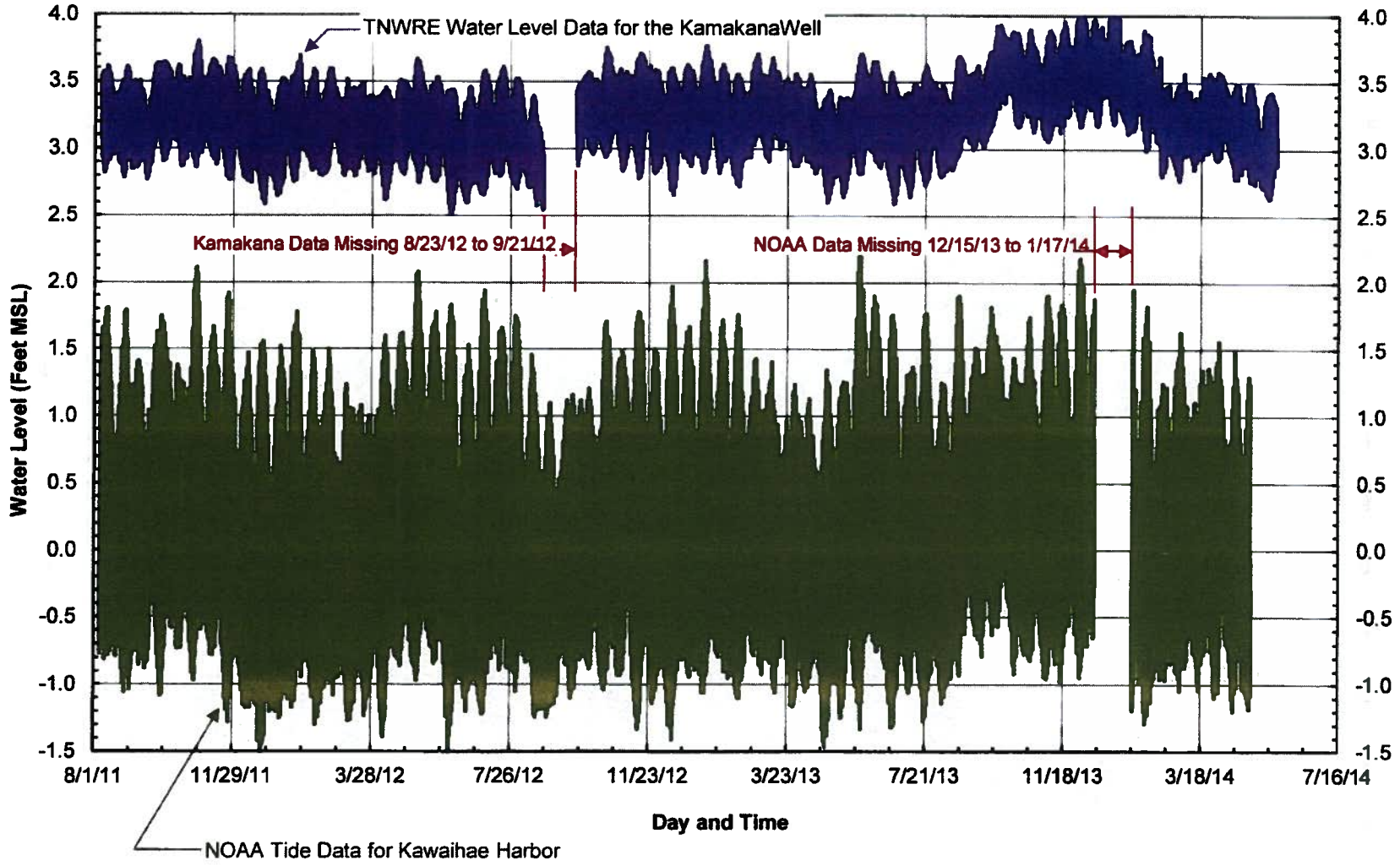


Figure 10. Filtering the Semi-Diurnal Tide Using the 24-MAV Statistic

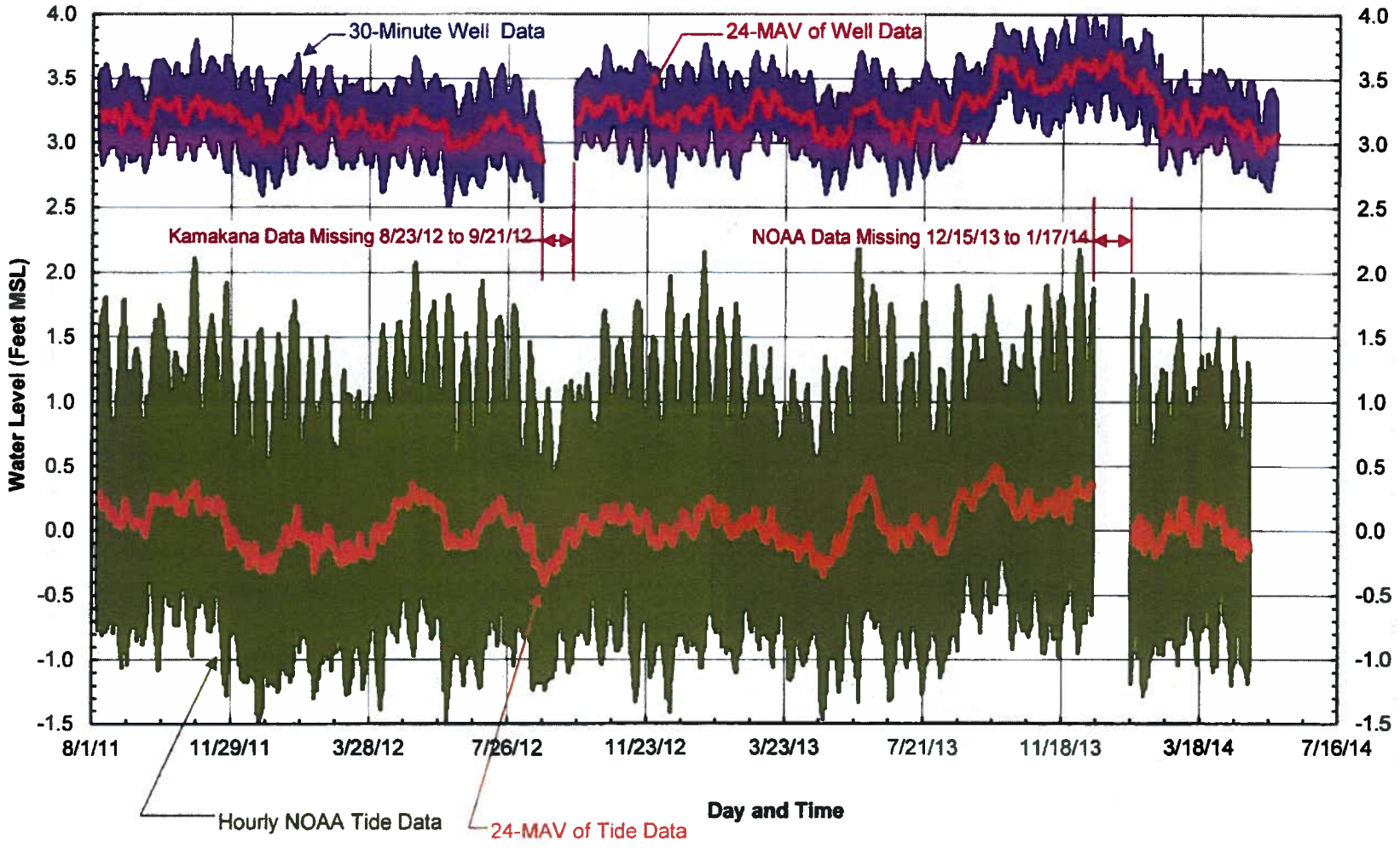
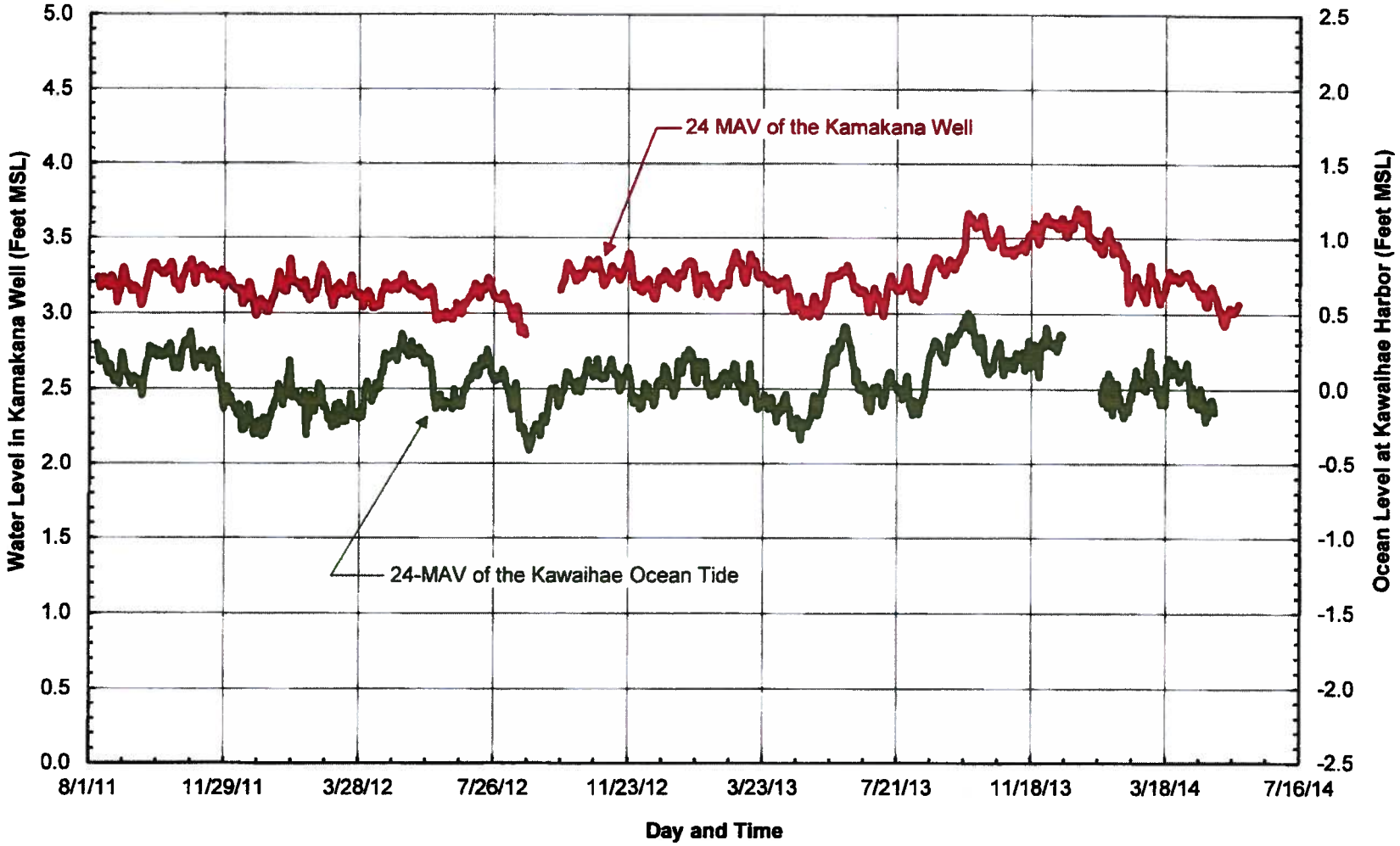


Figure 11. Comparison of the 24-MAVs of Water Levels in the Kamakana Monitor Well and at Kawaihae Harbor



Salinity Profiling to Track Changes in a Basal Lens

In nearshore areas with very permeable strata, mean water level changes in basal groundwater as a result of changes in the flowrate through the lens are very subtle and difficult to identify, particularly in comparison to the magnitude mean level changes resulting from the varying mean ocean level. Decades of monitoring by TNWRE have demonstrated that a far more effective way to monitor changes in basal groundwater is by a series of salinity profiles through the water columns of wells. The method is described below using results of the FG-2 monitor well in the Puuloa Sector of the very permeable Ewa limestone aquifer on Oahu.

- Using an instrument that records data at 10 times a second, a continuous salinity profile is made through the well's water column. A typical sigmoid salinity curve is obtained which depicts the brackish basal lens and the transition zone from the basal lens above the saline groundwater below (Figure 12). If a basal lens is shrinking due to a reduced flowrate, a time sequence of salinity profiles will shift to the right and shrink upwards over time.
- As shown on Figure 13, two indicators from the salinity profile are selected to track changes over time. For the FG-2 well, these indicators are the salinity at a depth of 10 feet into groundwater and the depth to the midpoint of the transition zone, defined for the FG-2 well as the depth where the salinity is 17.5 parts per thousand (PPT). 17.5 PPT is half of seawater's 35 PPT salinity. If the lens is shrinking due to a reduced flowrate, the salinity 10 feet into water would gradually increase and the depth to the midpoint of the transition zone would gradually decrease.
- The two indicators parameters are graphically arrayed over the 20-year record for FG-2 on Figure 14. Over that time, major changes to the aquifer are readily identified. Over this same 20-year period, TNWRE has recorded groundwater levels at a number of locations in the aquifer. Other than the dramatic impact of the November 1996 storm, the water level record over this 20 year period does not identify these changes as they are one to two orders of magnitude less than the effects of the varying mean ocean level.

Salinity Profiling Results in the Kamakana Monitor Well. Salinity profiling through the basal lens in the Kamakana Monitor Well has been done 22 times since April 2010. Figure 15 depicts the first (April 3, 2010) and most recent (May 22, 2014) profiles. Using as indicators the salinity ten feet into groundwater and the depth to the midpoint of the transition zone (ie. the depth at a salinity of 17.5 PPT), the series of results for the 22 profiles is presented on Figure 16. The salinity 10 feet into water at present is essentially the same as its level in April 2010. There has been a slight decrease in the depth to the midpoint of the transition zone, an aspect that bears watching during future monitoring.

Figure 12. Salinity and Temperature Profile through the Water Column of the FG-2 Monitor Well on May 4, 2014

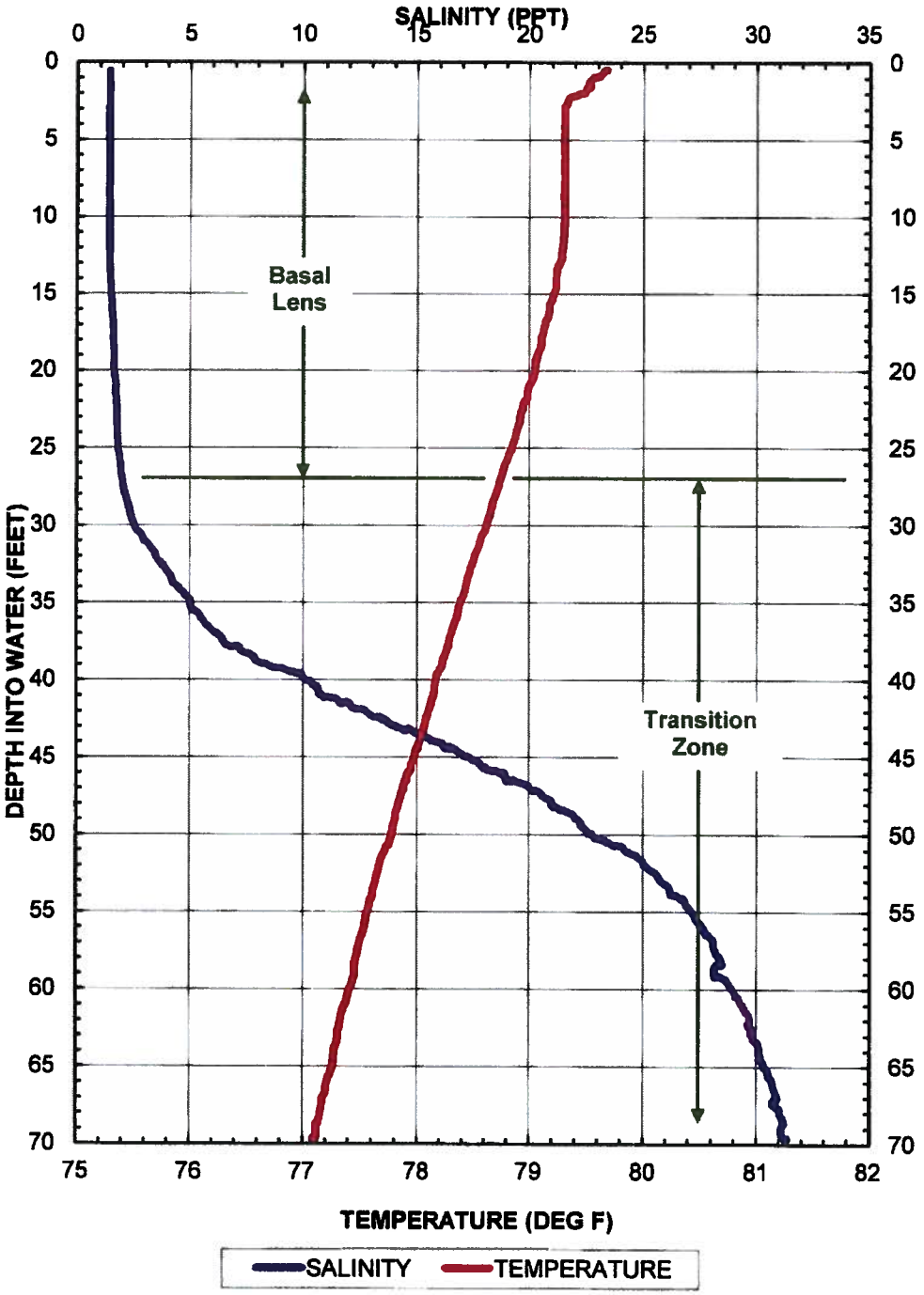


Figure 13. Salinity Profile Indicator Parameters

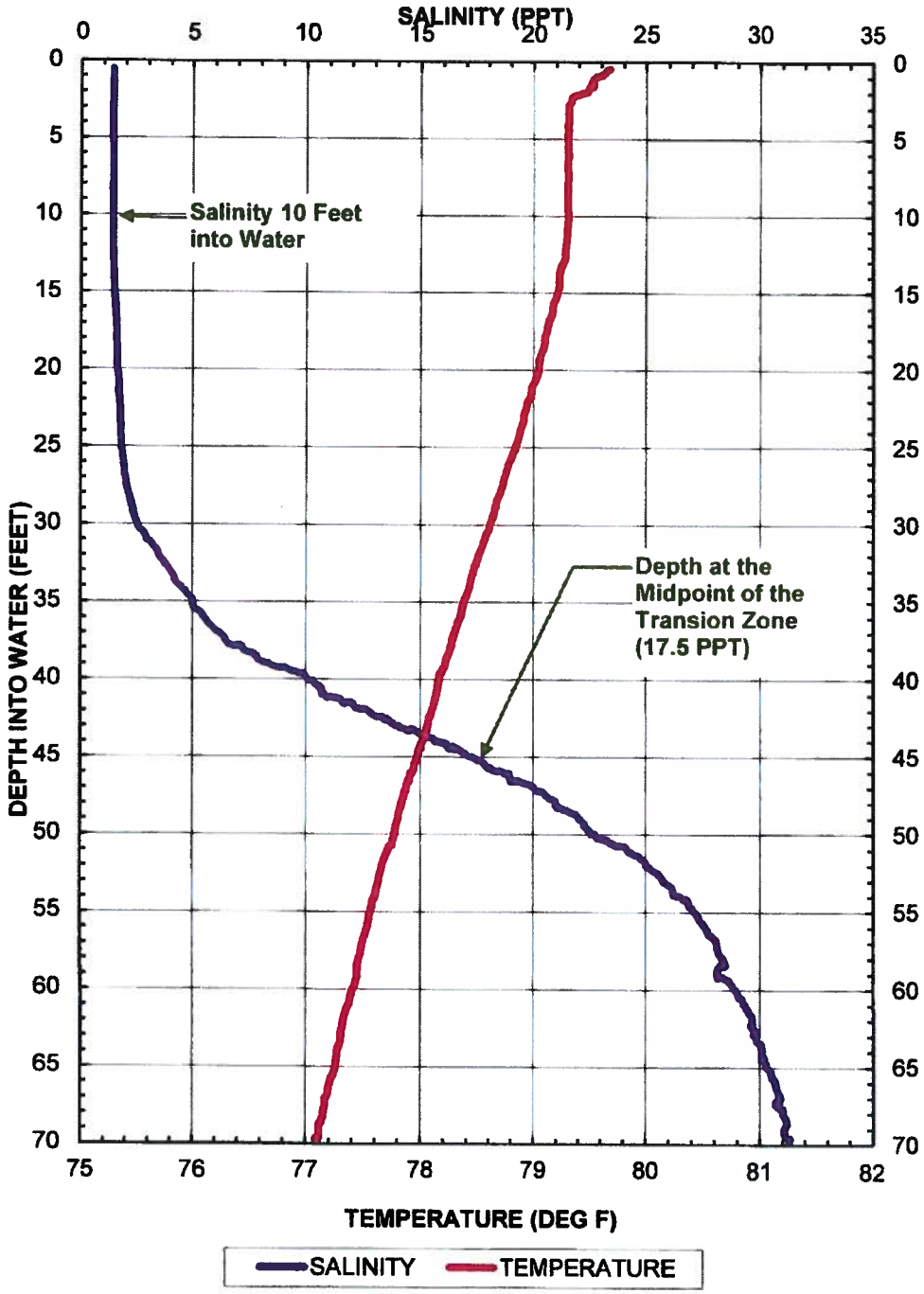


Figure 14. Salinity Trends in the Puuloa Sector of the Ewa Limestone Aquifer as Depicted by Data from the FG-2 Monitor Well

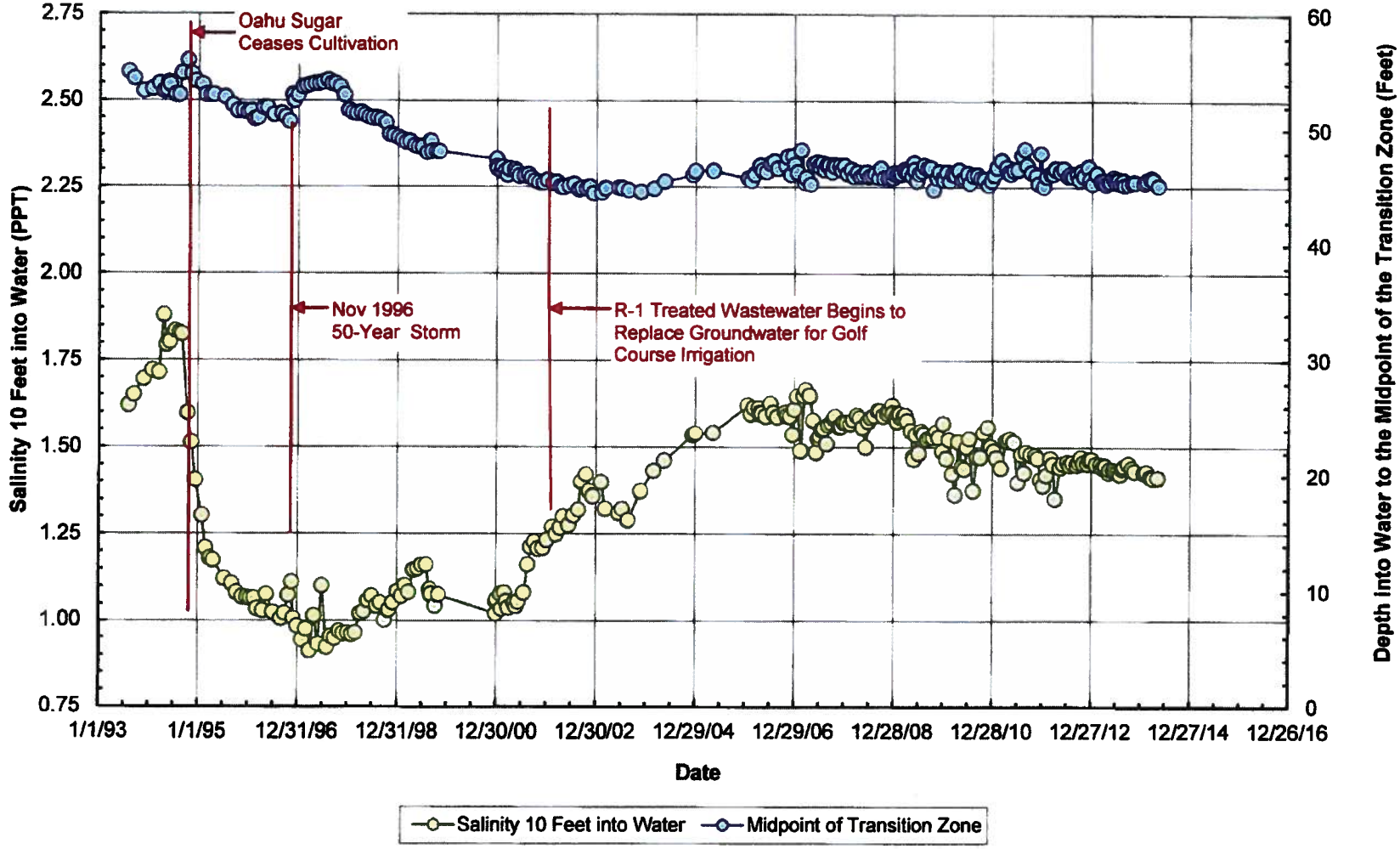


Figure 15. Comparative Salinity Profiles through the Water Column of the Kamakana Monitor Well, April 3, 2010 Versus May 22, 2014

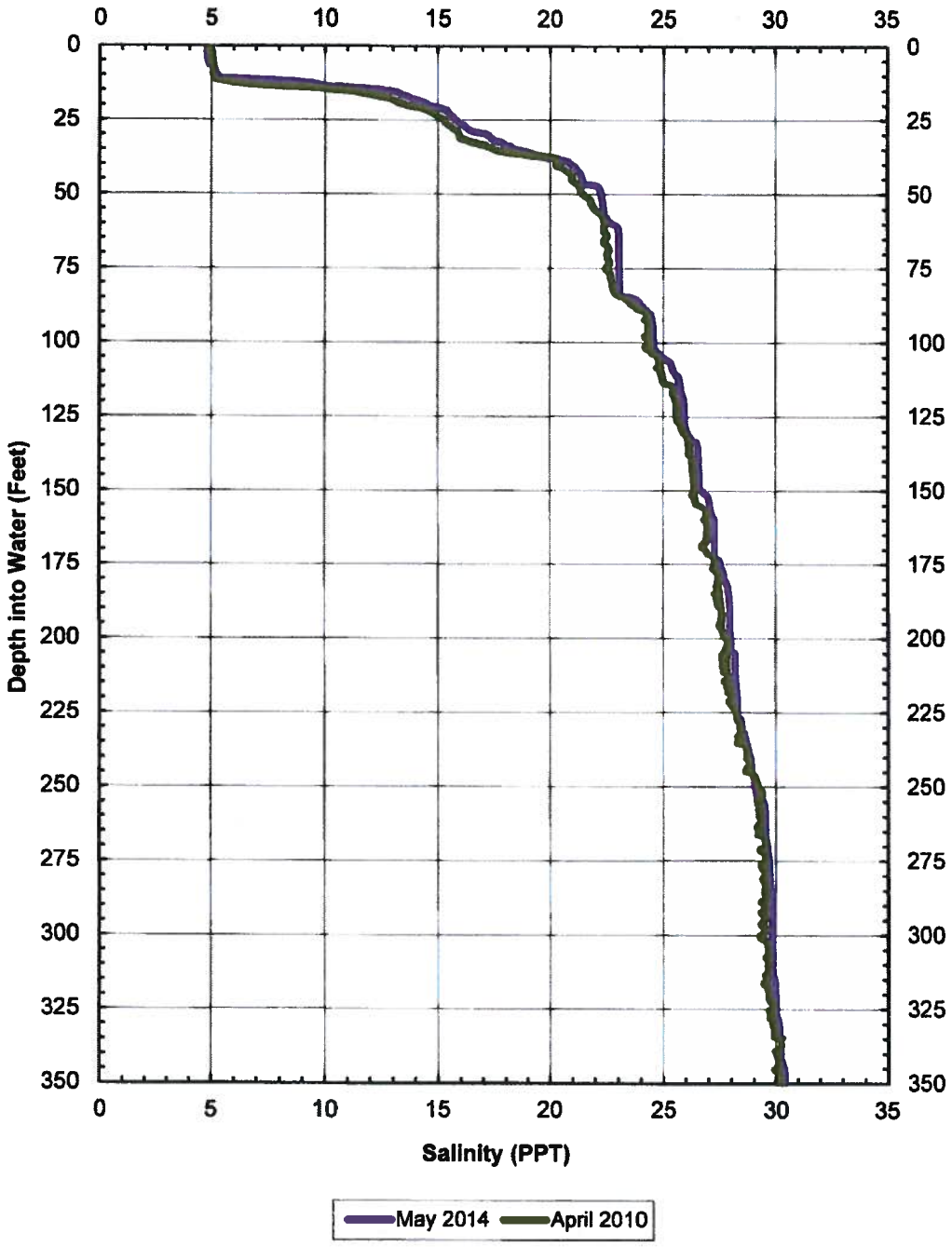
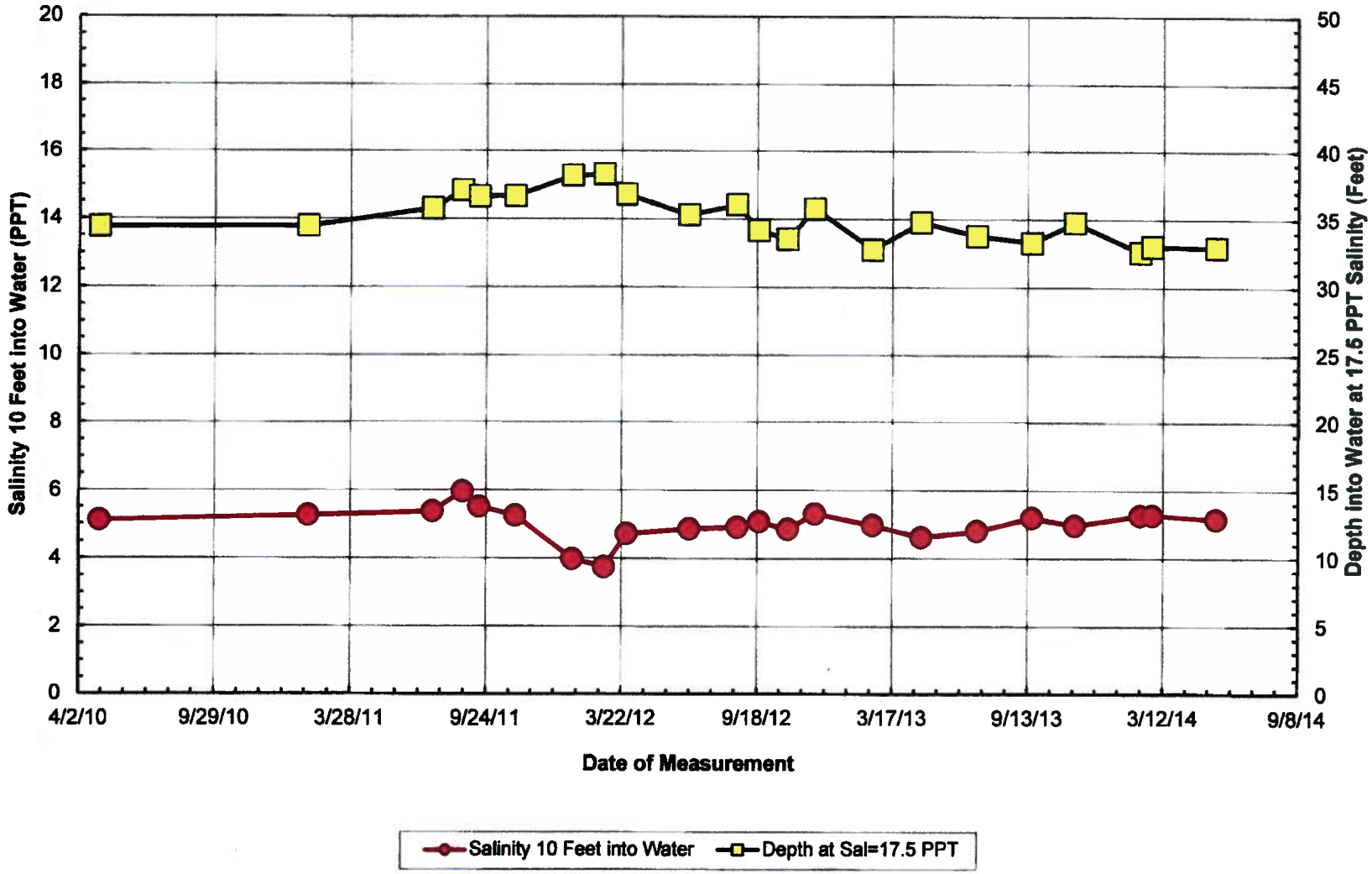


Figure 16. Trends of Salinity Indicator Parameters from Salinity Profiling in the Kamakana Monitor Well



Salinity Profiling Results in the Ooma Monitor Wells. Locations of the two Ooma monitor wells are shown on Figure 4. Although they have not been profiled as frequently as the Kamakana Monitor Well, their record starts in November 2002, a longer period of time than for the Kamakana well. Its most recent salinity and temperature profiles are shown on Figures 17 and 18. Trends of salinity (10 feet into water) and lens thickness (depth to 17.5 PPT salinity) are shown on Figures 19 and 20. Over the 12-year period of record, the salinities 10 feet into water are the same or slightly fresher than in November 2002 and the depths to the midpoint of the transition zone are essentially unchanged. The closely spaced sequence of profiles in May 2009 and again in May 2014 were done to see the effect on the profiles of the semi-diurnal tide. For nearshore wells such as the two at Ooma, that effect is relatively significant, creating significant variability in the indicator parameters.

Salinity Profiling Results in the Kaloko 2 Irrigation Well. The Kaloko 2 irrigation well only penetrates about 18 feet into groundwater, not deep enough to reach the midpoint of the transition zone (Figure 21). In lieu of this, the salinity at varying depths into groundwater have been tracked (Figure 22). No trend of increasing salinity in this well has occurred since the first salinity profile done in March 1996.

FUTURE MONITORING AS PUMPAGE OF HIGH LEVEL GROUNDWATER INCREASES

So far, monitoring data of the basal lens as complied by TNWRE has not shown an impact of high level groundwater pumpage on the nominally downgradient basal lens. However, there is still an unresolved question on whether the natural discharge of groundwater is into or beneath the basal lens. Also, it is virtually certain that high level groundwater pumpage will increase in the future. A number of new wells in production are foreseeable, including Palani 1 (No. 4158-03), Keopu 4 (No. 3957-05), another QLT well, and another well near Waiaha. Greater use of the Keopu Well (No. 3957-01) will be made possible with transmission improvements in the Mamalahoa corridor to be completed as a part of outfitting the Keopu 4 Well. Similarly, greater use of the Waiaha Well (No. 3857-04) will occur with completion of a nearby mauka-to-makai transmission corridor. In light of the foreseeable increase in high level groundwater pumpage, it is reasonable to ask if current ongoing monitoring will adequately detect changes to basal groundwater resulting from this use. Recommendations for groundwater monitoring going forward are as follows:

- Continue salinity profiling and water level recording in the Kamakana Monitor Well. It is ideally located downgradient of present and foreseeable future high level groundwater pumping.
- Drill the Kaloko 2 irrigation well at least 400 feet deeper and convert it to a permanent monitoring well with continuous water level recording and salinity profiling. The recommended depth will completely portray the basal lens and transition zone and also the temperature reversal at depth. As with the Kamakana Well, the well is ideally located. It is downgradient of DWS' Hualalai Well

Figure 17. Salinity and Temperature Profile in the Ooma Mauka Monitor Well on May 20, 2014

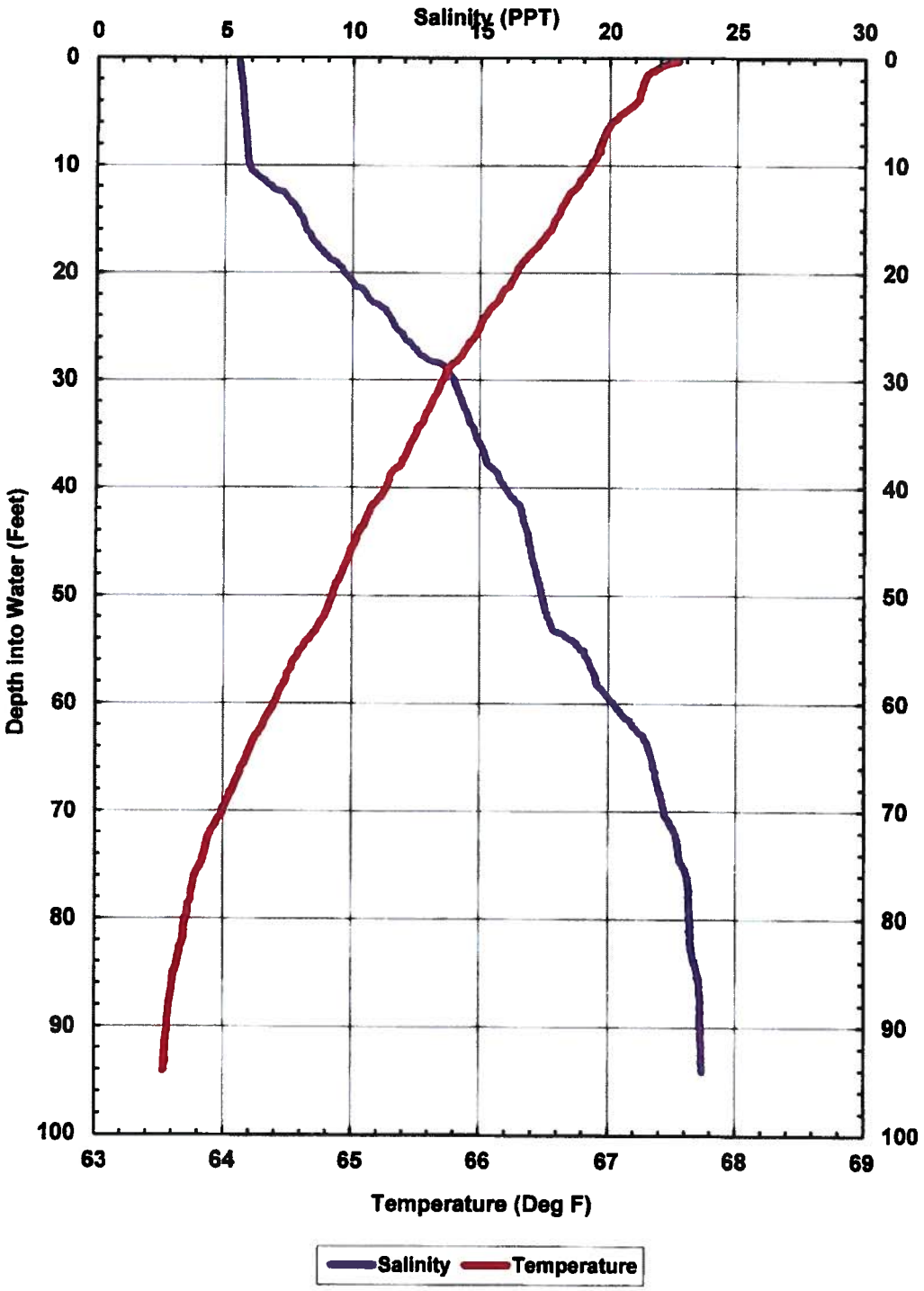


Figure 18. Salinity and Temperature Profile in the Ooma Makai Monitor Well on May 20, 2014

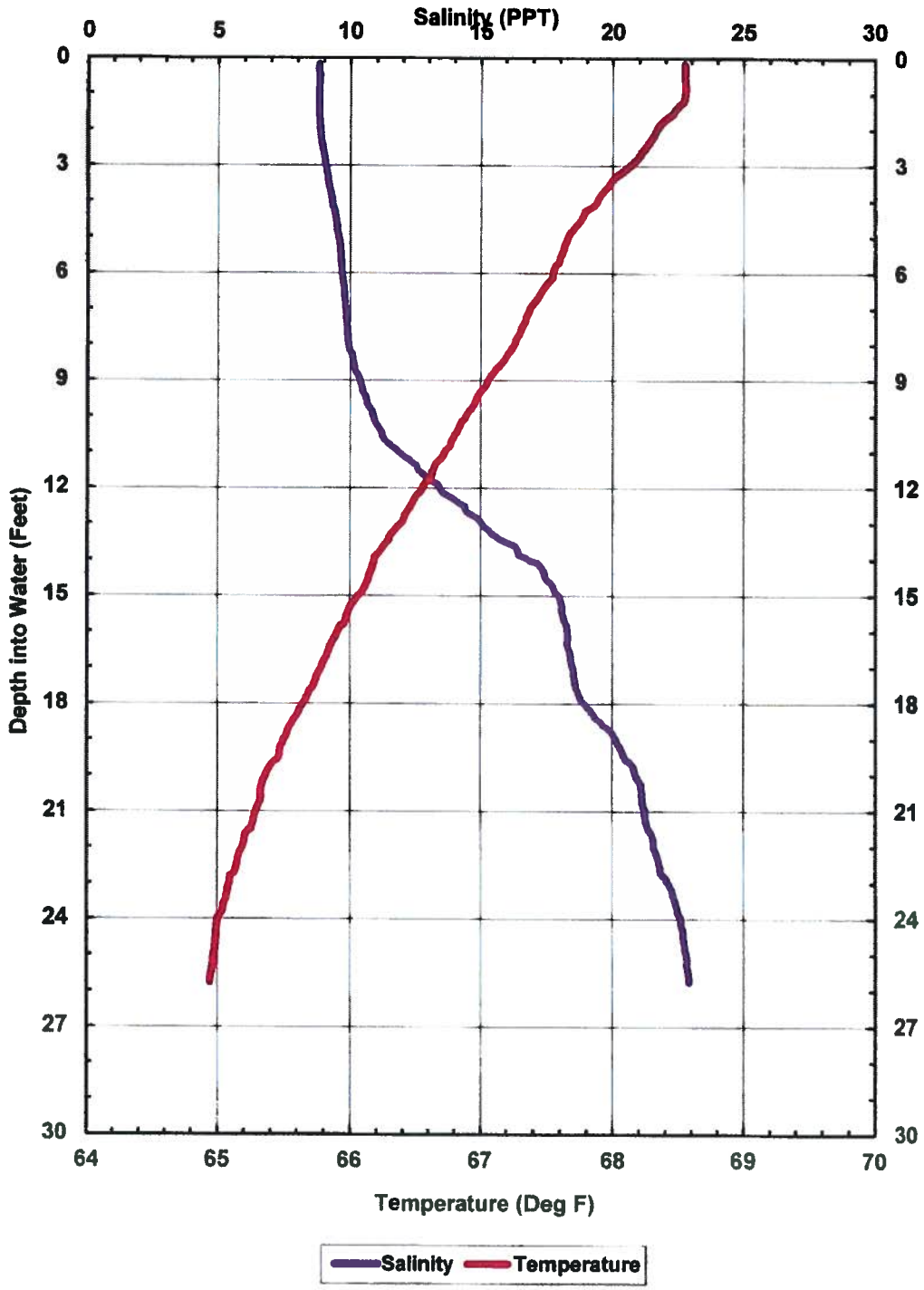


Figure 19. Trends of Salinity Indicator Parameters in the Ooma Mauka Monitor Well

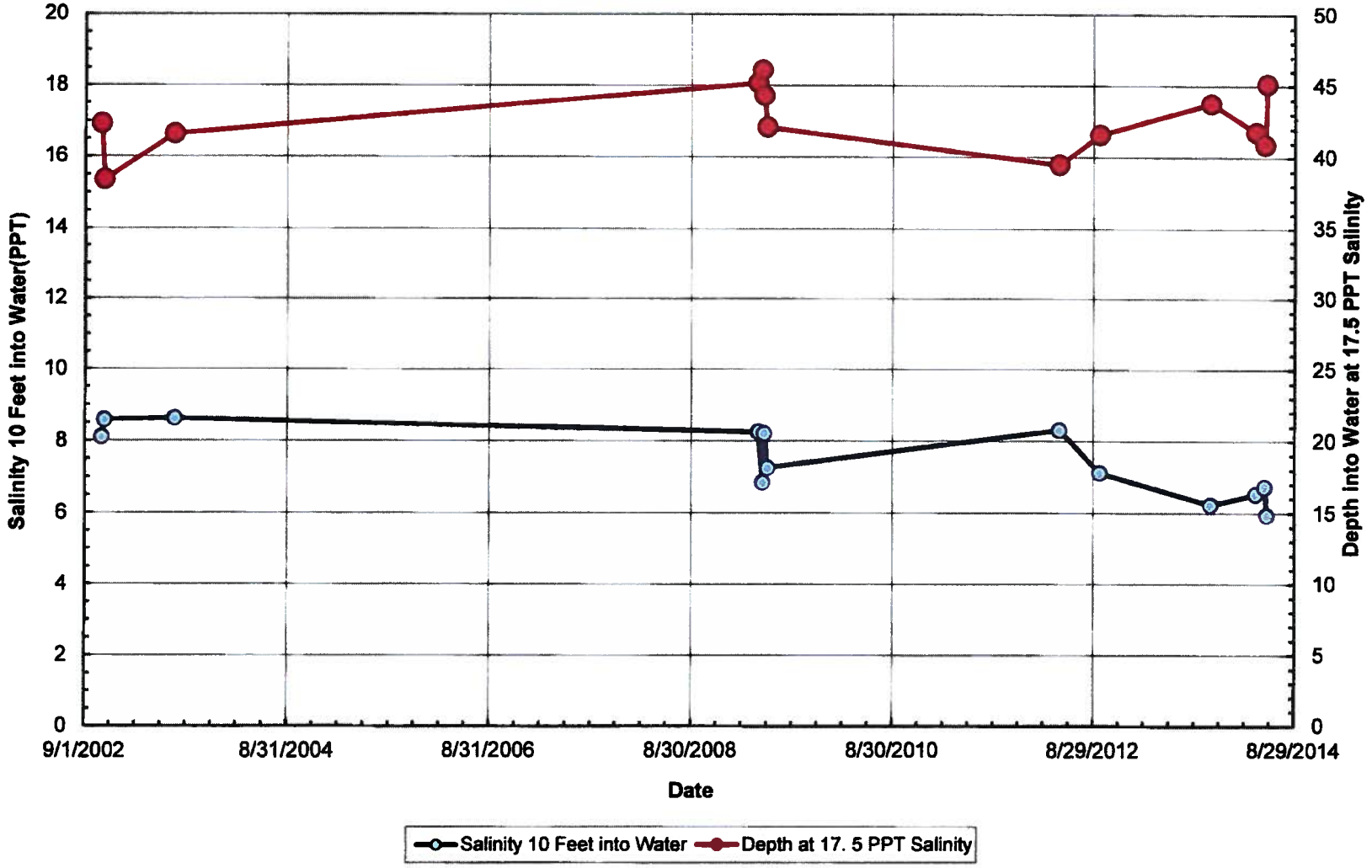


Figure 20. Trends of Salinity Indicator Parameters in the Ooma Makai Monitor Well

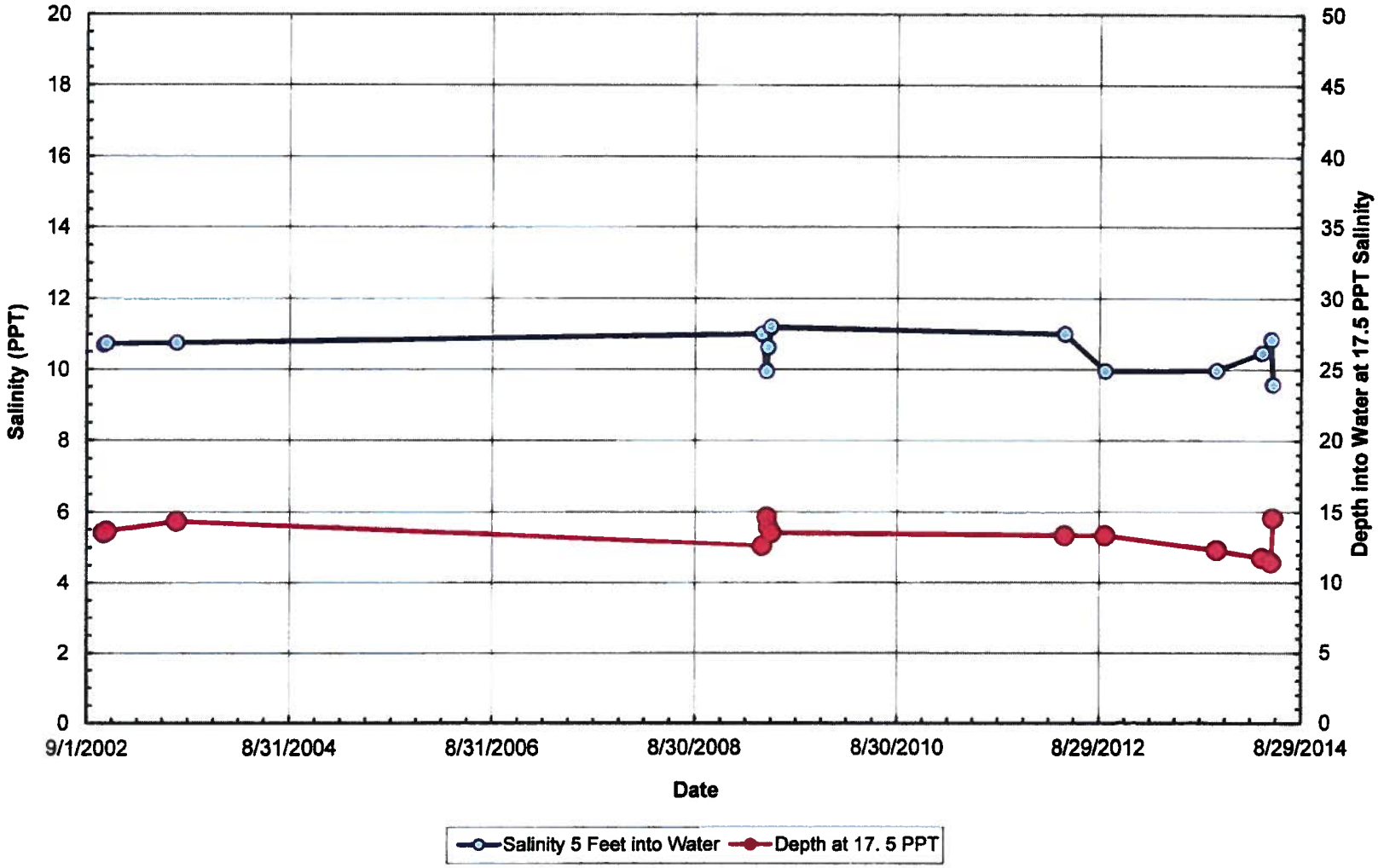


Figure 21. Salinity and Temperature Profile through the Water Column of the Kaloko 2 Irrigation Well (No. 4160-02) on May 13, 2014

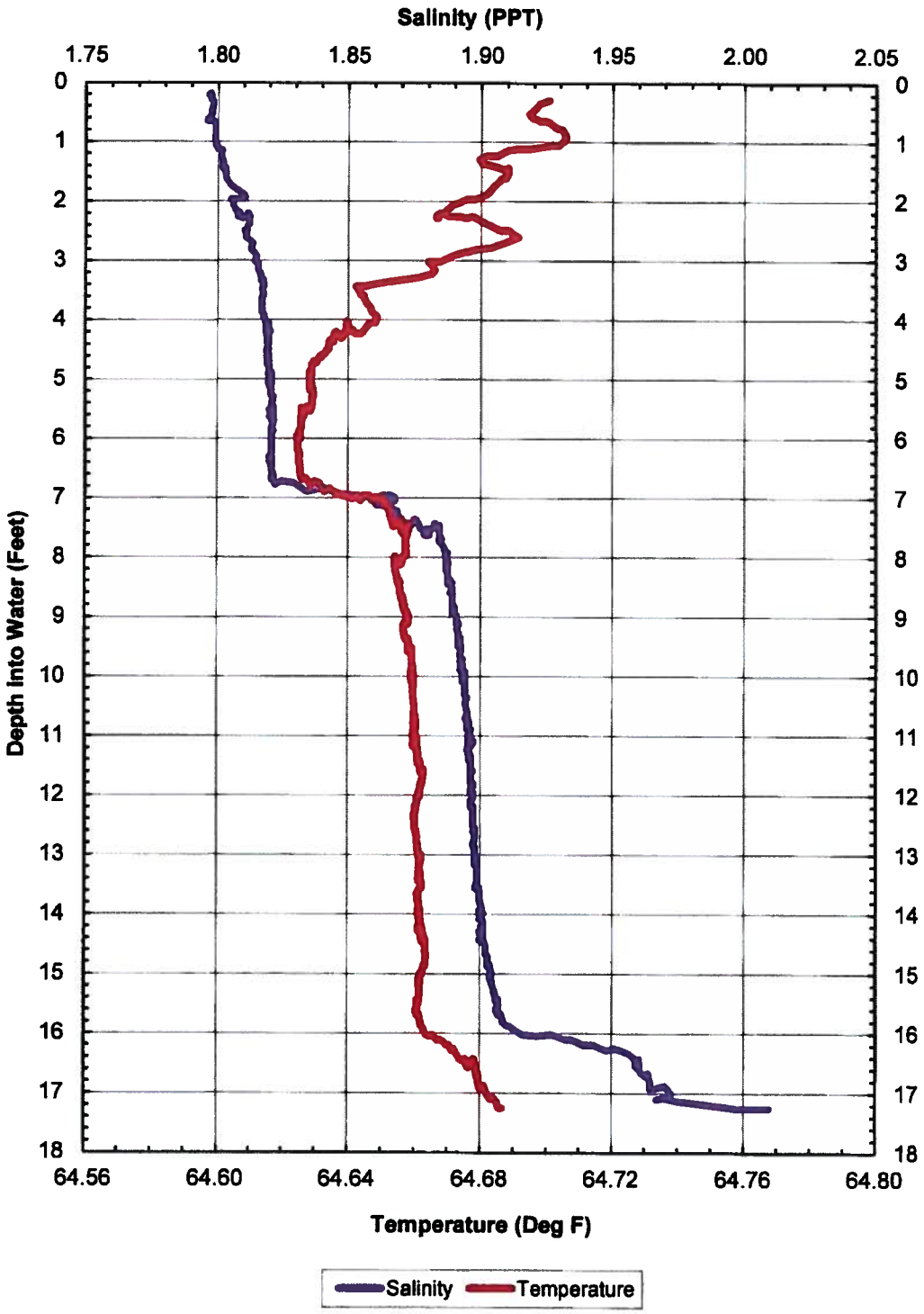
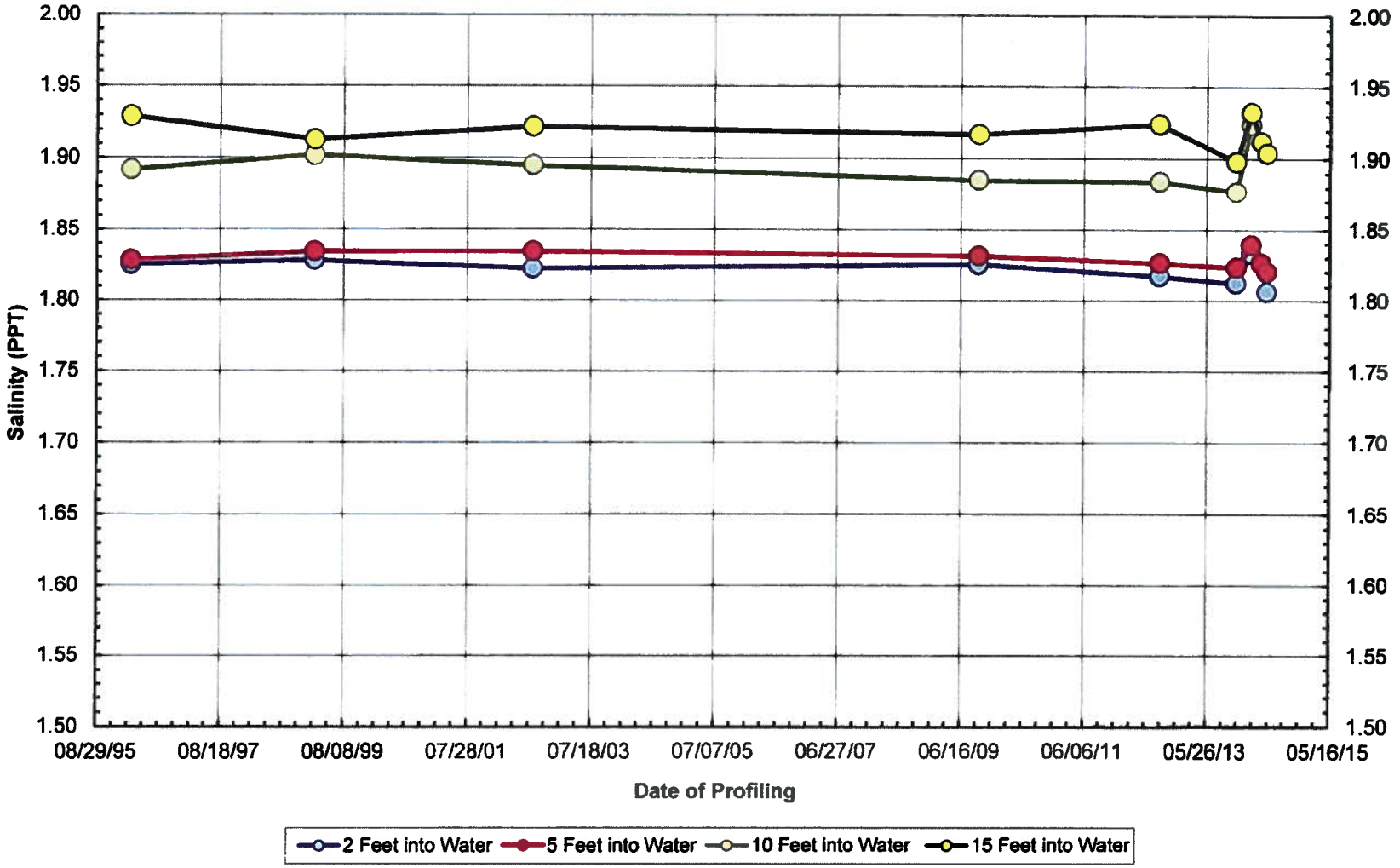


Figure 22. Salinity Trends in the Water Column of the Kaloko 2 Irrigation Well



(No. 4258-03) and the soon to be put into service Palani Well (No. 4158-03). It is also directly upgradient of KAHO. The water levels and periodic salinity profiles in both the Kamakana and Kalaoa 2 Wells would enable an accurate depiction of potential changes in the basal lens downgradient of pumpage of the high level aquifer between Kalaoa and Waiaha.

- Continue periodic salinity profiling in the Ooma monitor wells. Although these wells are not ideally located, their records predate the start of pumpage in the high level aquifer and are useful in that respect.

SUMMARY OF RESULTS FROM THE KOHANAIKI WATER QUALITY MONITORING PROGRAM

Prepared by:
Dr Richard Brock, Ph.D.
Aquatic Resource Specialist
Environmental Assessment, LLC
1232 Lunalilo Home Road
Honolulu, Hawaii 96825

SUMMARY OF RESULTS FROM THE

KOHANAIKI WATER QUALITY MONITORING PROGRAM

Richard Brock, Ph.D.

Environmental Assessment, LLC
1232 Lunalilo Home Road
Honolulu, Hawaii 96825

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EAC Report No. 2014-09

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SUMMARY OF RESULTS FROM THE

KOHANAIKI WATER QUALITY MONITORING PROGRAM

R. Brock, Ph.D.

1.0 Background

1.1 The Monitoring Program

As part of the permitting process allowing the Kohanaiki development to occur, the County of Hawai'i imposed a requirement for a water quality monitoring program to insure that the quality of the ground and nearshore marine waters are not degraded as the development proceeds. This monitoring program was approved by federal, state and county agencies and the methods follow the Hawai'i State Department of Health (DOH) Regional water quality protocols (HAR Chapter 11-54-[6]d). Samples are handled as per USEPA protocols and follow procedures outlined in Standard Methods (1999). Samples are analyzed at the University of Washington's School of Oceanography Marine Chemistry Laboratory that specializes in low level nutrient analysis.

Sampling is carried out six times a year during dry periods as well as following high rainfall events where the "trigger" initiating sampling is 1.5 inches or more of rainfall falling within a 24-hour period. In each survey between 105 to 110 samples are collected which includes replicates for quality assurance/quality control purposes. Samples are collected from the ocean, in brackish anchialine ponds present on the project site and from wells present in the project area. Eight marine samples are collected along transects that commence at the shoreline at extend 500 m seaward. Four marine transects have been established away from the project site to serve as control sites (one fronting Wawaloli Beach, 1.2 km north of the project site and three transects to the south established offshore of the Kaloko-Honokohau National Historical Park (or KAHO). Five marine transects have been set up fronting the Kohanaiki project site. Thus on each survey, 32 marine samples are from control sites and 40 marine samples come from the waters fronting the Kohanaiki project site. On land samples are drawn from 14 wells, 16 anchialine ponds and one reservoir all located on the project site. Figure 1 shows the approximate locations of the marine transects as well as the pond and well sample sites.

Four surveys (from April through June 2005) were undertaken prior to the commencement of construction. Site grading commenced in September 2005 and more recently construction is ongoing. Over this period of time 57 water quality monitoring surveys have been completed with eleven of them occurring following high rainfall events. Golf course construction was undertaken in the June 2007 through May 2009 period and the "grow-in" period establishing the golf course turf was finished in October 2009. Since the completion of golf course grow-in, 32 surveys have been done and through the January 2014 period 5,683 water quality samples have been analyzed and reported on. This report summarizes the findings of this monitoring program

through January 2014.

FACT: Because the Kohanaiki project site is directly north of the KAHO, the water quality monitoring program is the most stringent of all such non-potable monitoring programs in West Hawai'i (i.e., frequency of sampling, numbers of samples).

2.0 Results

2.1 Compliance with State Standards

The state DOH has water quality standards that apply to marine waters. There are no state water quality standards for anchialine pools or for coastal (non-potable) monitoring wells. In the preconstruction period 32 marine transects were completed finding that fronting the project site the rate of non-compliance was 28% among the parameters and for control site transects the rate of non-compliance was 52%. In the during construction period 461 transects have been completed and for those transects sampling waters offshore of the development the rate of non-compliance is 42% and for control site transects the rate of non-compliance is 60%.

What are the findings telling us? Non-compliance is commonplace for all parameters in the pre- and during construction periods. More non-compliance occurs at the control stations than at stations fronting the development and the greatest geometric means (which are used to determine compliance) are found at control sites for all parameters. These findings are related to the greater groundwater escapement to the sea fronting some control site transects.

Fact: Compliance/non-compliance among parameters occurs on a coast-wide basis and is not differentially greater at stations fronting the development.

2.2 Pre-Development Water Quality

The following generalizations have been noted at Kohanaiki as well as at other West Hawai'i sites prior to much development: (1) nutrient concentrations are elevated in mauka groundwater and as groundwater flows towards the sea, the concentrations decrease due to mixing with intruding seawater. (2) However, biological activity and physical processes in anchialine pools may modify nutrient concentrations both up and down but (3) as the groundwater approaches and enters the sea, concentrations decrease very rapidly because ocean water has low concentrations of these parameters. These decreases are primarily due to simple dilution. Figure 2 shows the concentrations of the nutrient nitrate nitrogen (nitrate-N or NO_3) over the first three and a half years prior to the start of golf course construction in a mauka monitoring well adjacent to the property boundary at Kohanaiki and also in two anchialine pools seaward of this well and finally at the shoreline seaward of the two ponds. Figure 3 show the changes in orthophosphorous (ortho-P or PO_4) over the same time period and sample locations.

Fact: In natural undisturbed environments, nutrient concentrations vary tremendously

through both time and space. At some locations concentrations are naturally elevated and at others they are low, but all of them have high variability in concentrations through time. This is reflected in the well data as given in Figures 2 and 3 and is most evident in static monitoring wells relative to coastal wells developed for water withdrawal.

2.3 Water Quality with Development

The same facts continue to hold with development but with the following caveat: coastal development will usually cause increases in some nutrient concentrations and these are seen at sample points makai of the development. At Kohanaiki most of these makai sample points are located in the anchialine pools present on the project site. To expect development not to cause change is denying common sense.

Figure 4 is a continuation of Figure 2 showing the changes in concentration of NO_3 to the present time. Again, the concentrations are generally greater in the mauka well and decrease moving towards the ocean but occasional increases occur in the anchialine pools and these are related to the development and sometimes to high rainfall events. Figure 5 is a continuation of Figure 3 and shows these changes for PO_4 at the same locations up to the present time. Figure 5 again demonstrates the greater fluctuation in the concentration of PO_4 in the mauka well and to a lesser extent at sample points makai due to dilution.

Golf course "grow-in" temporarily increased the concentration of NO_3 in some of the anchialine pools as shown in Figure 6 but the concentrations measured have no impact on biota. Why? There are three reasons: (1) the changes are often less than those found at some non-developed Kona sites, (2) when nutrients are in excess (as is the case for much of Kona's groundwater), adding more does not cause a response and (3) the increases may be large but quickly decrease. If NO_3 is in excess as during "grow-in", it will readily move through soil horizons with irrigation water down to the seaward flowing groundwater below and into the anchialine pools. However phosphorus does not readily move but binds with the soil. This is evident in Figure 7 where there are no identifiable increases in PO_4 above earlier "preconstruction" peaks in the "grow-in" period.

Table 1 presents the mean concentrations of important nutrient parameters in the groundwater over the 2005-2014 period at Kohanaiki as it moves from the mauka boundary of the project site to the shoreline. Nitrate-N, Ortho-P and Total-P all show decreases as the groundwater approaches the shoreline. Similarly in the preconstruction period, Total-N showed the same decrease moving from inland to shoreline sample points. However today in the anchialine pools there is a ~3% increase of Total-N which may be related to the restoration activities occurring in some pools. As expected, salinity increases with proximity to the shoreline. Ammonia-N increases because it is a product of organism metabolism and the anchialine pools have a complex community of organisms nevertheless ammonia-N concentrations like all of the others decrease with proximity to the ocean.

Fact: With development, the decrease in nutrient concentrations in groundwater as measured at inland wells, anchialine pools and seaward to the shoreline seen previously continue to hold with some transitory increases occurring in the anchialine pools but the signature continues to be lost at the shoreline. Despite the fluctuations in concentrations of some nutrients in anchialine pools, there is no evidence of decline to pond biota connected to changes in water quality (Figure 8).

2.4 Changes in Marine Water Quality

The question, "Has the quality of the ocean waters fronting the Kohanaiki project site been negatively impacted by the development?" is addressed in Table 2 examining the means of important nutrient parameters in two time periods, before the commencement of construction and in the during the construction period. The data are examined using the Wilcoxon 2-Sample Test and the results are presented in Table 2. Referring to Table 2, the during construction means for ammonia-N, total-P, salinity and turbidity are all significantly greater than are the preconstruction means. The preconstruction means for nitrate-N and total-N are significantly greater than the during construction means for those two parameters and the means for ortho-P and dissolved silica show no significant differences. These data suggest that the activities occurring at Kohanaiki could be increasing the concentrations of some nutrient parameters.

Another approach to determine if the activities on the Kohanaiki project site are having a negative impact to the quality of the adjacent marine waters is to examine the means of important nutrient parameters as sampled from the marine control sites and compare these means to those from the sample sites fronting Kohanaiki. Table 3 presents the results of the Wilcoxon 2-Sample Test addressing the question, "Are there significant differences among the mean parameter concentrations for samples collected at control transects relative to those collected fronting the project site?". Referring to Table 3, all of the important nutrient parameters have significantly greater mean concentrations at the marine control site transects relative to the Kohanaiki transects except for salinity which is significantly greater (by 0.953 ppt) offshore of Kohanaiki.

FACT: Despite significant changes in concentrations of some water quality parameters over time offshore of the Kohanaiki project site, these changes are small relative to the mean concentrations measured at the marine control sites. In no case is there any evidence to suggest that the changes in water quality parameters are having any negative impact to the resident reef species.

KOHANAIKI WATER QUALITY SUMMARY: What have the impacts been?

In the Ocean:

No evidence of increased nutrients due to development when compared to adjacent control areas.

On Land:

Transitory increases seen in anchialine pools but the signature is lost at the shoreline.

No decline found in the pond biota connected to changes in water quality.

3.0 OBSERVATIONS ON SALINITY AND ANCHIALINE BIOTA

There is concern that water withdrawals from the Keauhou aquifer for consumption and irrigation may, at some point in the future, cause an increase in the salinity of the anchialine pools and fishponds at the KAHO. These increases in salinity could have a negative impact on some of the aquatic resources at KAHO and elsewhere. After more than forty years of observations on salinity and anchialine biota along the Kona coast, Big Island residents should be aware of the following observations:

1. Most Kona coast anchialine ponds have salinities in the range from 5 to 13 ppt (parts per thousand). For comparative purposes ocean salinity is 34-35 ppt and freshwater is 0 ppt.

2. Most of the common aquatic native anchialine species (like opae'ula) are found in a wide range of salinities (from ~1 ppt to ~30 ppt).

3. There are a few native species found in anchialine pools (like the orangeback damselfly and some emergent vegetation) that do not tolerate higher salinity water (above 8 ppt for the damselfly). However, **all** of these species are found in many other brackish water habitats in the Hawaiian Islands.

4. The rarest of the unusual anchialine shrimp species (6-7 species) are found exclusively in higher salinity anchialine systems (usually above 15 ppt). Some of these species are known from one or two locations only in the Hawaiian Islands and are not found anywhere else. On the Kona coast, ponds with salinities greater than 15 ppt are relatively rare. Any increase in salinity of the Kona coast anchialine ponds would increase the available habitat for these rare species.

4.0 Literature Cited

Standard Methods. 1999. Standard methods for the examination of water and wastewater. 20th edition. American Health Assoc., Washington, D.C. Port City Press, Baltimore, Md. 1325 p.

TABLE 1. Table of means for parameters measured over the 2005 through 2013 period in nine wells located in proximity to the mauka boundary of the Kohanaiki project site (n=290), in 16 anchialine pools (n=971) located makai of most of the development and at five marine shoreline stations (n=289) at Kohanaiki showing the decrease in mean parameter concentrations with proximity to the ocean. All parameter means are in ug/L unless otherwise shown, ppt = parts per thousand.

LOCATION	NO3	NH4	TN	PO4	TP	SALINITY (ppt)
Mauka Wells (n=290)	**1215**	**19**	**1952**	**95**	**156**	**7.779**
Anch. Pools (n=971)	**1077**	**42**	**2013**	**60**	**119**	**12.758**
Shoreline (n=289)	**45**	**4**	**173**	**8**	**16**	**33.948**

TABLE 2. Results of the Wilcoxon 2-Sample Test examining the means of important nutrient parameters in the marine waters fronting the Kohanaiki project site in two time periods: Preconstruction (n=163) and During Construction (n=2,160). The question being addressed is, "Are there any significant differences between the preconstruction means of parameters to those collected in the during construction time period?". All means are in ug/L unless otherwise noted, NTU = Nephelometric Turbidity Units.

Parameter	Preconstruction Mean (n=163)	During Construction Mean (n=2160)	Significantly Different?
Nitrate-N	11.38	10.38	YES (P<0.0001)
Interpretation: During Construction means is significantly less			
Ammonia-N	2.43	3.22	YES (P<0.009)
Interpretation: During Construction means is significantly greater			
Total-N	146.30	131.62	YES (<0.0001)
Interpretation: During Construction mean is significantly less			
Ortho-P	5.62	5.18	NO
Interpretation: No significant differences			
Total-P	12.14	13.07	YES (P<0.0001)
Interpretation: During Construction mean is significantly greater			
Si	399.42	248.21	NO
Interpretation: No significant differences			
Salinity (ppt)	34.191	34.685	YES (P<0.0001)
Interpretation: During Construction mean is significantly greater			
Turbidity (NTU)	0.08	0.11	YES (P<0.0001)
Interpretation: During Construction mean is significantly greater			

TABLE 3. Results of the Wilcoxon 2-Sample Test examining the means of important nutrient parameters in the marine waters fronting the Control Sites (n=1,764) and the Kohanaiki project site (n=2,323) addressing the question, "Are there significant differences among the mean parameter concentrations for samples collected at control transects relative to those collected fronting the project site?". All means are in ug/L unless otherwise noted.

Parameter	Mean Control Sites (n=1764)	Kohanaiki Transect Means (n=2323)	Significantly Different?
Nitrate-N	34.93	10.45	YES (P<0.0001)
Interpretation: Control Site means are significantly greater			
Ammonia-N	6.00	3.16	YES (P<0.0001)
Interpretation: Control Site means are significantly greater			
Total-N	164.20	132.65	YES (P<0.0001)
Interpretation: Control Site means are significantly greater			
Ortho-P	8.97	5.21	YES (P<0.0001)
Interpretation: Control Site means are significantly greater			
Total-P	17.40	13.00	YES (P<0.0001)
Interpretation: Control Site means are significantly greater			
Si	955.60	258.82	YES (P<0.0001)
Interpretation: Control Site means are significantly greater			
Salinity (ppt)	33.698	34.651	YES (P<0.0001)
Interpretation: Kohanaiki Transect mean are significantly greater			
Turbidity (NTU)	0.17	0.11	YES (P<0.0001)
Interpretation: Control Site means are significantly greater			

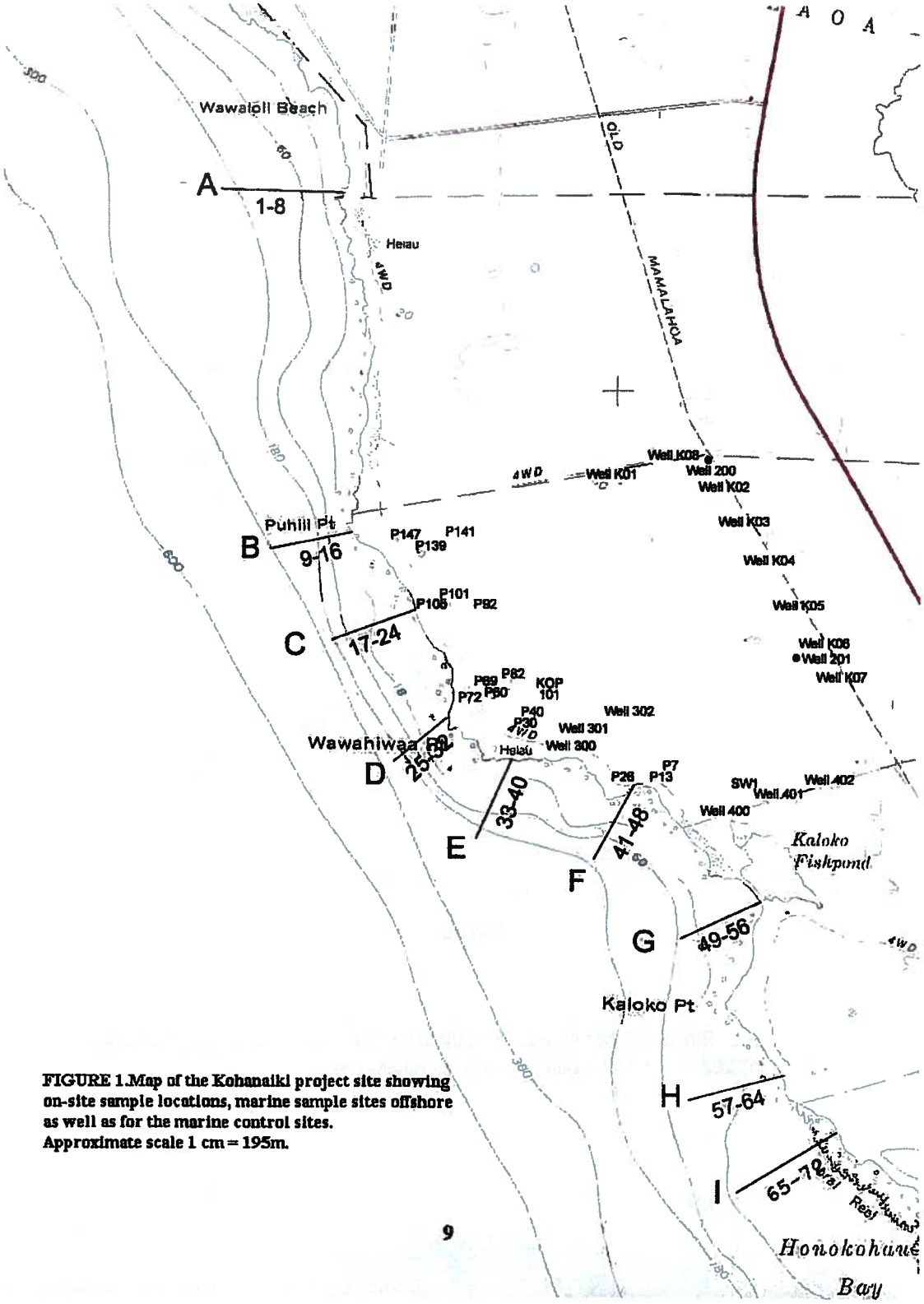

FIGURE 1.Map of the Kohanaiki project site showing on-site sample locations, marine sample sites offshore as well as for the marine control sites. Approximate scale 1 cm = 195m.

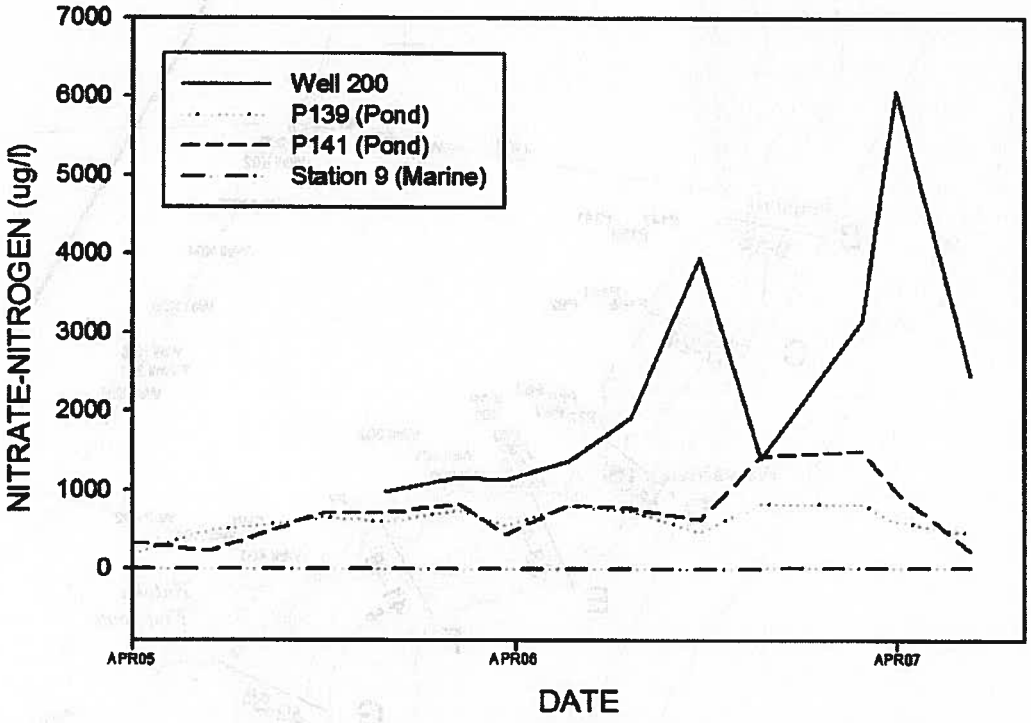

FIGURE 2. Plot of nitrate nitrogen from 2005 through June 2007 at four Kohanaiki sites: Well 200, Pond 139, Pond 141 and shoreline (site 9).

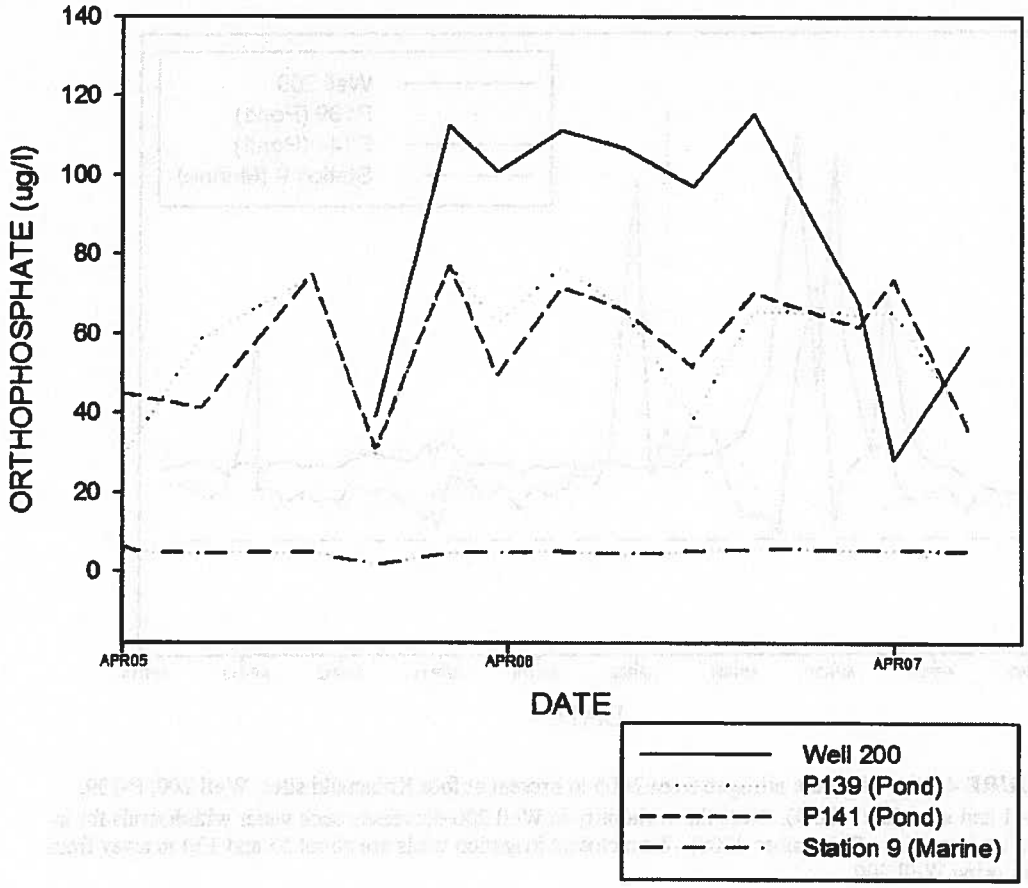

FIGURE 3. Plot of orthophosphorous from 2005 through June 2007 at four Kohanaiki sites: Well 200, Pond 139, Pond 141 and shoreline (site 9).

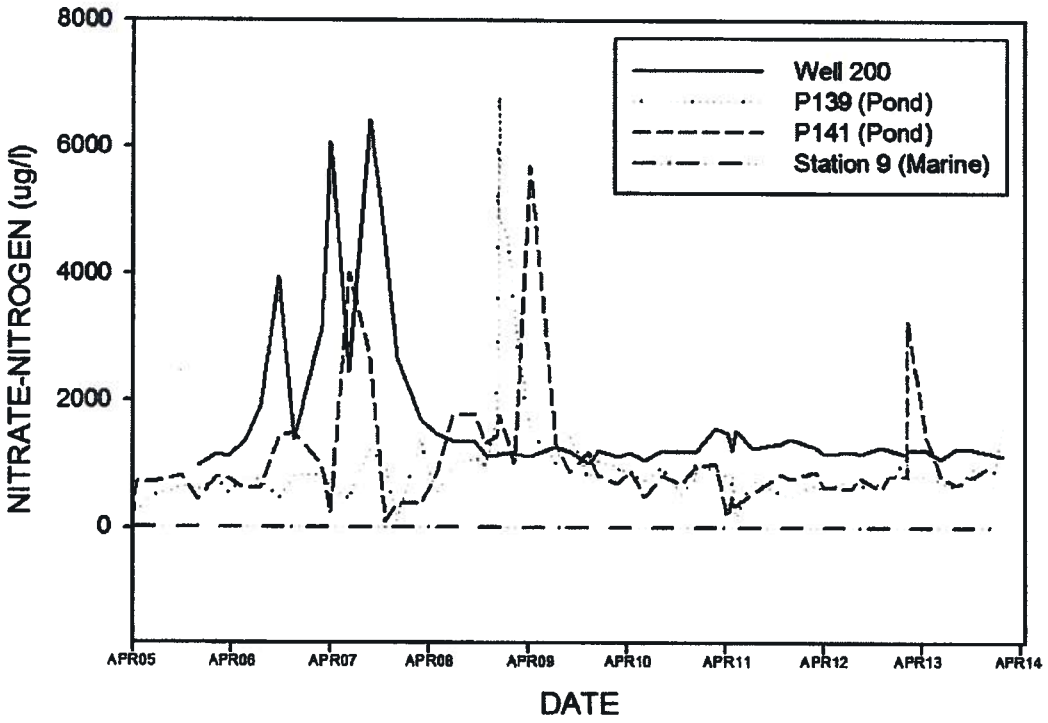

FIGURE 4. Plot of nitrate nitrogen from 2005 to present at four Kohanaiki sites: Well 200, P-139, P-141 and shoreline (site 9). Note the variability in Well 200 decreases once water withdrawals for irrigation commence (December 2008). Two closest irrigation wells are about 55 and 130 m away from monitoring Well 200.

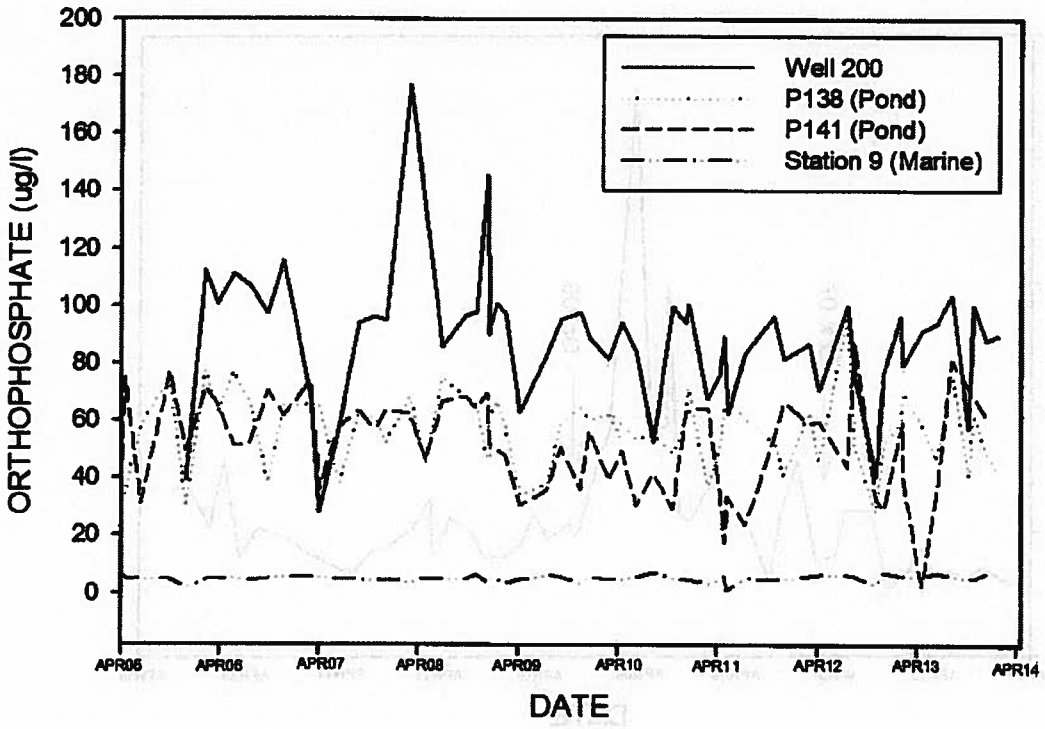

FIGURE 5. Plot of orthophosphorous from 2005 to present at four Kohanaiki sample sites: Well 200, Pond 139, Pond 141 and shoreline (site 9). Unlike nitrate nitrogen, variability with orthophosphorous does not appear to be affected by the operation of nearby irrigation wells.

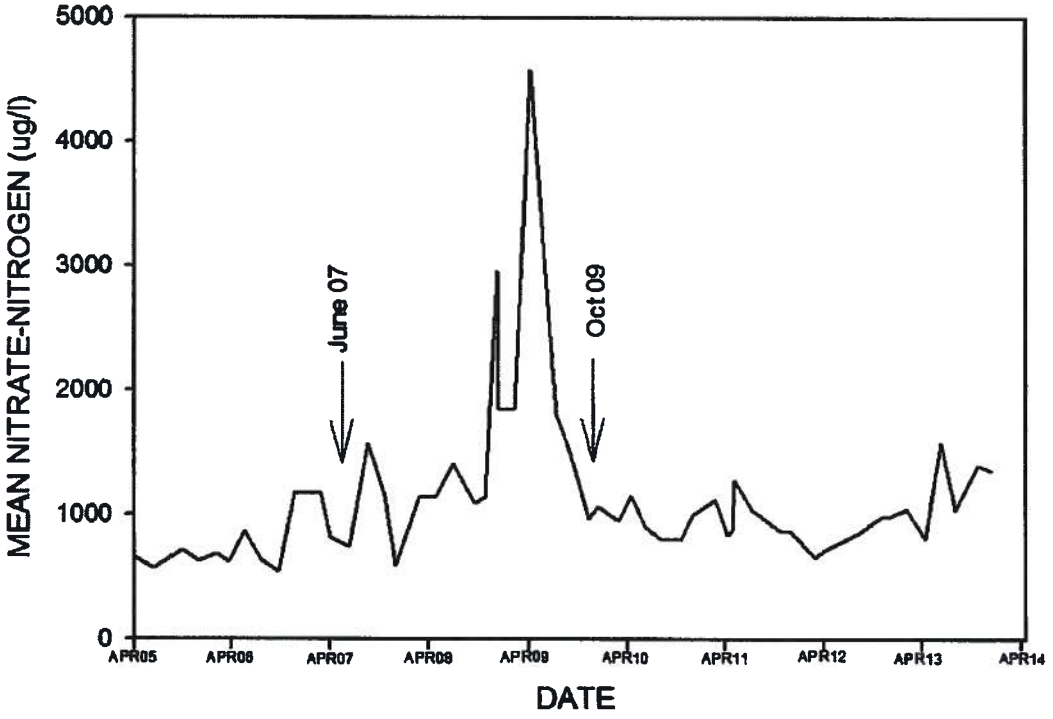

FIGURE 6. Plot of mean nitrate nitrogen by date in all sampled anchialine pools at Kohanaiki from 2005 to present (n=934). Also shown are the start of golf course construction (June 2007) and the completion of golf course "grow-in" in October 2009.

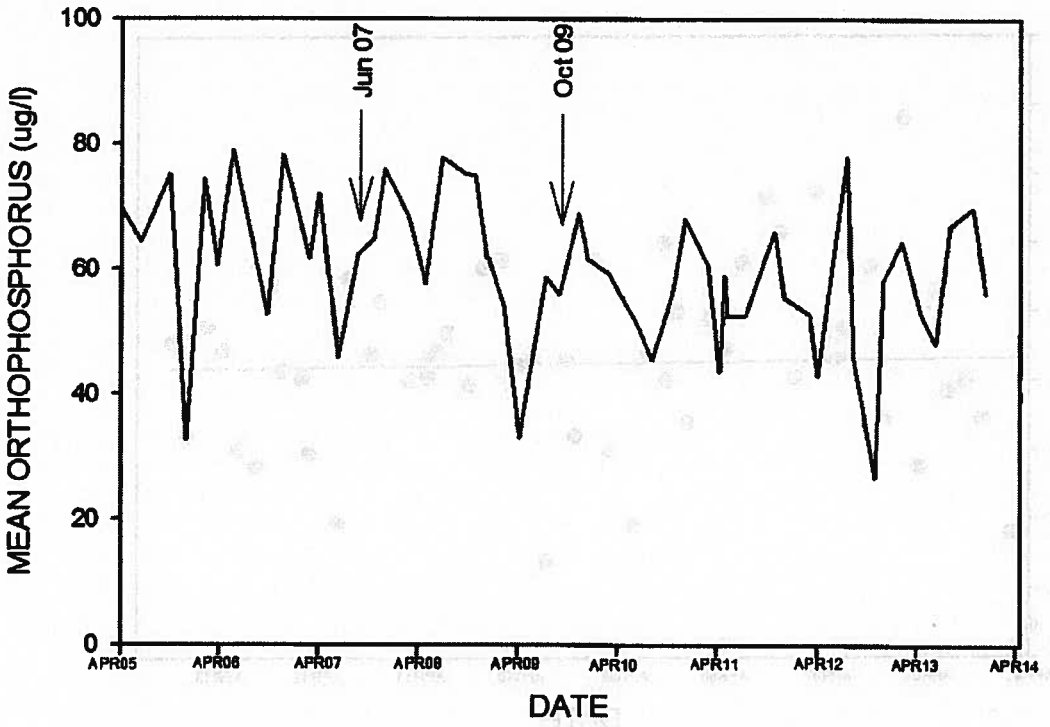

FIGURE 7. Plot of mean orthophosphorous by date in all sampled anchialine pools at Kohanaiki from 2005 to present (n=934). Also shown are the start of golf course construction (June 2007) and the completion of the golf course "grow-in" in October 2009. Note that golf course construction and "grow-in" do not appear to influence the variability in orthophosphorous concentrations due to its affinity to bind with soil.

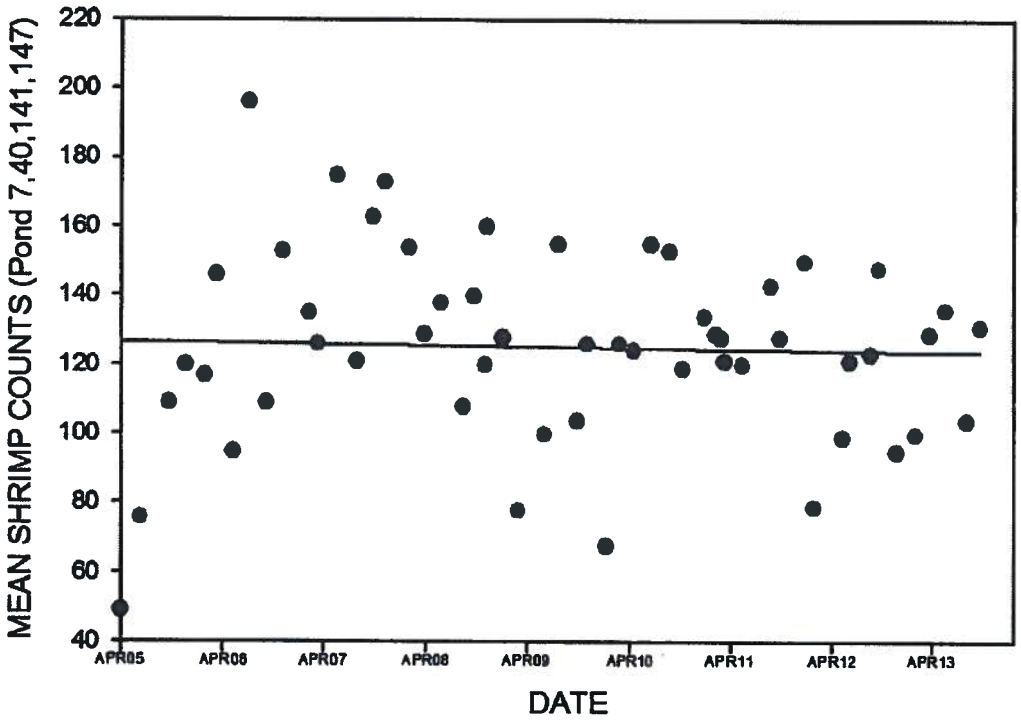

FIGURE 8. Plot of mean opae'ula shrimp counts by date in anchialine pools at Kohanaiki from 2005 through 2013. Also shown is the fitted regression line to those data having almost no slope (b= -0.00097) that does not differ significantly from zero indicating no significant change has occurred in shrimp abundance albeit the fit of the line is poor (r= 0.03).

EFFECTS OF GROUNDWATER ON FISHPONDS AND COASTAL OCEAN OF THE KALOKO-HONOKŌHAU NATIONAL HISTORICAL PARK

Prepared by:
Dr Steve Dollar, Ph.D.
Coastal Zone & Coral Reef Specialist
Marine Research Consultants, Inc.
1039 Waakaua Pl
Honolulu, Hawaii 96822

EFFECTS OF GROUNDWATER ON FISHPONDS AND COASTAL OCEAN OF THE KALOKO-HONOKOHAU NATIONAL HISTORICAL PARK

Prepared for:

Hawai'I Island Economic Development Board

Prepared by:

Marine Research Consultants, Inc.
1039 Waakaua Pl
Honolulu, HI 96822

July 2014

EXECUTIVE SUMMARY

This report has been prepared in response to a petition by the National Park Service (NPS) to the State Commission on Water Resource Management to designate the Keauhou Aquifer as a Groundwater Management Area. The petition asserts that present or planned future use of groundwater from the Keauhou Aquifer will reduce the flow of basal groundwater through Kaloko Honokohau (KAHO) National Historical Park, thereby causing harm to KAHO's anchialine ponds and its nearshore marine environment.

This report summarizes data collected by Marine Research Consultants, Inc. during four field surveys between 2000-2012 for the purpose of evaluating the composition of waters within two large fishponds within KAHO(Aimakapa and Kaloko) and the coastal ocean offshore of these fishponds, with particular emphasis on evaluating the contribution and fate of groundwater input.

In the earlier studies (2000, 2007) Aimakapa Pond exhibited little vertical and horizontal stratification, appearing as a uniformly well-mixed system with long residence time. These conditions were characterized by near complete uptake of all inorganic nutrients entering the ponds through groundwater flux, and elevated values of organic nutrients that are the product of decomposition of organic material. This condition indicated the pond was progressing toward a terminal successional stage where the pond becomes a sediment-filled wetland. More recent studies in 2012 reveal consistent input of groundwater along the landward shoreline of the pond, resulting in steep gradients of salinity and inorganic nutrients found in groundwater. These results suggest that there has not been a detectable decrease in basal groundwater to the ponds; in fact the opposite appears to be the case. While the differences in groundwater dynamics within the ponds over the 12-year interval of studies may reflect the relationship between sampling and tidal state, results of these studies indicate that at a minimum the fishponds are not in a cycle of uninterrupted progression toward a more senescent state.

Scaling nutrients concentrations to salinity indicate that there are no nutrient subsidies to the ponds from sources other than naturally occurring groundwater. None of the data scaling inorganic nutrients to salinity within the ponds or nearshore ocean indicate substantial nutrient subsidies to groundwater that could be a result of human activities in upland areas.

These results indicate that under the present scenario, the existing development upslope of KAHO is not causing detectable input of nutrient subsidies, or reduction in groundwater flux to the ponds. Rather, recent conditions in the ponds appear to represent a more open system with respect to hydraulic and nutrient fluxes.

In a companion report TNWRE found no impacts to basal groundwater have been identified to date as a result of high level groundwater pumpage. While it is not resolved whether high level groundwater actually drains into the nominally downgradient basal lens, evidence gathered to date suggests that at least some, if not most, of the high level groundwater actually flows at depth beneath the basal lens to discharge into the marine environment offshore. If leakage of high level groundwater into the basal lens is limited to the modest amounts that evidence collected to date suggests, then the foreseeable future increases in pumpage of high level groundwater will have little or no impact on the basal lens.

If indeed pumping of high level groundwater has minimal effects on basal groundwater, then it is clear that pumping high level groundwater will also have no effect on nearshore processes influenced by basal groundwater. The results summarized in this report correspond to such a conclusion, as no negative impacts were detected in nutrient dynamics of the KAHO fishponds over the last 12 years.

1. PURPOSE

This report has been prepared in response to a petition by the National Park Service (NPS) to the State Commission on Water Resource Management to designate the Keauhou Aquifer as a Groundwater Management Area. The petition asserts that present or planned future use of groundwater from the Keauhou Aquifer will reduce the flow of basal groundwater through Kaloko Honokohau (KAHO) National Historical Park, thereby causing harm to KAHO's anchialine ponds and its nearshore marine environment.

This report contains data collected by Marine Research Consultants, Inc. during four field surveys between 2000 and 2012 for the purpose of evaluating the composition of waters within two large fishponds (Aimakapa and Kaloko), as well as the coastal ocean, with particular emphasis on evaluating the contribution and fate of groundwater input. This report provides a summary of these data, and also presents an opinion as to the effects of potential alteration of groundwater fluxes on the condition of the fishponds and adjoining coastal ocean. Examination of the list of publications and studies provided by the NPS relating to KAHO does not include any materials that address these issues. Hence, the results and conclusions presented below provide the sole evaluation of the effects of groundwater input in the KAHO fishponds.

2. BACKGROUND

The National Parks and Recreation Act of 1978 provided for the establishment of the Kaloko-Honokohau National Historical Park to preserve the integrity of the many archaeological features and fishponds found in the area. Kaloko Pond and Aimakapa Pond are large brackish bodies of water separated from the ocean by a man-made basaltic rock wall at Kaloko, and a sand beach berm at Aimakapa. The rock wall at Kaloko Pond has recently been reconstructed, and the new wall incorporates channels which afford a direct connection between the pond and ocean.

Water in the ponds is brackish, consisting of a mixture of low salinity groundwater, and seawater. As a result, water chemistry in the ponds can potentially be influenced by changes in groundwater composition and runoff of surface water. Leaching of materials such as fertilizer nutrients, pest control agents or other materials originating from anthropogenic activities to groundwater could potentially alter pond water chemistry. In addition, as pond water exchanges with ocean water in the nearshore marine area, there is also potential for alteration of marine water chemistry owing to changes in groundwater composition. Such alterations in water chemistry can, in turn, provide the potential to affect the structure of marine biotic communities in the nearshore area.

In 2000, 2007 and 2012 Marine Research Consultants, Inc. had the opportunity to conduct investigations of these systems as part of the planning process for several different proposed upland development projects. All of these studies used identical methodologies allowing the resulting data to serve as a time-course analysis to determine how water chemistry has changed over the 12-year period. During this time, upland development proceeded. Thus, the time-course analysis can serve as a tool for evaluating the effects of existing land development makai of KAHO on the functional aspects of the fishponds. Based on these changes in the past, it is possible to predict the potential future effects to the composition of the marine and pond environments. Of particular interest is assessing the nutrient dynamics and associated metabolic activity of the Aimakapa Pond. As this pond is essentially sealed from direct contact with the ocean, the metabolic function of the pond is directly linked to groundwater flux and composition. As a result, Aimakapa Pond is the area with the most potential for changes associated with alteration of groundwater from activities upslope of KAHO.

3. METHODS

Water sampling protocols consisted of collecting surface and bottom water along transects through the center of fishponds from the most landward edges to the most seaward edges. Sampling was continued in the nearshore ocean from the shoreline adjacent to the ponds to a distance offshore considered to be beyond the major influences of land. Constituents measured included all listed in Chapter 11-54, Hawaii Administrative Rules, Water Quality Standards, Department of Health, State of Hawaii. These constituents included various forms of dissolved nutrients (nitrogen and phosphorus), chlorophyll a (Chl a), turbidity, dissolved oxygen, pH and salinity.

Evaluation of the marine biological community was conducted by qualitative reconnaissance surveys along the length of the area comprising the marine portion of the Kaloko-Honokohau National Historical Park from the shoreline out to the 10 meters (30 feet) depth contour. Information gathered during the surveys included abundance estimates of the dominant flora and fauna, as well as observations on the factors that affect these biotic assemblages.

4. RESULTS

Concentrations of twelve chemical constituents in surface and bottom water samples from Kaloko and Aimakapa Ponds and the offshore ocean from the four survey years are plotted as functions of distance from the shorelines in Figures 2-9. These plots show several major patterns of horizontal stratification of water chemistry constituents in the ponds and ocean. One of the most obvious differences is the

dissimilarity between patterns in Aimakapa and Kaloko Ponds and the ocean. Aimakapa pond is separated from the ocean by a fairly wide (~20 m) continuous sand berm which is not very permeable to exchange between the pond and the ocean. Such impermeability is apparent in the sharp, nearly vertical gradients at the shoreline of many of the water chemistry constituents shown in Figures 2-9.

Compared to the sand berm bounding Aimakapa Pond, the rock wall that separates Kaloko Pond from the ocean is highly permeable, and exchange of water between the ocean and pond is enhanced by flushing channels (makahas) constructed into the wall. Hence, the gradation in the water chemistry constituents between pond and ocean are less distinct in Kaloko compared to Aimakapa Pond, and the gradients within Kaloko Pond are more continuous between pond and ocean compared to Aimakapa (Figures 2-9). It should be noted that these direct connections between the pond and ocean eliminate Kaloko Pond from the designation of "anchialine" which requires that no such connections exist.

While both ponds contain thick sediment bottoms, there is a substantial difference in the quality of the sediment. Bottom composition of Aimakapa Pond consists of soft flocculent silty mud that is easily penetrable for at least one meter. Bottom composition of Kaloko Pond is a hard sand/mud mixture that is largely covered with marine algae, primarily the introduced species *Acanthophora specifera*. Sand/mud bottoms in both ponds were distinctly anaerobic beneath the surface layer as evidenced by the strong odor of H_2S when the bottom was even slightly disturbed.

4.1 Patterns of Salinity in the Ponds and Ocean

During all sampling events, salinity within the two ponds showed very different patterns of horizontal gradations from the ocean to the shoreward sides of the ponds (Figure 2). In Aimakapa Pond, average salinity during the four surveys was 12.64±0.43‰ (part per thousand). These data indicate that the water in the pond consists of about 36% groundwater and 64% ocean water. In addition, salinity in Aimakapa is remarkable constant over the entire area of the entire pond as well as through the water column. In addition, salinity was nearly constant over the 12-year interval of sampling. There is however, a slight trend of freshening over time, with the 2012 samples exhibiting the lowest salinities. The constancy of salinity through both time and space in Aimakapa Pond is clearly evident in Figure 2.

The overall pattern of salinity in Kaloko Pond was substantially different than in Aimakapa. Average salinity in the fishpond during the four increments of sampling 24.81‰± 6.11. As Kaloko Pond is "connected" to the ocean, the variability in salinity is a result of sampling at various stages of tide, and is also likely a response to the various stages of construction of the rock wall separating the pond from the ocean. As can be seen in Figure 2, all of the samplings of Kaloko Pond exhibited a pattern of

increasing salinity with decreasing distance from the shoreline, indicating gradient of mixing between seawater and groundwater. The overall patterns of salinity, with the lowest values in 2007 and the highest in 2000 do not suggest any consistent pattern with respect to time as a function of groundwater input into the pond.

Comparing values of salinity within Aimakapa Pond to salinities of anchialine pools located in KAHO indicate that salinity in the fishpond is within the range of salinity in water in three representative pools water (8-14‰), while the salinity in Kaloko Pond is substantially higher than anchialine pools (Table 1). These comparisons again point to the open circulation between Kaloko Pond and the ocean.

Nearshore ocean waters in West Hawaii are typified by a pattern of decreasing salinity with distance from shore. This gradient is indicative of low salinity groundwater entering the ocean near the shoreline and mixing with high salinity ocean water. While this was the general pattern observed on the KAHO transect sites in 2007 and 2012, a somewhat unusual result in the 2000 data is that the lowest salinities in the ocean samples were not found nearest to the shoreline off of either fishpond. Rather, the lowest salinities were measured in surface ocean samples approximately 25-50 m offshore (Figure 2). Such a result suggests that the majority of groundwater flow to the ocean may be around the pond boundaries, rather than through the shoreline barriers that separate the ponds from the ocean.

Horizontal and vertical stratification of salinity in the ocean samples was evident at all stations during all surveys. Beyond 25-50 m from shore, with increasing distance from shore, salinity increased at all stations in both surface and bottom water, while at all sampling stations, surface salinity was lower than the corresponding bottom sample. These gradients indicate that mixing of groundwater entering the ocean does not completely homogenize the water column, with a surface layer of lower salinity water overlying a water column of ocean water.

4.2 Patterns of Nutrients in the Ponds and Ocean

As with salinity, the patterns of dissolved nutrients vary considerably between ponds. The patterns prescribed by the concentrations of dissolved Silica (Si) on transects are essentially a mirror image of salinity during all surveys (Figure 3). These mirror image patterns reflect the two orders of magnitude difference in concentrations of Si between groundwater and ocean water. In addition, the mirror image of Si and salinity indicates that Si is a "conservative" tracer, in that it is not utilized to any measurable extent by biotic or chemical reactions within the ponds and ocean. As a result, there is the same large variation in patterns of concentration of Si between the ponds, and same degree of stratification of Si as was evident in salinity.

In addition to Si, the other nutrient found in high concentrations in groundwater relative to ocean water is nitrate nitrogen (NO_3^-). While the concentrations of NO_3^- in the 2000 and 2007 surveys were consistently low (below 0.5 µM) across the entire sampling transect, substantially different patterns occurred in both 2012 surveys (Figure 4). During the two most recent surveys, concentrations of NO_3^- at the inshore end of the pond exhibited peak values with rapidly decreasing concentrations to the center region of the pond (Figure 4). The magnitude of the gradients was different between the February and November 2012 surveys, with peak values of about 13 µM in February and 50 µM in November. However, the location in the pond where the concentrations dropped to previously measured levels of NO_3^- of less than 1 µM occurred at nearly the same place during both surveys (~150 m from the shoreline). The pattern of the other major inorganic nutrient, phosphate phosphorus (PO_4^{3-}) exhibits a similar pattern, with highest values at the shoreward edge of Aimakapa Pond wand sharply decreasing values up to the center of the pond (Figure 5).

These steep horizontal gradients of NO_3^- and PO_4^{3-}, as well as depressed salinity, suggest the possibility of a qualitatively different level of groundwater input at the mauka shoreline of Aimakapa Pond in 2012 relative to past surveys. While these changes between years may be result of an increase in the overall magnitude of groundwater flux into the ponds (although not likely), it is more likely that influx varies as a result of water level in the ponds. It has been shown that Aimakapa Pond responds to tidal fluctuations (damped relative to the ocean cycle in both magnitude and time) which push pond water inland during flood tides and draw groundwater into the ponds during ebbing tidal cycles (Tom Nance, personal communication). As pond salinity was higher in 2000 and 2007 relative to 2012 (Figure 7), the distinct differences in nutrient gradients between these years may be a reflection of when samples were collected relative to tidal state. However, while there is a distinctly higher input flux of NO_3^- and PO_4^{3-} along the mauka shoreline of Aimakapa during 2012, the incoming inorganic plant nutrients are almost completely taken up within the shoreward half of the pond (Figure 4). In sum, there are no indications of reduction of groundwater flux into Aimakapa Pond over the last 12 years, and in fact the opposite appears true.

Kaloko Pond also shows distinct gradients of NO_3^- and PO_4^{3-}, with an overall similar pattern to Aimakapa Pond. While the peak values of NO_3^- occurred in 2012 in Aimakapa, the peaks in Kaloko occurred in 2007 corresponding to minimum values of salinity (Figures 4 and 5. In contrast to the steeply declining concentrations of NO_3^- down to very low values before the center of Aimakapa Pond, gradients were less steep and extended further toward the ocean end of Kaloko Pond.

Gradients of other forms of nitrogen and phosphorus show distinctly different patterns of distributions than NO_3^- and PO_4^{3-}, particularly in Aimakapa Pond. During all four of the sampling events, total nitrogen (TN) is relatively constant across the entirety of

Aimakapa Pond. The majority on TN exists as total organic nitrogen (TON) (Figure 7), rather than either NO_3^- or ammonium (NH_4^+) (Figure 6). In the 2012 surveys, concentrations of TON mirror NO_3^- with lowest values at the inshore end of the pond, and elevated values in the seaward portion of the pond. In particular, during the November 2012 survey, the sharp elevation in concentrations of TON occur at the sampling station approximately 150 m from the shoreline, which is the same location that concentrations of NO_3^- dropped to low values. The same patterns are evident for total phosphorus (TP) and total organic phosphorus (TOP) (Figure 8).

Total organic nitrogen and phosphorus are the end products of decomposition of organic material, while the inorganic nutrients NO_3^- and PO_4^{3-}, as well as NH_4^+ are the nutrients taken up by plants during photosynthetic activity. The considerably different patterns of distributions of these nutrient components in Aimakapa Pond over the last 12 years suggest a shift in metabolic function over time. During the earliest survey in 2000, virtually all of the nitrogen and phosphorus in Aimakapa Pond was in the form an organic form (TON, TOP), with essentially no NO_3^- and PO_4^{3-} present. Such a distribution indicates that the pond was in a decaying state, proceeding toward anoxic conditions.

During both 2012 surveys, the metabolic functioning of Aimakapa appears to have shifted toward a more "open" system. High input of low salinity water containing high concentrations of inorganic nutrients found in groundwater is evident along the inland shoreline of the pond. These concentrations decrease with distance seaward until the approximate center of the pond, where concentrations approach the levels found in 2000. TON mirrors the pattern of nutrients indicating gradients of progressive uptake and metabolic processes from the mauka edge toward the center of the pond. Hence, the recent data showing steep gradients of nutrients within Aimakapa Pond indicate that the entire system has not remained a completely heterotrophic system removing nutrients from the water column, while adding back end products of metabolic decomposition. Rather, the apparent increase in groundwater now results in indications that at least part of the pond is a more open system with respect to metabolic cycling somewhat reversing he progression toward an anoxic system. It may be however, that the differences between nutrient gradients in different sampling years is a response to sampling during different phases of the tidal cycle, with nutrient fluxes into the pond more pronounced during ebbing tides. In any case, the time-course evaluation indicates that there is not a progressing decomposition of the ponds during the 12-year interval of sampling.

Plots of Chlorophyll *a* reveal substantially elevated values throughout the water column in Aimakapa in 2000 (Figure 9). The close tracking of Chl *a* and turbidity in this survey indicates that the high values are not the result of resuspension of bottom sediment. Chlorophyll *a* and turbidity are also elevated in surface and bottom waters

of Kaloko Pond relative to ocean water, but without the anomalous values in bottom water during 2000 (Figure 9).

4.3 Conservative Mixing Analysis

A useful treatment of water chemistry data for interpreting the extent of material input from land is application of a hydrographic mixing model. In the simplest form, such a model consists of plotting the concentration of a dissolved chemical species as a function of salinity. Comparison of the curves produced by such plots with conservative mixing lines provides an indication of the origin and fate of the material in question. Figures 10-12 show plots of concentrations of nutrient constituents as functions of salinity for Aimakapa and Kaloko ponds, anchialine pools and ocean water samples collected in the KAHO during the four sampling surveys in 2000, 2007 and 2012. In addition, nutrient concentrations and salinity from data collected in three monitoring wells within the KAHO boundaries are also shown. Each plot in Figures 10-12 also show two conservative mixing lines that were constructed by connecting the end member concentrations of open ocean water and averaged high-level groundwater concentrations from the DWS Honokohau Well (4158-03), and averaged basal groundwater Kaloko Irrigation Well (4160-02) (Well data provided by TNWRE).

If the parameter in question displays purely conservative behavior (no input or removal from any process other than physical mixing), data points should fall on, or very near, the conservative mixing line. If, however, external material is added to the system through processes such as leaching of fertilizer nutrients to groundwater, data points will fall above the mixing line. If material is being removed from the system by processes such as uptake by biotic metabolic processes, data points will fall below the mixing line. It is also important to note that since nutrient concentrations are scaled to salinity, the effects of tidal state are not a factor in interpreting data on source or sinks.

Dissolved Si represents a check on the model as this material is present in high concentration in groundwater, but is not a major component of fertilizer. In addition, Si is not utilized rapidly within the nearshore environment by biological processes. It can be seen in Figure 10 that all of the data points from Aimakapa and Kaloko Ponds, the three anchialine pools, and the ocean fall very close to the conservative mixing line for Si. Such agreement indicates that the end members used to construct the lines are representative of the system. The only data set that deviates from the linear pattern falling near the conservative mixing lines is for Monitoring Well 1, with anomalously low values in samples collected in 2000 and 2001. The lack of curvature in the linear arrays of data points also indicate that there is no detectable uptake of

Si within the pond and marine system, and no other sources of Si other than groundwater.

The plot of NO_3^- versus salinity reveals distinctly different results than plot of Si (Figure 10). Plots of concentrations of NO_3^- versus salinity in Aimakapa Pond show a distinct nearly vertical line extending from the point of intersection with the mixing line (data from November 2012) to the X-axis with a NO_3^- concentration of essentially zero. This linear array illustrates the process described in the section above where groundwater containing high levels of NO_3^- relative to seawater enters Aimakapa Pond at the mauka shoreline. With mixing of the groundwater into the pond, NO_3^- is rapidly stripped by biotic uptake. The orientation of data points from both of the surveys in 2012 along the same linear array suggests the same degree of removal of nutrients relative to salinity is occurring within the pond.

The arrays of NO_3^- data points for Kaloko Pond are substantially different than for Aimakapa (Figure 10). At the low salinity end of the plots, at salinities less than 15‰, all data points fall on the conservative mixing lines, indicating that concentrations in the pond at these sampling points consists exclusively of mixing of groundwater and ocean water. At salinities higher than 15‰, data points all lie beneath the mixing lines, with concentrations of NO_3^- decreasing steadily to very low values to a salinity of approximately 30‰. These patterns delineate uptake of NO_3^- by biotic processes within the main body of Kaloko Pond. As with the smooth linear array of data points of decreasing value with increasing salinity in Aimakapa, the relatively smooth curve prescribed by the data points in Kaloko indicate that there are no other sources or sinks of NO_3^- within the pond. Salinities above about 30‰ represent samples from the nearshore ocean, which show a slight increase in concentration relative to pond waters. Such an increase suggests that groundwater may be entering the ocean from other entry points than through the ponds.

Concentrations of NO_3^- in the anchialine pools scaled to salinity lie on, or slightly above the conservative mixing lines. The position of these points indicates that the same processes of NO_3^- uptake occurring in the two large fishponds is not occurring in the anchialine pools. Rather, groundwater nutrients remain in essentially the same concentration while in the anchialine pool as in the submarine aquifer. Such a difference in nutrient cycling in the smaller anchialine pools relative to the fishponds is a result of far more rapid flushing and turnover rate of water in the pools. Concentrations of NO_3^- in monitoring wells are generally above the conservative mixing lines, suggesting an external source of NO_3^- other than naturally occurring groundwater.

Phosphate phosphorus (PO_4^{3-}) is also a major component of fertilizer and sewage effluent, but is usually not found to leach to groundwater to the extent of NO_3^-, owing to a high absorptive affinity of phosphorus in soils. The curves defined by the plotted data of PO_4^{3-} as a function of salinity are similar to NO_3^-, although the concentrations

differ by an order of magnitude (Figure 11). In addition, data points from the shoreward end of Aimakapa Pond occur above the mixing lines, indicating a source of PO_4^{3-} that is not completely naturally occurring groundwater. However, the near-vertical linear array of data points indicates rapid uptake of PO_4^{3-} beyond the shoreward edge of the pond. The distribution of data points in Kaloko Pond also reflects mixing of groundwater and ocean water along with uptake by biotic activity within the pond, although the magnitude of uptake is less than in Aimakapa Pond (Figure 11). Concentrations of PO_4^{3-} scaled to salinity in the anchialine pools all fall near the conservative mixing lines indicating that there are no external sources of PO_4^{3-} to the anchialine pools from sources other than naturally occurring groundwater. Similar to anchialine pools, the scaled concentrations of PO_4^{3-} for monitoring wells 2 and 3 fall on the conservative mixing lines, while most data points for well 1 lies below the mixing lines.

The other form of dissolved inorganic nitrogen, NH_4^+, shows a reversed pattern of distribution relative to conservative mixing lines when concentrations are plotted as functions of salinity. It can be seen in Figure 11 that the conservative mixing lines are nearly flat with nearly similar concentrations in groundwater and ocean water. The occurrence of nearly all of the data points from all water sources lying above the mixing lines indicates that the observed concentrations of NH_4^+ are not a result of mixing of groundwater and ocean water. Rather, these concentrations are the result of either input from another source, or as is more likely the case, from *in-situ* metabolic processes within the ponds.

Because total organic nitrogen and phosphorus (TON and TOP) occur in very low concentrations in both open ocean water and high level groundwater, the mixing lines for these constituents are essentially flat (Figure 12). The occurrence of data points of TOP and TON far above the mixing lines reflects the metabolic cycling conversion of inorganic nutrients to organic nutrients by metabolic cycling of nutrients in the Aimakapa Pond ecosystem. Products of metabolic decomposition of organic material include organic nitrogen (TON) and organic phosphorus (TOP). Owing to low circulation and flushing of the majority of Aimakapa Pond, and no apparent uptake by biotic function, these organic nutrients remain in the water column. Contrary to Aimakapa Pond, the data points of TOP and TON in Kaloko versus salinity fall near the mixing lines, indicating that the level of organic decomposition and/or flushing of the pond is not occurring. Within the anchialine pools and monitoring wells, TON and TOP occur at very low levels, supporting the observation that rapid water exchange through the pools and wells prevents accumulation of the products of organic metabolism.

Two major points can be made to summarize the results of the mixing analyses. First, and most importantly, there are no indications of significant input to any of the ponds of inorganic nutrients from sources other than naturally occurring groundwater. None

of the data points scaling inorganic nutrients to salinity within the ponds or nearshore ocean indicate substantial nutrient subsidies to groundwater that could be a result of human activities in upland areas. The constituents that show substantial elevations in the ponds (NH_4^+, TON and TOP) are not the direct result of nutrient loading, but rather byproducts of metabolic cycling coupled with long residence time (slow water exchange) within the ponds.

The second major point that is illustrated by the nutrient data and mixing plots is that during the most recent samplings in 2012 Aimakapa Pond exhibited a far more detectable pattern of active groundwater flux than in previous surveys. At the inland shoreline of the pond, input of low salinity, high nutrient groundwater was clearly evident during both of the 2012 surveys. Such input was not present in earlier surveys utilizing identical sampling methods. While the nutrient inputs were rapidly taken up within the shoreward half of the pond, the input of groundwater suggests a more active circulation than in the past. While the process responsible for these differences in input over a decadal period are not readily decipherable, it is clear that there is no indication of increased senescence of Aimakapa Pond. Rather, these data indicate that the pond may be stabilizing the trend of tending toward a system completely dominated by decomposition and infilling of sediment.

While not included in the present data presentation, past investigations of the KAHO area have included comparisons of the nutrient dynamics occurring in the fishponds to the effects of discharges of water from the Natural Energy Laboratory of Hawaii at Keahole Point. These comparisons indicate that subsidies to groundwater of NO_3^- and PO_4^{-3} are far greater at NELHA than in the Kaloko-Honokohau area as a result of high concentrations in deep seawater that is discharged into disposal trenches along the shoreline.

4.4 Effects to the Nearshore Marine Environment

Coral reef ecosystems have adapted to grow in low nutrient marine waters. So a reduction in flux of nutrients through reduced groundwater flux will have no effect on offshore marine systems. Even if changes in groundwater flux results in an increase in nutrients, it is also unlikely that there would be any effects to the nearshore marine environment. Data reveal that groundwater nutrients were retained within a surface layer, with no exposure to the benthos. Circulation within the area is rapid enough to prevent phytoplankton blooms. These results indicated that even with long-term input of high nutrient subsidies, there are no negative effects to the receiving environment.

5. DISCUSSION and CONCLUSIONS

The purpose of this data review is to provide the information to make valid estimates of the potential for impact to the marine and pond environments at Kaloko

Honokohau National Historical Park, and possibly NELHA, from upland development involving increased use of potable basal groundwater.

To summarize, it is generally accepted that one of the large fishponds within the Kaloko-Honokohau National Historical Park function in a similar manner to smaller anchialine ponds that occur on the west coast of Hawaii. By definition anchialine ponds are surface exposures of the water table with no direct connection to the ocean that contain brackish water which is a mixture of seaward flowing groundwater and landward flowing seawater. Anchialine ponds in early successional stages usually have sediment-free bottoms which allow for relatively rapid exchange of water. It is important to note that healthy anchialine ponds are NOT nutrient limited systems, and contain high concentrations of plant nutrients. The excess nutrients do not lead to algal dominated water columns (at least until late stages of pond senescence, as a result of a balance between short residence time of water within the ponds, and production and consumption by pond biota. Rapid flux of water through the ponds, and grazing by resident populations prevent plankton buildup within the water column. In the later stages of the anchialine pond cycle, infilling by sediment reduces the rate of water exchange and the balance between production and consumption is lost. Ultimately, in the last stages of pond senescence infilling is complete and ponds transition to wetlands.

During surveys of Aimakapa Pond conducted in 2000 and 2007 restricted groundwater flow into Aimakapa Pond was borne out by the near complete lack of both vertical and horizontal gradients within the ponds. Such lack of detectable inputs suggested that the pond is essentially a closed system which was accumulating sediment and metabolic decay products which cannot be naturally flushed from the enclosed pond basin. Continued metabolic activity would produce increasing sediment deposition which would elevate rates of nutrient release from sediment decomposition, which would in turn allow for increased phytoplankton growth.

During surveys in 2012, evidence of groundwater input at stations within the inshore half of Aimakapa Pond was detected as steep horizontal gradients of salinity and inorganic nutrients found in groundwater. These results suggest that Aimakapa Pond may be experiencing either increased groundwater input, or at least not a decrease in groundwater input relative to a decade earlier. As the existing developments in the areas upslope of the KAHO ponds have been in place for the last decade, water quality in the ponds changes can be assumed to be influenced by the present level of development upslope from the KAHO ponds.

In a companion report TNWRE found no impacts to basal groundwater have been identified to date as a result of high level groundwater pumpage. A key unresolved issue is whether or not the high level groundwater actually drains into the nominally downgradient basal lens in the area between Keahole Point and Kailua Town.

Evidence gathered to date suggests that at least some, if not most, of the high level groundwater actually flows at depth beneath the basal lens to discharge into the marine environment offshore. If leakage of high level groundwater into the basal lens is limited to the modest amounts that evidence collected to date suggests, then the foreseeable future increases in pumpage of high level groundwater will have little or no impact on the basal lens.

If indeed pumping of high level groundwater has minimal effects to basal groundwater, it is clear that pumping high level groundwater will have no effect on nearshore processes influenced by basal groundwater. The results summarized in this report correspond to such a conclusion, as no negative impacts were detected in nutrient dynamics of the KAHO fishponds over the last 12 years. In fact, time-course data indicate a potential reversal of pond metabolism toward a less senescent stage. As this time period includes the addition of upslope development and pumpage of high level groundwater it can be concluded that these activities do not represent a negative influence, and there is no reason to expect this pattern to change in the future.

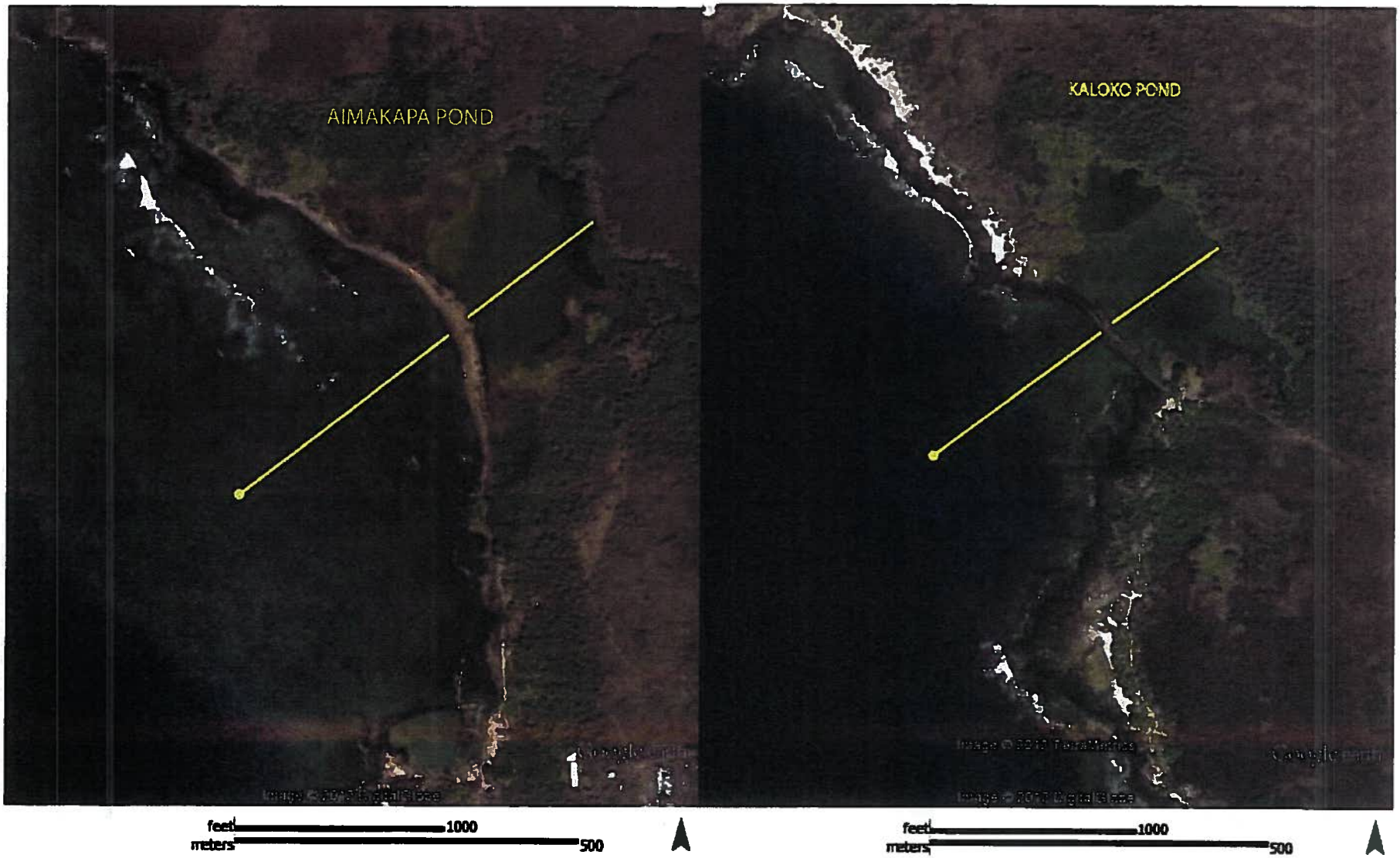

FIGURE 1. Aerial images of Aimakapa (left) and Kaloko Fishponds at Kaloko-Honokohau National Historical Park on West Coast of the Island of Hawaii. Yellow lines in each photo represent sampling transects extending through the length of the ponds and into the coastal ocean.

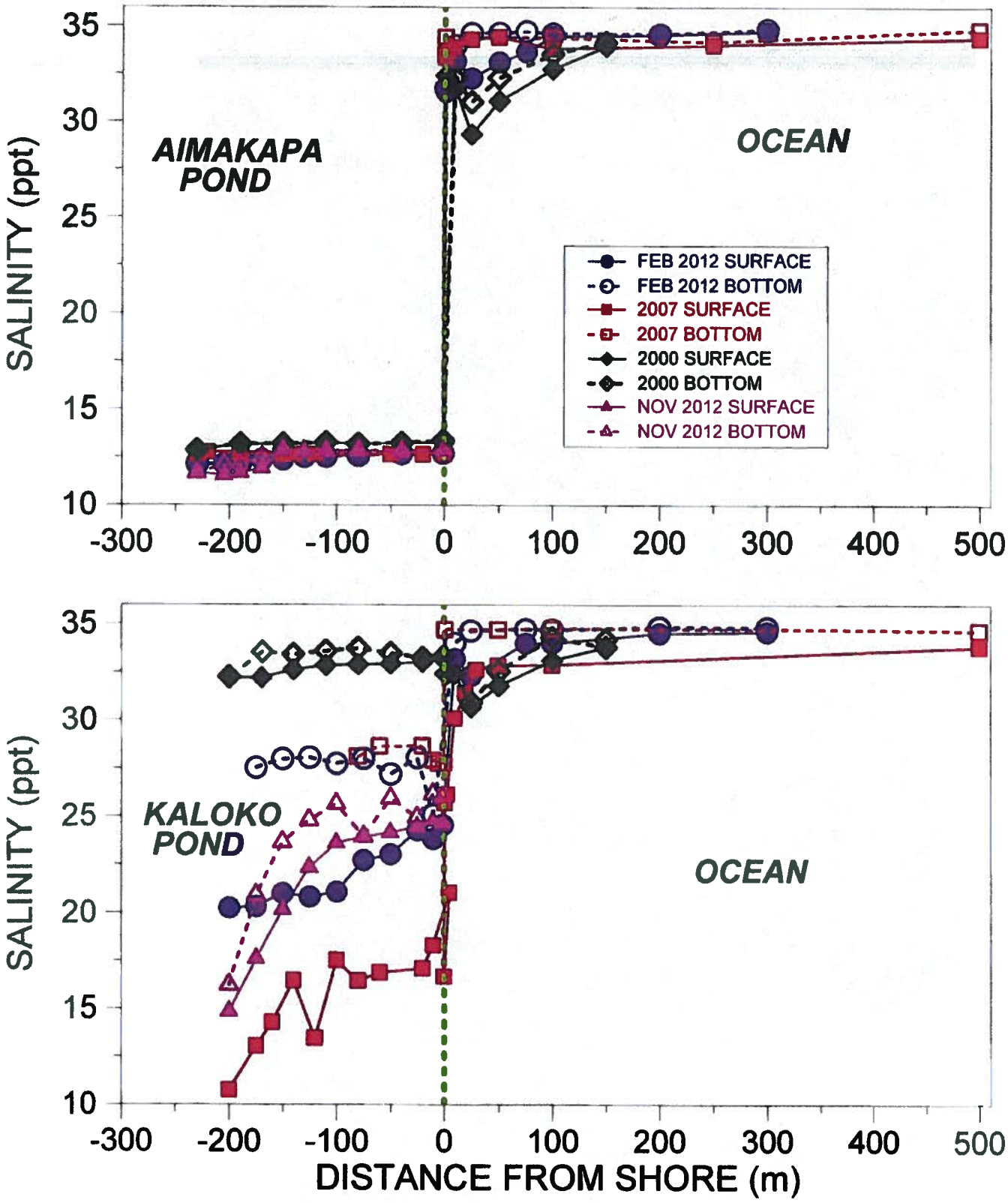

FIGURE 2. Plots of salinity in Aimakapa Pond (top) and Kaloko Pond (bottom) and adjacent offshore ocean as functions of distance from the shoreline measured in 2000, 2007 and 2012 (sampled in February and November). Shoreline is represented by green vertical line; positive values indicate distance seaward from the shoreline in the ocean; negative values indicate distance inland from the shoreline in the ponds. For locations of sampling transects, see Figures 1.

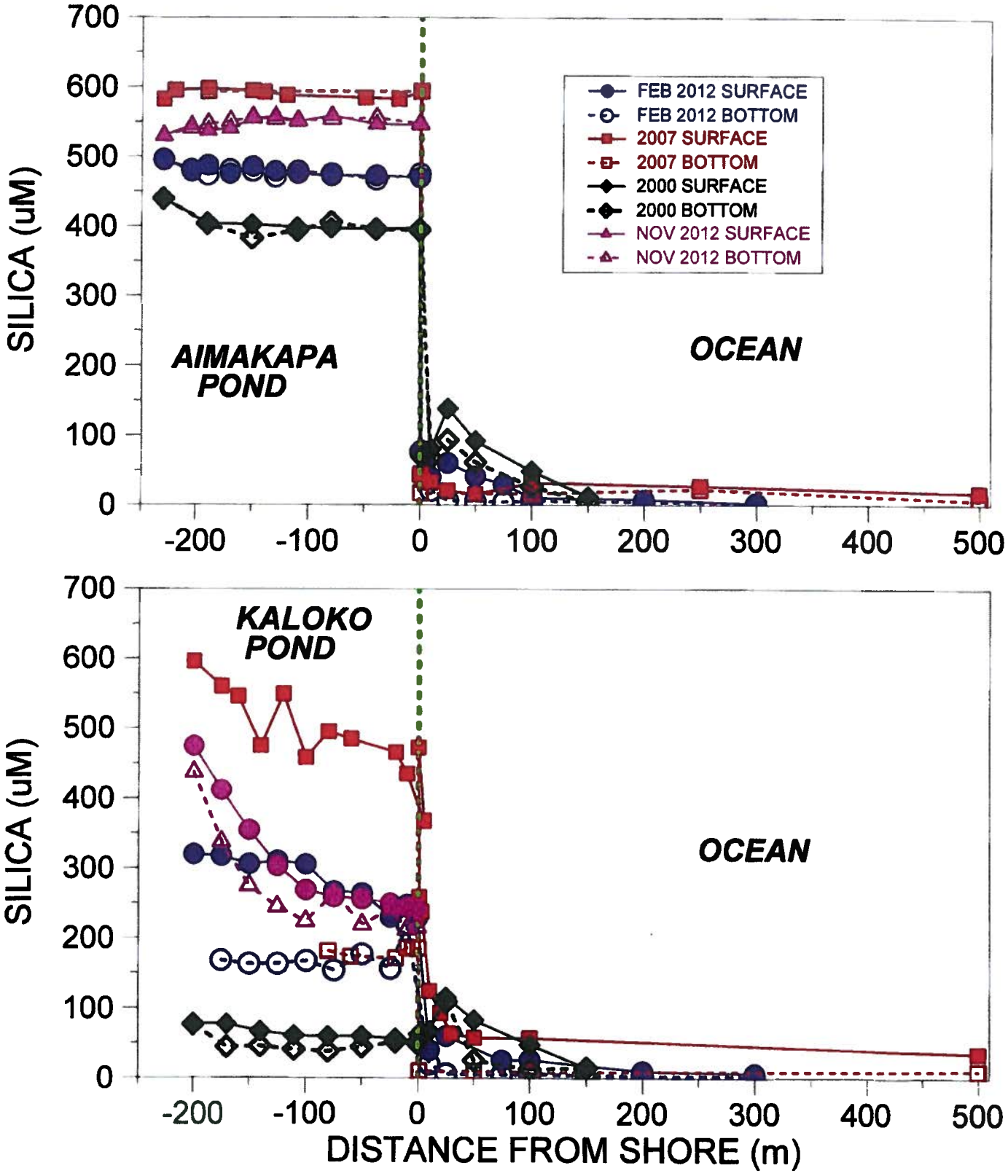

FIGURE 3. Plots of silica in Aimakapa Pond (top) and Kaloko Pond (bottom) and adjacent ocean as functions of distance from the shoreline measured in 2000, 2007 and 2012 (sampled in february and november). The shoreline is represented by the green vertical line; positive values indicate distance seaward from the shoreline in the ocean; negative values indicate distance inland from the shoreline in the ponds. For locations of sampling transects, see Figure 1.

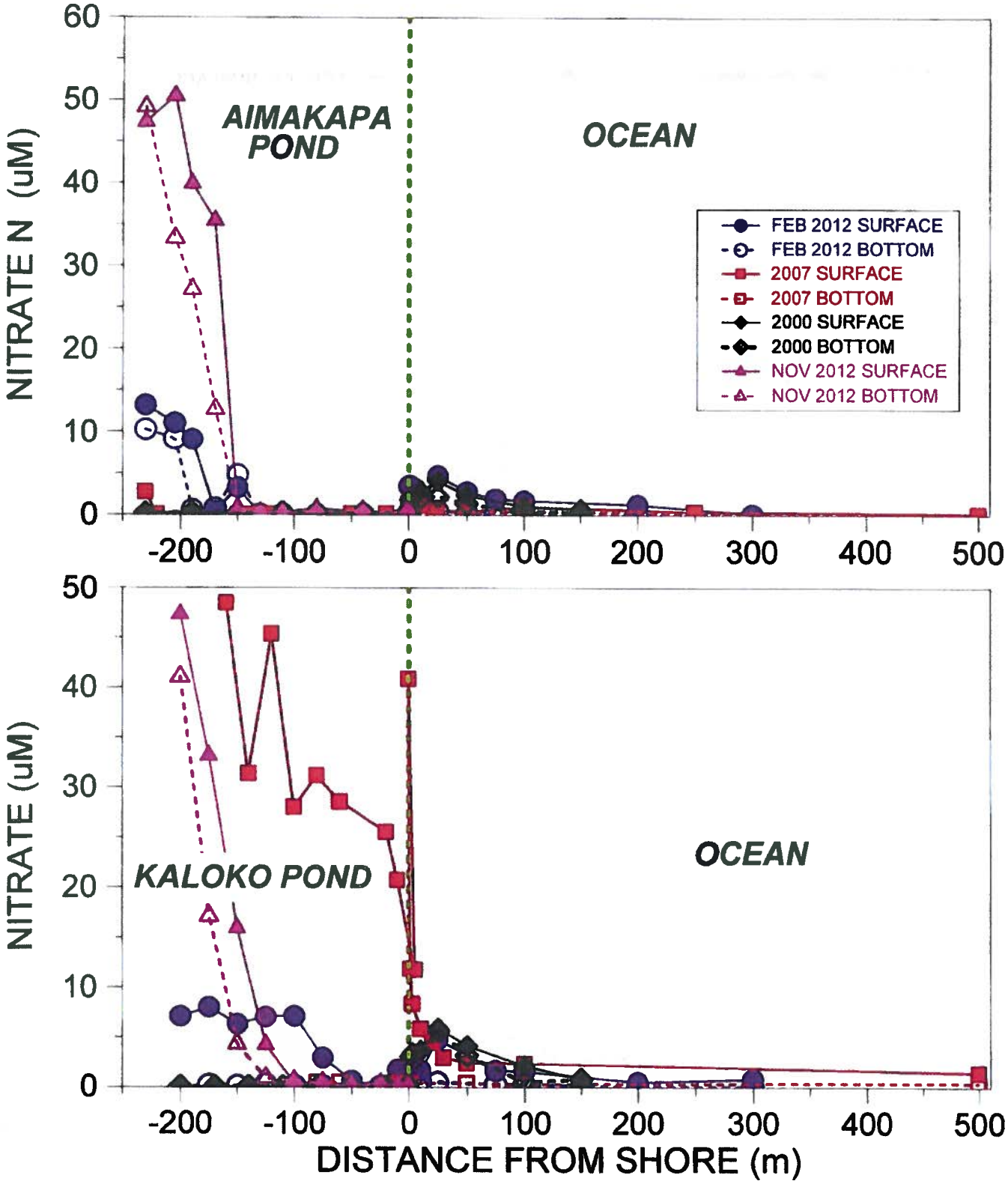

FIGURE 4. Plots of nitrate nitrogen in Aimakapa Pond (top) and Kaloko Pond (bottom) and adjacent ocean as functions of distance from the shoreline measured in 2000, 2007 and 2012 (sampled in February and November. The shoreline is represented by the green vertical line; positive values indicate distance seaward from the shoreline in the ocean; negative values indicate distance inland from the shoreline in the ponds. For locations of sampling transects, see Figure 1.

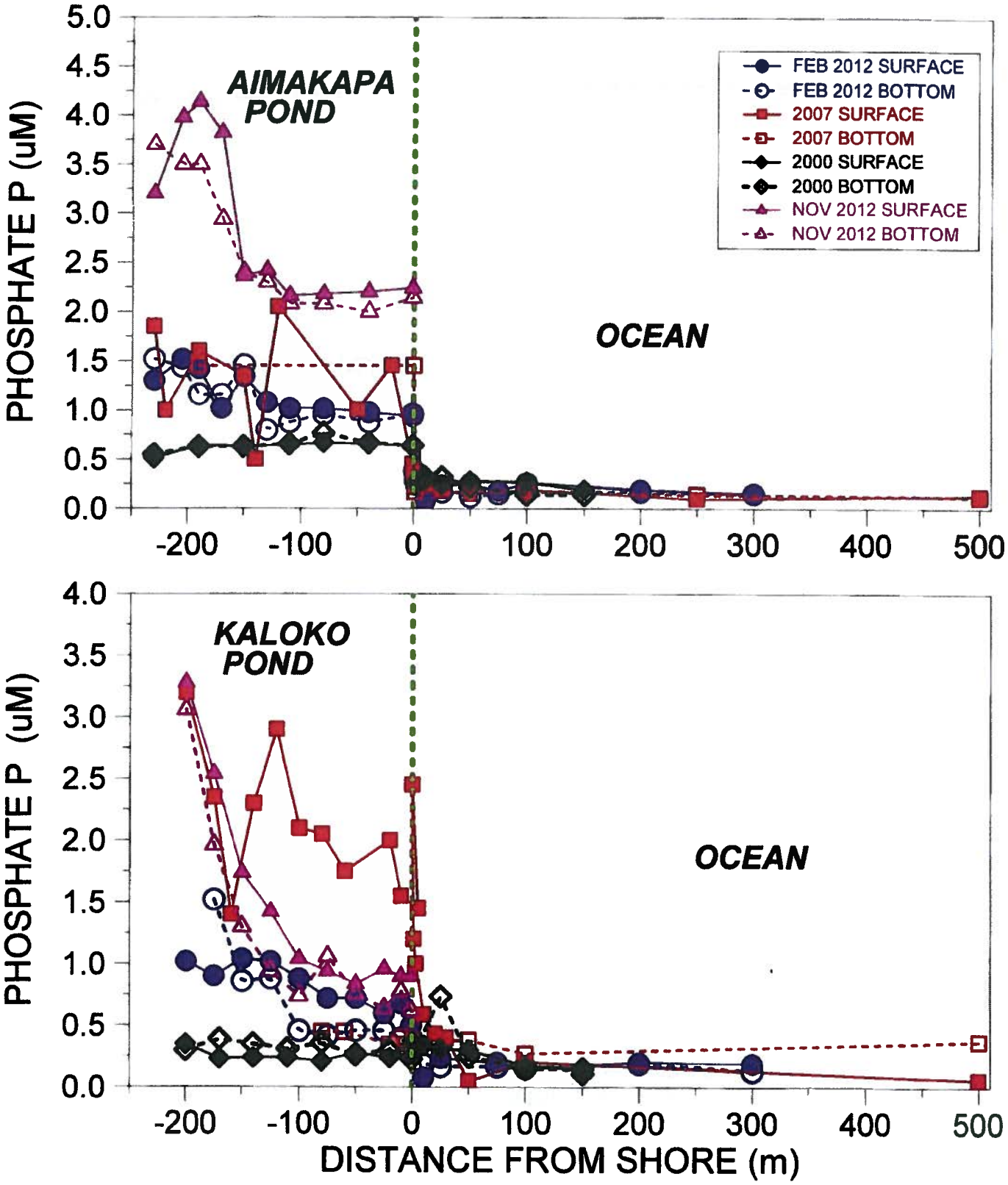

FIGURE 5. Plots of phosphate phosphorus in Aimakapa Pond (top) and Kaloko Pond (bottom) and adjacent ocean as functions of distance from the shoreline measured in 2000, 2007 and 2012 (sampled in February and November). The shoreline is represented by the green vertical line; positive values indicate distance seaward from the shoreline in the ocean; negative values indicate distance inland from the shoreline in the ponds. For locations of sampling transects, see Figure 1.

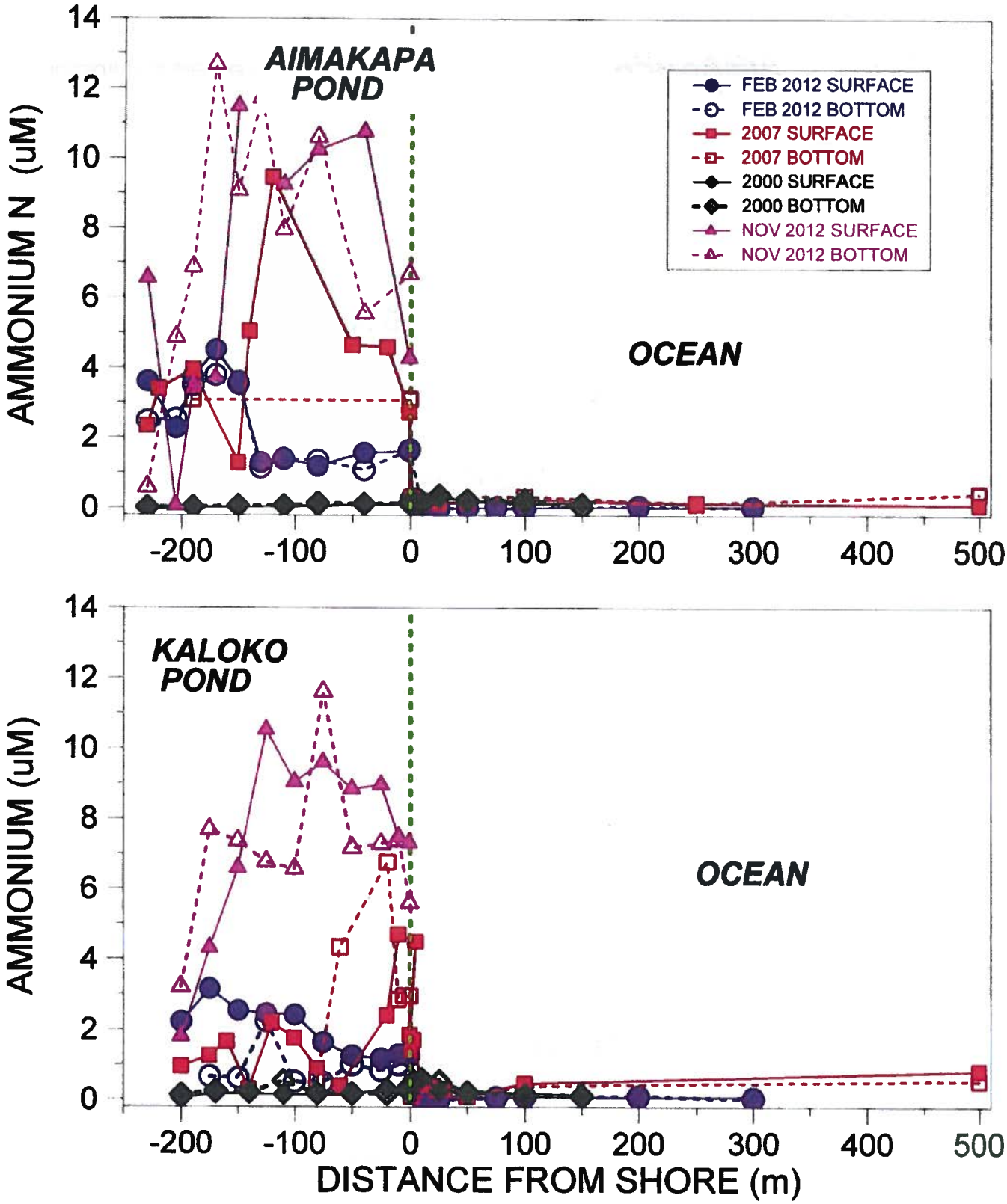

FIGURE 6. Plots of ammonium nitrogen in Aimakapa Pond (top) and Kaloko Pond (bottom) as functions of distance from the shoreline measured in 2000, 2007 and 2012 (sampled in February and November). The shoreline is represented by the green vertical line; positive values indicate distance seaward from the shoreline in the ocean; negative values indicate distance inland from the shoreline in the ponds. For locations of sampling transects, see Figure1.

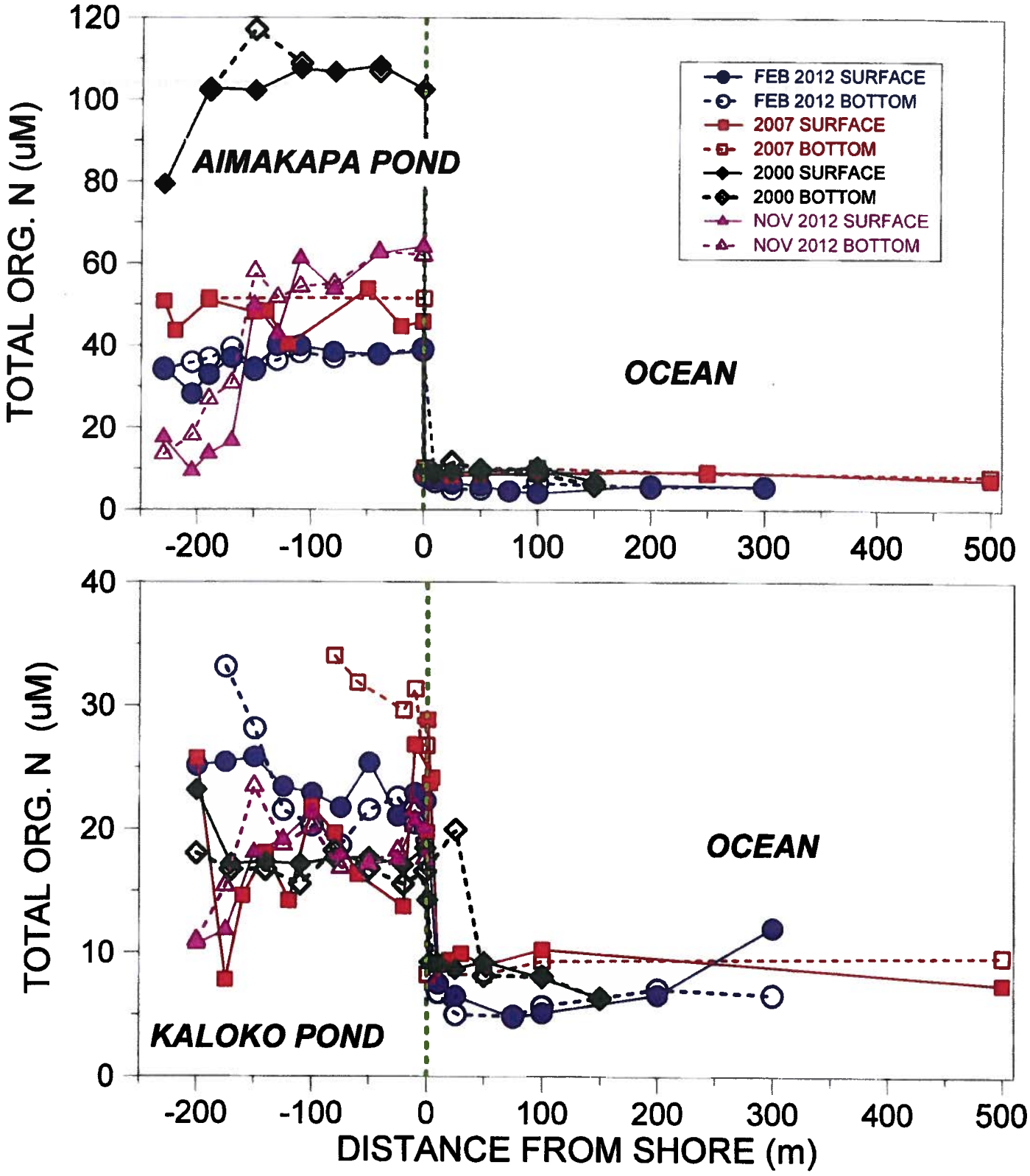

FIGURE 7. Plots of Total Organic Nitrogen in Aimakapa Pond (top) and Kaloko Pond (bottom) and the adjacent ocean as functions of distance from the shoreline measured in 2000, 2007 and 2012 (sampled in February and November). The shoreline is represented by a green vertical line; positive values indicate distance seaward from the shoreline in the ocean; negative values indicate distance inland from the shoreline in the ponds. For locations of sampling transects, see Figure 1.

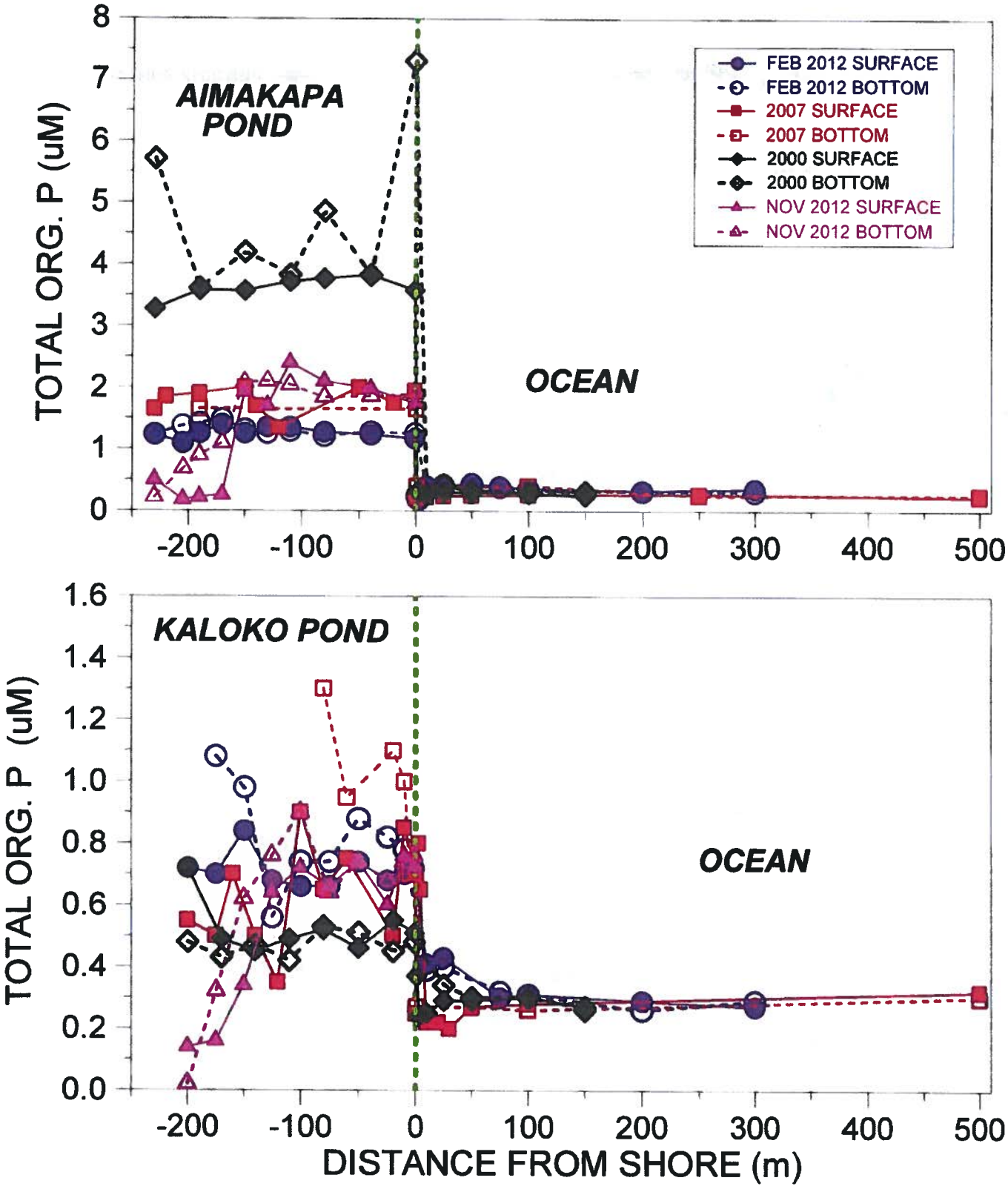

FIGURE 8. Plots of Total Organic Phosphorus in Aimakapa Pond (top) and Kaloko Pond (bottom) and adjacent ocean as functions of distance from the shoreline measured in 2000, 2007 and 2012 (sampled in February and November. Shoreline is represented by green vertical line; positive values indicate distance seaward from the shoreline in the ocean; negative values indicate distance inland from the shoreline in the ponds. For locations of sampling transects, see Figure 1.

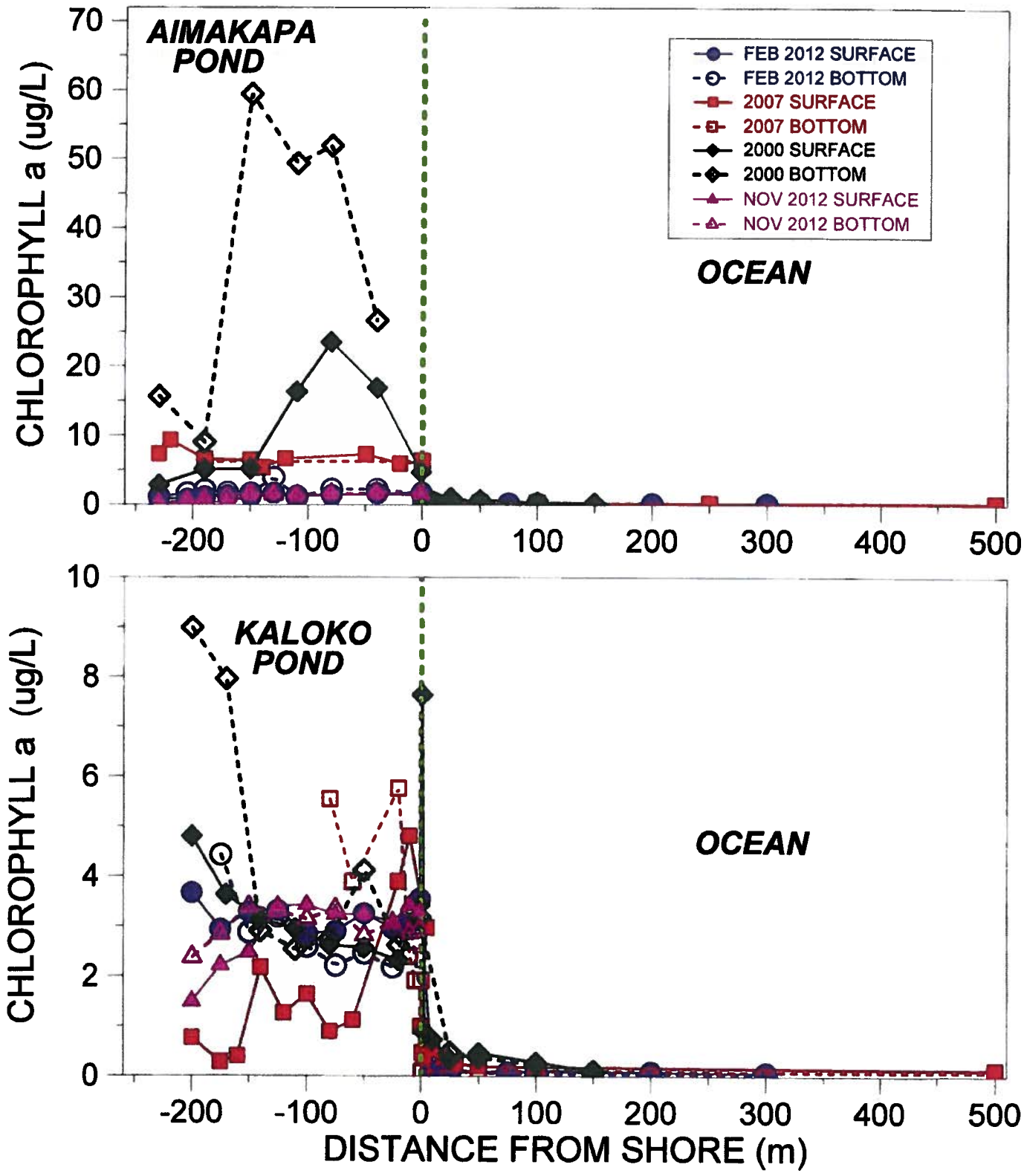

FIGURE 9. Plots of Chlorophyll a in Aimakapa Pond (top) and Kaloko Pond (bottom) as functions of distance from the shoreline measured in 2001, 2007 and 2012 (sampled in February and November). The shoreline is represented by the green vertical lines; positive values indicate distance seaward from the shoreline in the ocean; negative values indicate distance inland from the shoreline in the ponds. For locations of sampling transects, see Figure 1..

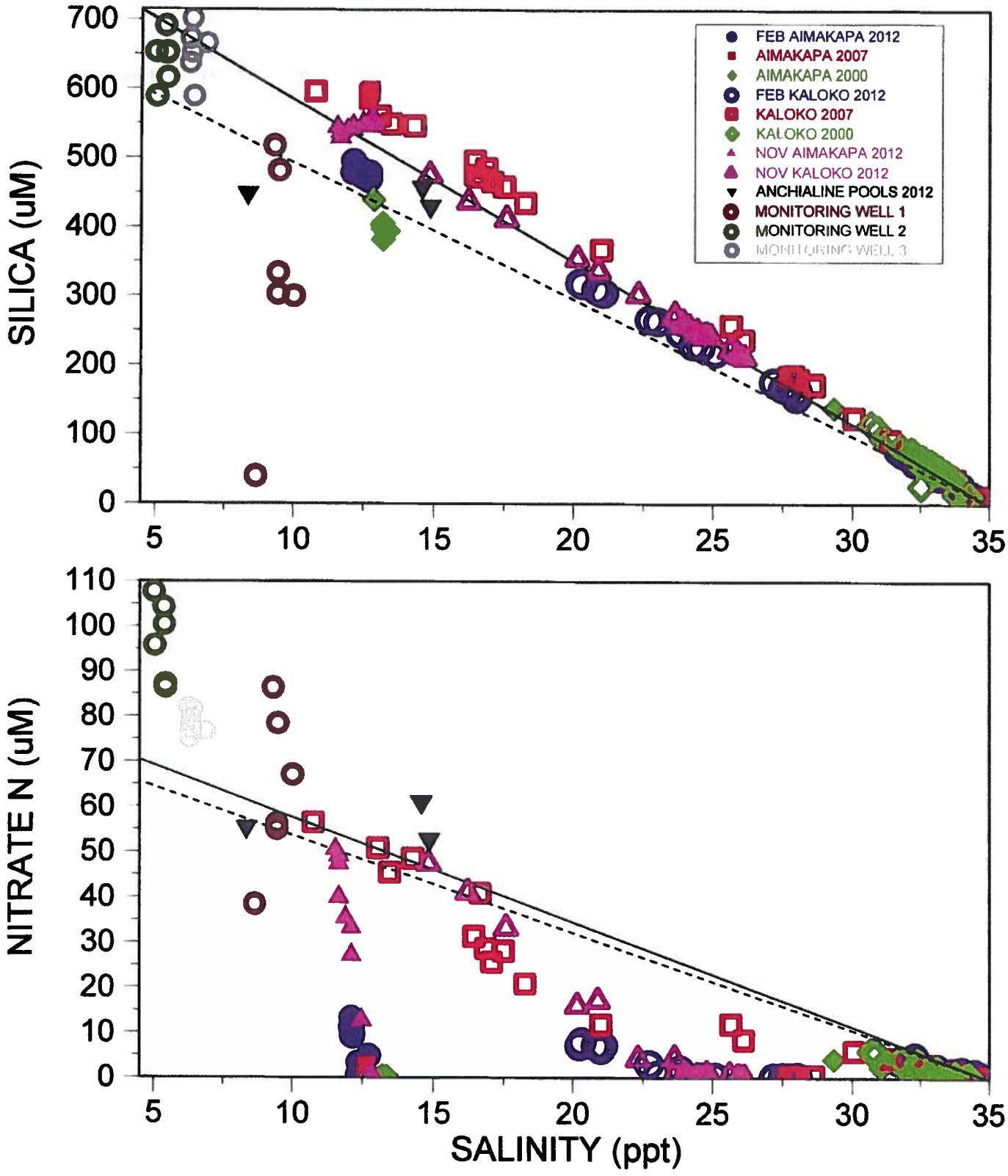

FIGURE 10. Mixing plots showing Silica (top) and nitrate nitrogen as functions of salinity in Aimakapa and Kaloko Fishponds, anchialine pools and the adjacent ocean during four sampling periods (2000, 2007, Feb. 2012 and Nov. 2012). Also shown are data from three KAHO Monitoring wells. Solid line is conservative mixing line connecting endpoint concentrations from the open ocean and high level groundwater from the DWS Honokohau Well (4158-03), while dashed line is conservative mixing line connecting open ocean concentrations to basal groundwater sampled from the Kaloko Irrigation Well (4160-02).

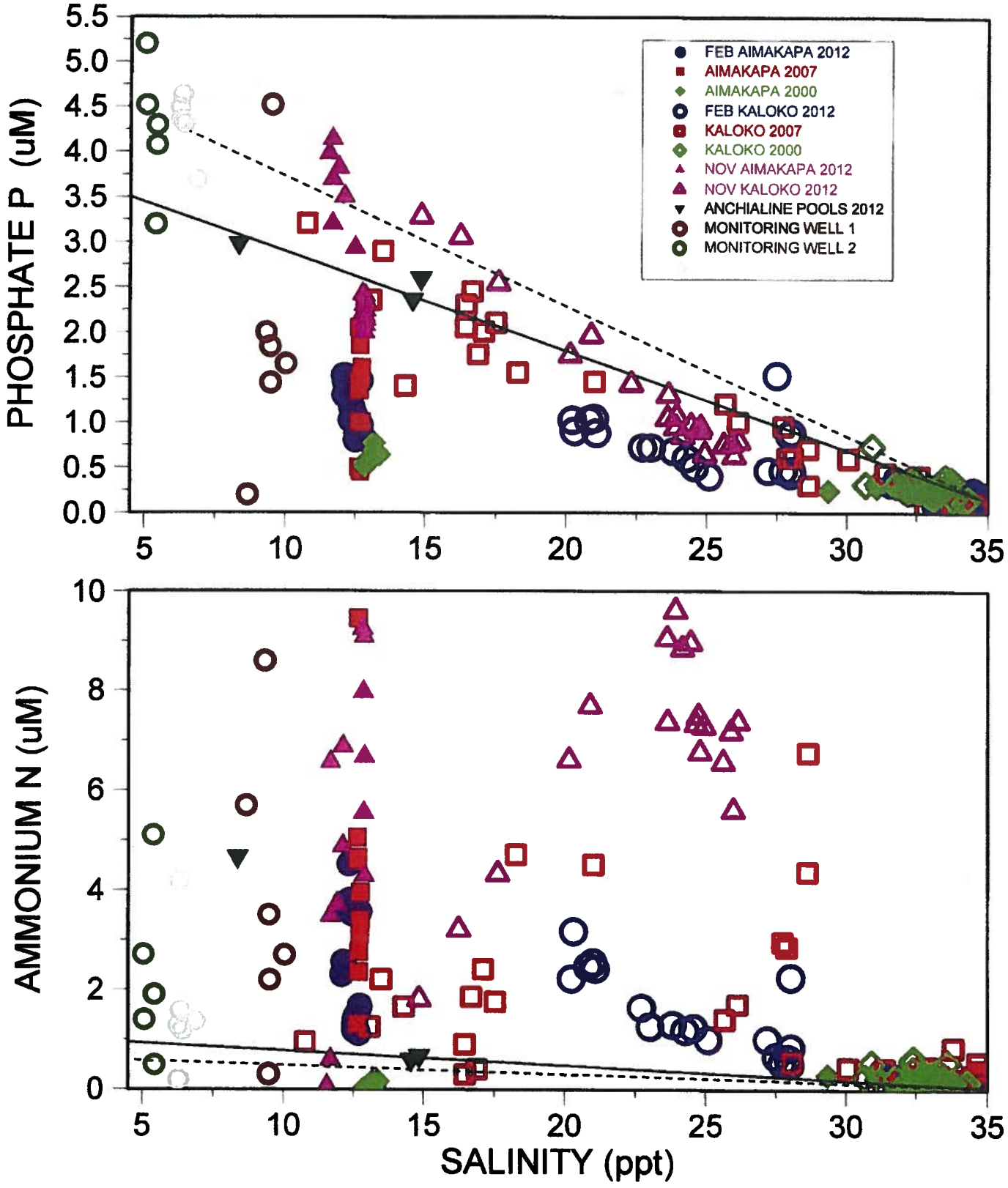

FIGURE 11. Mixing plots showing Phosphate phosphorus (top) and Ammonium nitrogen as functions of salinity in Aimakapa and Kaloko Fishponds, anchialine pools wells and the adjacent ocean during four sampling periods (2000, 2007, Feb. 2012 and Nov. 2012). Also shown are data from KAHO monitoring wells. Solid line is conservative mixing line connecting endpoint concentrations from the open ocean and high level groundwater from the DWS Honokohau Well (4158-03), while dashed line is conservative mixing line connecting open ocean concentrations to basal groundwater sampled from the Kaloko IrrigationWell (4160-02).

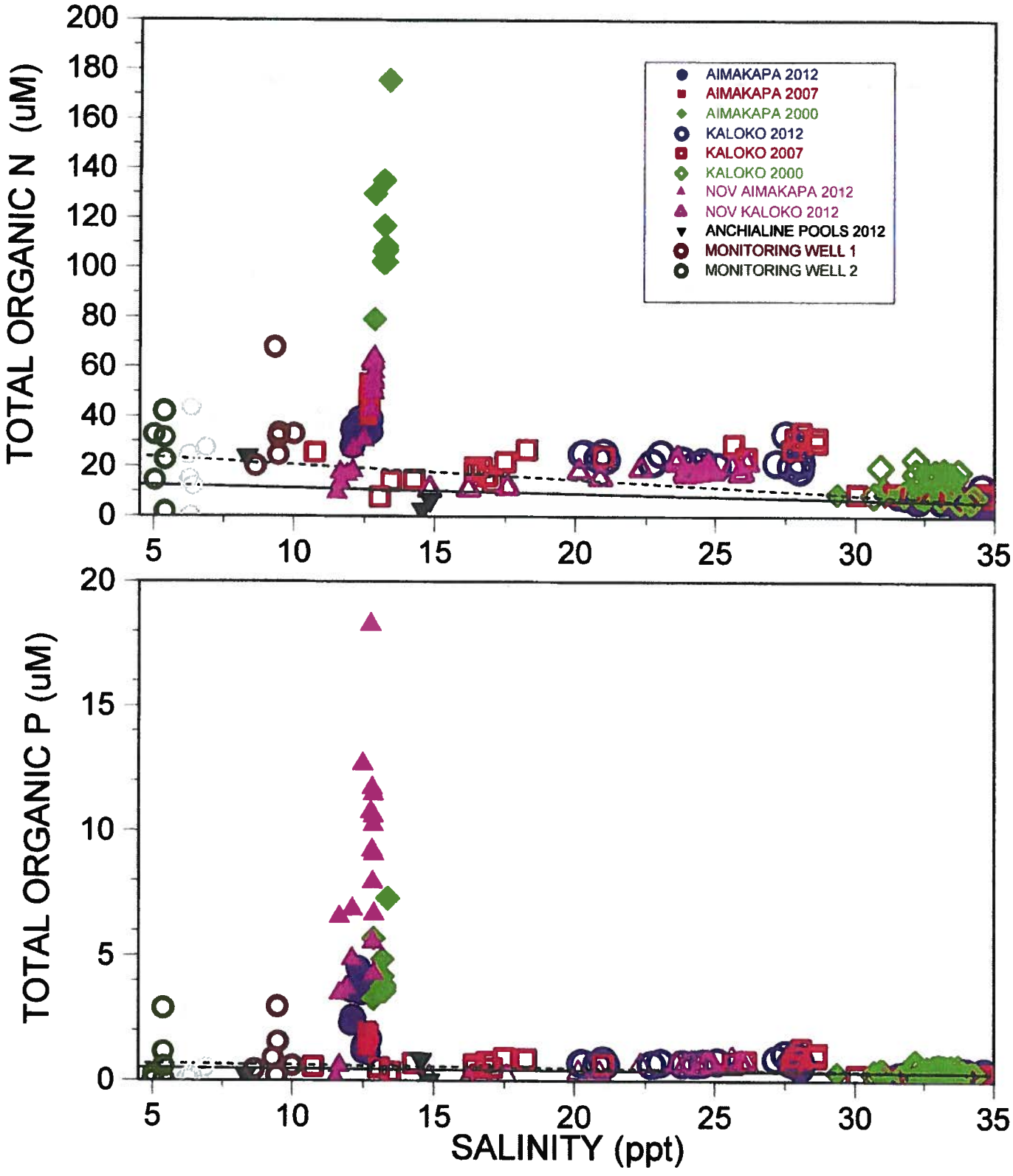

FIGURE 12. Mixing plots showing Total Organic Nitrogen (top) and Total Organic Phosphorus (bottom) functions of salinity in Aimakapa and Kaloko Fishponds, anchialine pools and the adjacent ocean during four sampling periods (2000, 2007, Feb. 2012 and Nov. 2012). Also shown are data from three KAHO monitoring wells. Solid line is conservative mixing line connecting endpoint concentrations from the open ocean and high level groundwater from the DWS Honokohau Well (4158-03), while dashed line is conservative mixing line connecting open ocean concentrations to basal groundwater sampled from the Kaloko Irrigation Well (4160-02).

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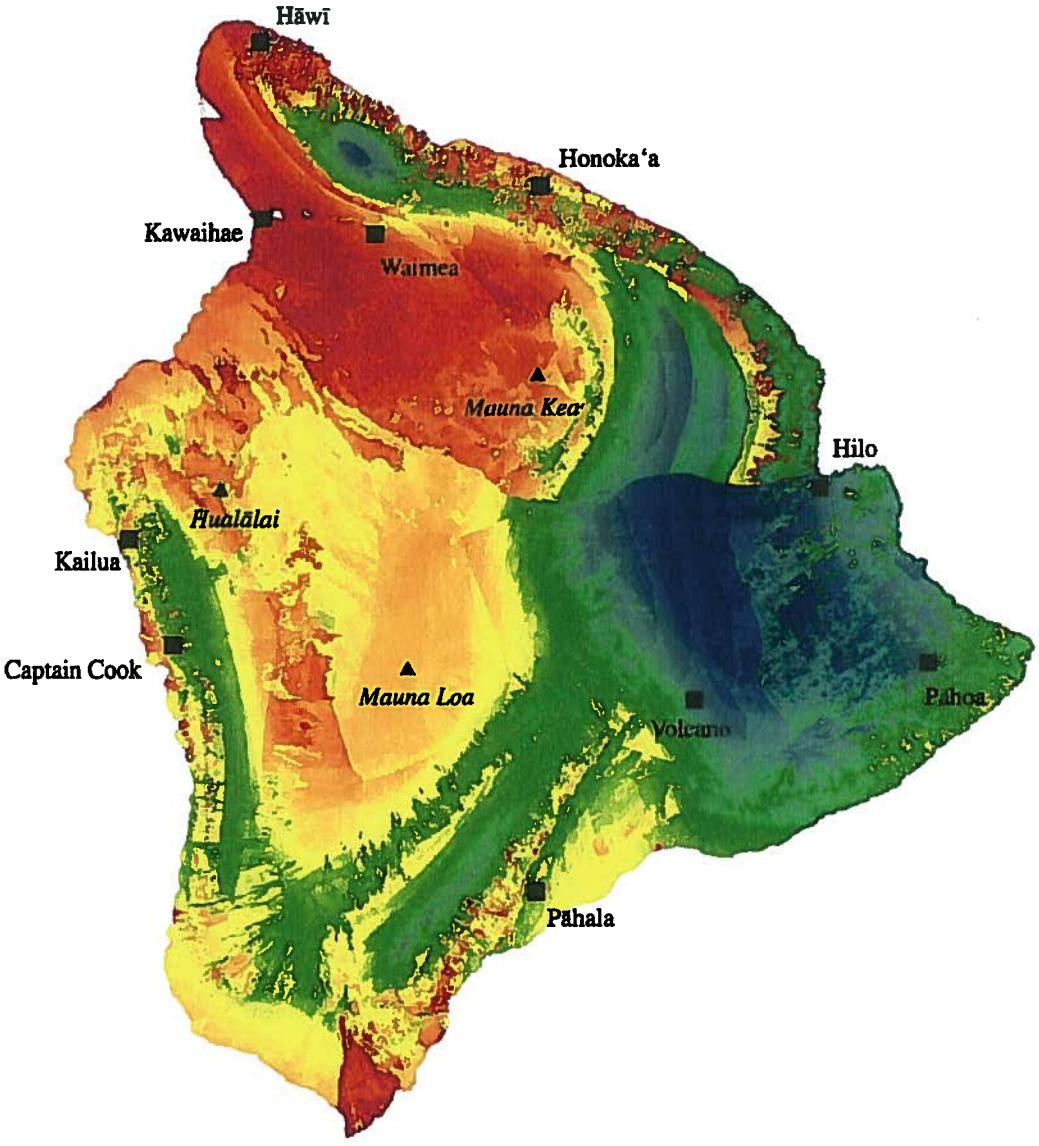
A Water-Budget Model and Assessment of Groundwater Recharge for the Island of Hawai'i



Scientific Investigations Report 2011–5078

U.S. Department of the Interior
U.S. Geological Survey

Exhibit B

A Water-Budget Model and Assessment of Groundwater Recharge for the Island of Hawai'i

By John A. Engott

Scientific Investigations Report 2011–5078

U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
KEN SALAZAR, Secretary

U.S. Geological Survey
Marcia K. McNutt, Director

U.S. Geological Survey, Reston, Virginia: 2011

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Executive Summary

Concern surrounding increasing demand for groundwater on the Island of Hawai'i, caused by a growing population and an increasing reliance on groundwater as a source for municipal and private water systems, has prompted a study of groundwater recharge on the island using the most current data and accepted methods. This report documents the development of a daily water-budget model for computing groundwater recharge for the entire Island of Hawai'i and the application of the model to estimate mean recharge for various land-cover and rainfall conditions. The development of a submodel for the Kona area and the application of the model to estimate historical groundwater recharge in the Kona area during the period 1984–2008 also are documented. Recharge estimates from this study are compared to recharge estimates used by the State of Hawai'i Commission on Water Resource Management (CWRM) in setting the sustainable yields (maximum allowable pumping rates) of Hawai'i aquifer systems in the 2008 version of the Water Resource Protection Plan (2008 WRPP).

Groundwater Recharge on Hawai'i

Estimated mean annual recharge on the Island of Hawai'i is 6,594 million gallons per day, which is about 49 percent of mean annual rainfall. Recharge is highest on the windward slopes of Mauna Loa, below the tradewind inversion, and lowest on the leeward slopes of Kohala and Mauna Kea (fig. ES1). Local recharge maxima also occur on (1) the higher elevations of windward Kohala, (2) windward Mauna Kea below the tradewind inversion, (3) windward Kīlauea, (4) the middle elevations of southeastern Mauna Loa, and (5) the lower middle elevations of leeward Mauna Loa and southwestern Hualālai, in the Kona area. Local recharge minima also occur on (1) Mauna Kea and Mauna Loa, above the tradewind inversion, (2) the northern tip of Kohala, (3) leeward Kīlauea, (4) the southern tip of Mauna Loa, and (5) the northwestern slopes of Mauna Loa and Hualālai.

In 18 of the 24 aquifer systems on the island, mean annual recharge estimated in this study for baseline conditions was higher than the recharge estimates used in the 2008 WRPP (fig. ES2). Baseline conditions for this study were 2008 land cover and mean annual rainfall from the period 1916–1983. The higher recharge estimates for most areas in this study generally are attributable to differences in the methods used to estimate runoff and ET, the inclusion of fog interception in this study, and the shorter time step used in this study. Substantially lower estimates of recharge were calculated for the Māhukona, Waimea, and Hāwī aquifer systems—38, 34, and 29 percent lower, respectively. These lower estimates mainly are due to much higher ET estimates in this study compared to the 2008 WRPP. This may be cause for concern, because these particular areas are experiencing a growth in development and a related growth in water demand. For the drought simulation performed in this study, the estimates of recharge for all three of these aquifer systems were substantially less than the sustainable yields of the aquifer systems set by CWRM.

Recent projections of change in rainfall owing to effects of ongoing climate change generally indicate a slight increase in islandwide rainfall, and estimates of annual recharge in the late 21st century are higher than baseline estimates for every aquifer system, except 'Anaeho'omalu. On average, these aquifer-system recharge estimates are higher by about 8 percent compared to baseline estimates.

Recharge in the Kona Area (1984–2008)

For the Kona submodel, the period 1984–2008 was broken into five subperiods to simplify calculation: 1984–1988, 1989–1993, 1994–1998, 1999–2003, and 2004–2008. Groundwater recharge was highest during 2004–8 and lowest during 1999–2003 (fig. ES3). Estimated mean annual recharge during 1999–2003 was only 50 percent of estimated recharge during 2004–8. These extremes coincided with the periods of lowest and highest mean rainfall, respectively. On a monthly basis, average recharge during the entire 1984–2008 period was highest in January and lowest in August; however, no clear seasonal pattern is discernible. Spatially, the highest recharge occurred in a belt about 4 miles wide running parallel to the coast about 2 miles inland.

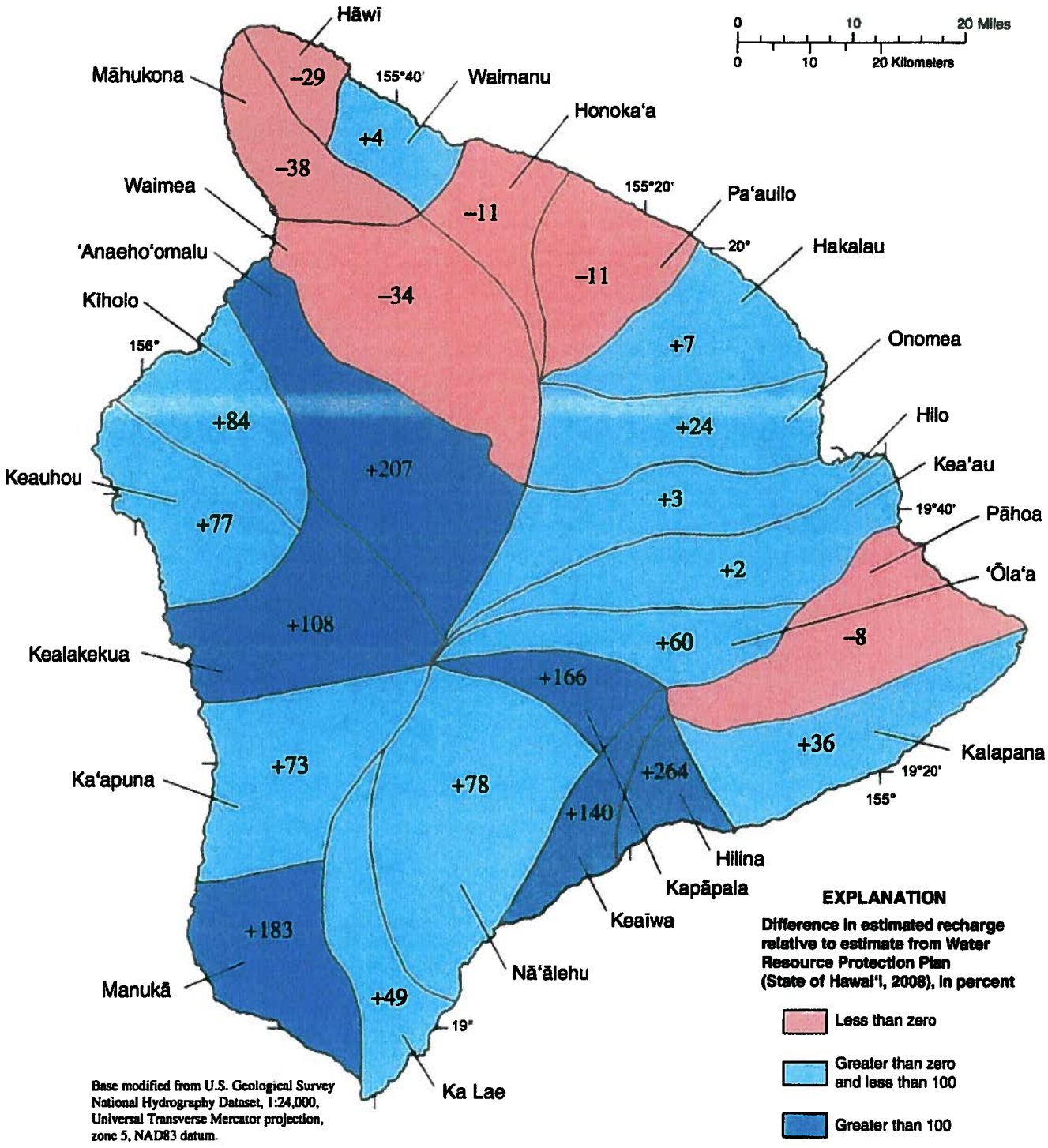
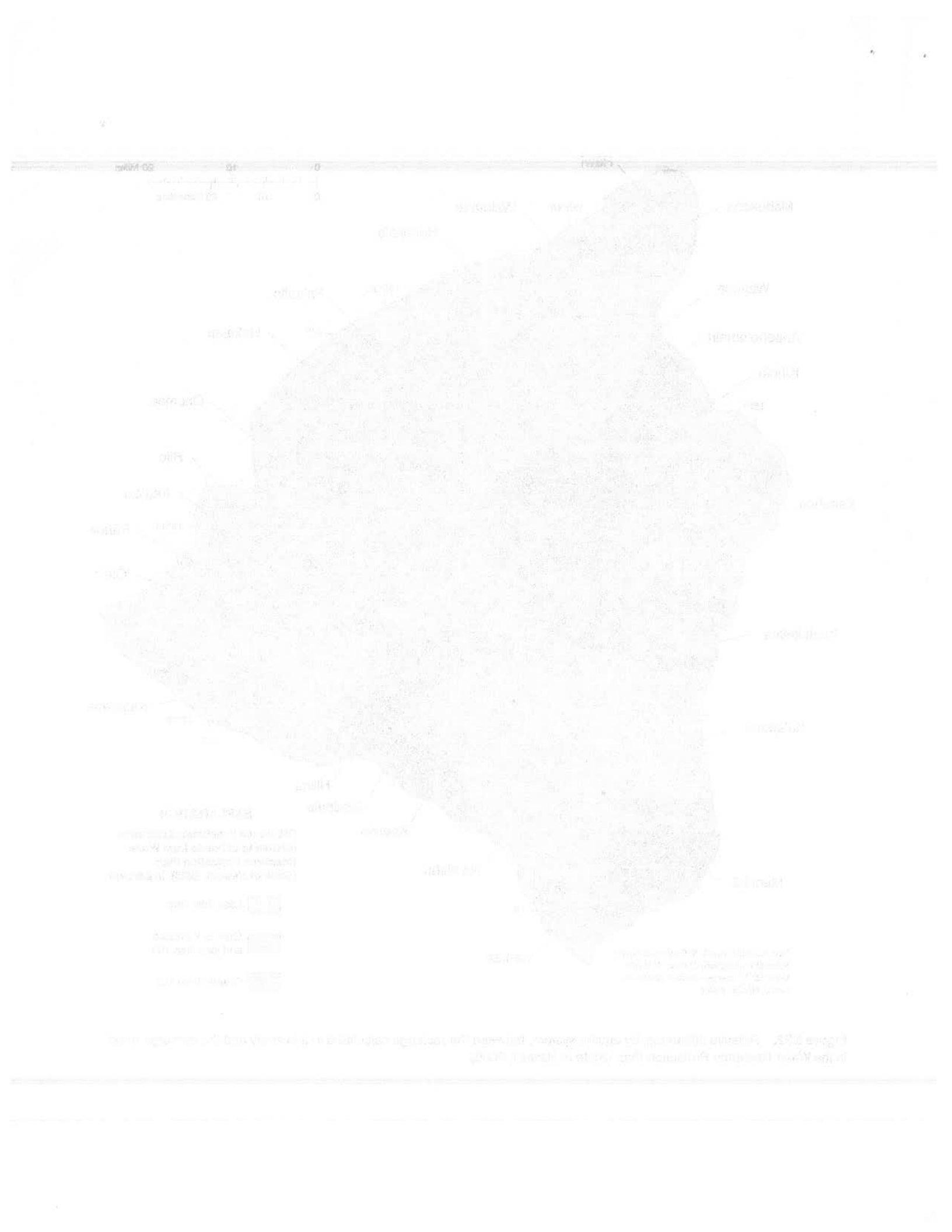


Figure ES2. Relative difference, by aquifer system, between the recharge calculated in this study and the recharge used in the Water Resource Protection Plan (State of Hawai'i, 2008).



from the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (2007). Late-21st-century projections for specific rain-gage stations are published online (Timm and others, 2009). In general, precipitation is projected to increase slightly for most areas of the island. Projected late-21st-century rainfall changes from Timm and others (2009) were applied to each rainfall-variability zone in the water-budget model (table 9), except for zone 7, an area for which no climate-change projections were published.

The effect of climate change on pan evaporation was analyzed for each pan-evaporation zone by developing a linear regression of historical pan evaporation versus historical rainfall for stations in each zone (table 10). For this particular analysis, pan-evaporation and rainfall data were normalized by dividing the annual or monthly observed values by the mean values for the particular pan-evaporation or rain-gage station published in Ekern and Chang (1985) or Giambelluca and others (1986), respectively. For the linear regression, a basic assumption was made that annual or monthly periods of mean pan evaporation should correspond to annual or monthly periods of mean rainfall. Hence, each regression line was forced through the point (1,1) on the plot of normalized pan evaporation versus normalized rainfall. The equation for each regression line is given by

$$PAN/(PAN)_{mean} - 1 = a(P/P_{mean} - 1) \quad (15)$$

where

PAN = pan evaporation [L],
$(PAN)_{mean}$ = mean pan evaporation [L],
a = slope of the regression line [dimensionless],
P = rainfall [L], and
P_{mean} = mean rainfall [L].

Solving equation 15 for pan evaporation (PAN) yields:

$$PAN = (a(P/P_{mean} - 1) + 1)(PAN)_{mean} \quad (16)$$

Late-21st-century mean pan evaporation in each pan-evaporation zone was estimated by using equation 16 and the following variable definitions:

Table 9. Parameters used for the simulation of late-21st-century rainfall conditions on the Island of Hawai'i.

[See figure 6 for locations of rainfall-variability zones; column (A) is the ratio of mean seasonal rainfall from Timm and others (2009) to the mean seasonal rainfall derived from Giambelluca and others (1986); columns (B), (C), and (D) are estimated rainfall-change factors based on the means and lower and upper margins of the 95-percent statistical confidence interval for a six-model ensemble for the late 21st century from Timm and others (2009); columns (E), (F), and (G) are the factors used to adjust mean rainfall in each rainfall-variability zone in the water-budget model to simulate late 21st century climate; SKN, state key number; NWS ID, National Weather Service cooperative identification number; HVNP HQ, Hawai'i Volcanoes National Park headquarters; –, no data given in Timm and others (2009)]

Rainfall-variability zone	Rain-gage station and SKN	NWS ID	Mean rainfall adjustment factor (A)	Mean change factor (B)	Lower 95% confidence change factor (C)	Upper 95% confidence change factor (D)	Overall adjustment factor for mean change (E) = (A) x (B)	Overall adjustment factor for lower 95% confidence change (F) = (A) x (C)	Overall adjustment factor for upper 95% confidence change (G) = (A) x (D)
Wet Season (November to April)									
1	Hāwī 168	511339	1.070	–	–	–	1.070	1.070	1.070
2	Pa'auilo 221	517312	0.996	1.033	0.852	1.214	1.029	0.849	1.209
3	HVNP HQ 54	511303	1.056	1.028	0.890	1.166	1.086	0.940	1.232
4	Nā'ālehu 14	516588	0.998	1.027	0.860	1.195	1.025	0.858	1.193
5	Kūlani Mauka 76	515018	0.975	–	–	–	0.975	0.975	0.975
6	Hōlualoa 70	511557	1.089	1.012	0.799	1.226	1.102	0.870	1.335
7	No estimates for this zone		–	–	–	–	1.000	1.000	1.000
Dry Season (May to October)									
1	Hāwī 168	511339	1.014	1.040	0.818	1.261	1.054	0.829	1.279
2	Pa'auilo 221	517312	0.941	1.070	0.839	1.300	1.007	0.790	1.224
3	HVNP HQ 54	511303	1.011	–	–	–	1.011	1.011	1.011
4	Kapāpala Ranch 36	513300	1.009	1.039	0.867	1.212	1.048	0.875	1.223
5	Kūlani Mauka 76	515018	0.847	–	–	–	0.847	0.847	0.847
6	Hōlualoa 70	511557	1.097	1.044	0.843	1.244	1.145	0.924	1.364
7	No estimates for this zone		–	–	–	–	1.000	1.000	1.000

ORIGINAL

Of Counsel:
ASHFORD & WRISTON
A Limited Liability Law Partnership LLP

BENJAMIN A. KUDO 2262-0
CONNIE C. CHOW 8556-0
First Hawaiian Center
999 Bishop Street, Suite 1400
Honolulu, Hawai`i 96813
Telephone: (808) 539-0400
Facsimile: (808) 533-4945
Attorneys for
THE WATER BOARD OF THE COUNTY OF HAWAII,
the Governing Board of the semi-autonomous Department
of Water Supply of the County of Hawaii

2014 DEC -3 AM 10: 37

BEFORE THE COMMISSION ON WATER RESOURCE MANAGEMENT

OF THE STATE OF HAWAII

In the Matter of: NATIONAL PARK SERVICE'S PETITION FOR GROUND WATER MANAGEMENT AREA DESIGNATION OF KEAUHOU AQUIFER.	) THE WATER BOARD OF THE COUNTY) OF HAWAII'S **NOTICE OF INTENT TO**) **FILE PETITION TO RESCIND THE**) **COMMISSION ON WATER RESOURCE**) **MANAGEMENT'S WATER**) **MANAGEMENT AREA DESIGNATION**) **OF KEAUHOU AQUIFER**; CERTIFICATE) OF SERVICE))

THE WATER BOARD OF THE COUNTY OF HAWAII DEPARTMENT OF WATER SUPPLY'S **NOTICE OF INTENT TO FILE PETITION TO RESCIND THE COMMISSION ON WATER RESOURCE MANAGEMENT'S WATER MANAGEMENT AREA DESIGNATION OF KEAUHOU AQUIFER**

The Water Board of the County of Hawaii, the Governing Board of the semi-autonomous Department of Water Supply of the County of Hawaii, a municipal corporation of the State of Hawaii (hereinafter the "Water Board"), by and through its counsel, Ashford & Wriston LLP, hereby notifies the Commission on Water Resource Management (the "Commission") of its

intent to file a Petition to Rescind the Commission's decision to designate the Keauhou Aquifer as a Water Management Area if the Commission grants the National Park Service's Petition for Water Management Area Action filed September 13, 2013 (the "Petition to Rescind").

The Water Board intends to petition the Commission to rescind the decision to designate the Keauhou Aquifer as a Water Management Area on the basis that there is insufficient evidence to support a designation under the criteria set forth in Hawaii Revised Statutes ("Haw. Rev. Stat.") § 174C-44 which the Commission is required to consider for designation.

The Petition to Rescind will be filed pursuant to Haw. Rev. Stat. § 174C-47, Haw. Rev. Stat. § 174C-9, and Haw. Rev. Stat. Chapter 91.

Dated: Honolulu, Hawaii, December 2, 2014.

BENJAMIN A. KUDO
CONNIE C. CHOW
Attorneys for
The Water Board of the County of Hawaii
the Governing Board of the semi-autonomous Department of Water Supply of the County of Hawaii

BEFORE THE COMMISSION ON WATER RESOURCE MANAGEMENT

OF THE STATE OF HAWAII

In the Matter of:	)	
	)	
NATIONAL PARK SERVICE'S PETITION FOR GROUND WATER MANAGEMENT AREA DESIGNATION OF KEAUHOU AQUIFER.	)	CERTIFICATE OF SERVICE

CERTIFICATE OF SERVICE

The undersigned hereby certifies that a copy of the foregoing document will be duly served upon the parties mentioned below by U.S. Mail, on the date listed below.

NATIONAL PARK SERVICE
Attn: Tammy A. Duchesne
73-4786 Kanalani Street, Suite #14
Kailua-Kona, Hawaii 96740

Dated: Honolulu, Hawaii, December 3, 2014.

BENJAMIN A. KUDO
CONNIE C. CHOW
Attorneys for
The Water Board of the County of Hawaii
the Governing Board of the semi-autonomous Department of Water Supply of the County of Hawaii