

LINDA LINGLE
GOVERNOR OF HAWAII



LAURA H. THIELEN
CHAIRPERSON

WILLIAM D. BALFOUR, JR.
SUMNER ERDMAN
NEAL S. FUJIWARA
CHIYOME L. FUKINO, M.D.
DONNA FAY K. KIYOSAKI, P.E.
LAWRENCE H. MIIKE, M.D., J.D.

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

LENORE N. OHYE
ACTING DEPUTY DIRECTOR

STAFF SUBMITTAL

for the meeting of the
COMMISSION ON WATER RESOURCE MANAGEMENT

August 25, 2010
Honolulu, Oahu

Division of Forestry and Wildlife
APPLICATION FOR WATER USE,
WELL CONSTRUCTION AND PUMP INSTALLATION PERMITS
Kawainui 1 to 11 Wells (Well No. 2235-05 to -11, 2345-02 to -05),
TMK 4-2-013:005, 4-2-013:022, WUP No. 882
Future (Habitat Maintenance) Use for 0.202 mgd
Waimanalo Ground Water Management Area, Oahu

APPLICANT:

Division of Forestry and Wildlife
Department of Land and Natural Resources
State of Hawaii
2135 Makiki Heights Drive
Honolulu, HI 96822

LANDOWNER:

Department of Land and Natural Resources
State of Hawaii
1151 Punchbowl Street
Honolulu, HI 96813

SUMMARY OF REQUEST:

The applicant requests that the Commission approve a water use permit for an allocation of 0.202 million gallons per day (mgd) of fresh ground water from 11 new wells to supply 24 acres of irrigation use for wetland habitat maintenance.

LOCATION MAP: See Exhibit 1

BACKGROUND:

On April 28, 2010, a completed water use permit application was received from the Division of Forestry and Wildlife by the Commission on Water Resource Management (Commission). Additional information regarding the source, use, notification and objections is provided in Attachment A.

ANALYSIS/ISSUES:

Section 174C-49(a) of the State Water Code establishes seven (7) criteria that must be met to obtain a water use permit. An analysis of the proposed permit in relation to these criteria follows:

(1) **Water availability**

Through the Hawaii Water Plan, the Commission has adopted 10 mgd as the sustainable yield for the Waimanalo Aquifer System Area. Individual existing water use permits in this aquifer system area are shown in Exhibit 2. A summary of the current ground water conditions in the aquifer is provided in Table 1:

Table 1. Waimanalo Aquifer System

<u>ITEM</u>	Waimanalo Aquifer System Area (mgd)
Sustainable Yield	10
Less: Other Existing Water Use Permits (shown in Exhibit 2)	1.532
Reservation to DHHL	0.124
Subtotal (Current Available Allocation)	8.344
Less: Other Completed Applications	0
Less: This Application	0.202
Subtotal (Potential Available Allocation)	8.142

Therefore, there is adequate water in the Waimanalo Aquifer System Area to accommodate the requested allocation.

(2) **Reasonable-beneficial**

Section 174C-3 HRS defines "reasonable-beneficial use" is

"...the use of water in such a quantity as is necessary for economic and efficient utilization, for a purpose, and in a manner which is both reasonable and consistent with the state and county land use plans and the public interest".

I. Purpose of Use

The applicant is requesting the use of fresh ground water to supply water to man-made artificially constructed wetlands to create a habitat for endangered water birds. The Declaration of Policy section, §174C-2(c) HRS, states that the Water Code shall be liberally interpreted to obtain maximum beneficial use of the waters of the State for various purposes including *the protection and procreation of fish and wildlife* (emphasis added).

II. Quantity Justification

The applicant is requesting a total of 0.202 mgd to provide water to wetlands. This is based on calculations derived from ambient conditions (rainfall and evapotranspiration) and infiltration. The total pumpage required from the wells to keep the ponds filled is calculated by taking rainfall and subtracting both infiltration and evapotranspiration. Detailed tables provided by the applicant that were used to calculate the demand can be found in Exhibit 3. Basically, the analysis demonstrates the pumpage required to meet infiltration and evaporation demands above that supplied by natural annual rainfall.

III. Efficiency of Use

The use is efficient because the required pumping will be done to accommodate the wetland habitat maintenance demands attributed to ambient evaporation conditions and infiltration.

IV. Analysis of Practical Alternatives

The applicant has considered alternatives to using fresh ground water and has provided the following reasons that they are not practical:

1. Non-potable municipal water is not available, and potable water for a non-potable use is not an efficient use of water.
2. Wastewater is both unavailable and potentially harmful to birds.
3. Maunawili Ditch System is nearby but supplies water to the Waimanalo Irrigation System and is therefore unavailable.
4. Desalinization is too costly.

(3) Interference with other existing legal uses

There are 6 other wells currently in use within 1 mile of the proposed Kawainui Wells. One of these wells (Well No. 2345-01) belongs to the DLNR's Division of Forestry and Wildlife. Two of these wells are abandoned and sealed (Well Nos. 2246-01 and 2245-01). One well is an irrigation well (Well No. 2245-04) and two are domestic (Well Nos. 2245-02 and -03). While it is not expected that pumpage will affect these sources because they are upgradient to the subject project, pump test data for these wells will indicate whether or not there will be adverse effects due to long term pumping. A condition of the pump installation permits for these wells is that pump tests will need to show no adverse effects on other resources.

(4) Public interest

Public interest is defined under §174C-2 - Declaration of policy, as follows:

“(c) The state water code shall be liberally interpreted to obtain maximum beneficial use of the waters of the State for purposes such as domestic uses, aquaculture uses, irrigation and other agricultural uses, power development, and commercial and industrial uses. However, adequate provision shall be made 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. Such objectives are declared to be in the public interest.”

There have been no public comments or objections to this application.

(5) State & county general plans and land use designations

The proposed uses are in the State Conservation District, and the county zoning is Preservation. The proposed use is consistent with these land use designations.

Normal agency review includes:

- 1) the State’s Department of Land and Natural Resources (DLNR) and its State Parks, Aquatic Resources, Historic Preservation, and Land Divisions; the Department of Health (DOH) with its Clean Water, Safe Drinking Water, and Wastewater Branches; the Department of Hawaiian Home Lands (DDHL), and Land Use Commission (LUC); and the Office of Hawaiian Affairs (OHA).
- 2) the Mayor’s office, Department of Planning and Permitting, and the Board of Water Supply;

No comments or objections have been made through this review. These proposed uses are consistent with the state and county general plans and land use designations.

(6) County land use plans and policies

Again, normal County review includes Mayor’s office, Department of Planning and Permitting, and the Board of Water Supply. No comments or objections have been made.

(7) Interference with Hawaiian home lands rights

All permits are subject to the prior rights of Hawaiian home lands. The Department of Hawaiian Home Lands (DHHL) and the Office of Hawaiian Affairs have reviewed this application and made no comments or objections. Further, standard water use permit conditions 3.g., 6., and 9.f. notify all water use permittees that their permits are subject to and cannot interfere with Hawaiian home land rights.

Therefore, this application will not interfere with Hawaiian home lands rights.

Other issues*I. Chapter 343 – Environmental Assessment (EA) Compliance***EA Triggers**

In accordance with §HRS 343-5(a), the applicant's proposed action triggers the need for an EA since there is: (1) use of state land, (2) use of state funds, and (3) use of conservation district lands.

EA Exemptions

- a. Commission exemption list – the Commission does not currently have an exemption list approved by the Environmental Council of the Department of Health's Office of Environmental Quality Control. Therefore, no exemptions for a triggered EA fall under this exemption category.
- b. DLNR's Department-wide exemption list – none are applicable.
- c. §HAR11-200-8.A. General exemption list – item 4. *Minor alterations in the conditions of land, water, or vegetation; see discussion below.*

Cumulative Impacts §HAR11-200-8.B.

Even where a categorical exemption appears to include a proposed action, that action cannot be declared exempt if the cumulative impact of planned successive action in the same place, over time, is significant, or when an action that is normally insignificant in its impact on the environment may be significant in a particularly sensitive environment.

A Final Environmental Assessment (FEA) and Finding of No Significant Impact (FONSI) was completed in March of 2000, and received by the Office of Environmental Quality Control (OEQC) on March 29, 2000. This FEA addressed most other cumulative impacts associated with the project but did not specifically address the source of water, and the impacts related to pumping groundwater. Rather, the document addressed the total inflows and outflows for the entire marsh, and states that the evapotranspiration from the ponds would be negligible.

A Final Supplemental Environmental Assessment and Finding of No Significant Impact was completed in December of 2008, and received by the OEQC on January 8, 2009. This document addressed ground water more specifically as a viable alternative, but only refined the discussion from the previous FEA to include estimates of inflow to the marsh from Maunawili and Kahanaiki Streams, and outflow from the marsh through evapotraspiration, surface outlets and groundwater seepage.

The previous two FEAs did not include an analysis to show if there would be any effects of pumping ground water on the adjacent Maunawili Stream.

The Commission has adopted the policy that ground water pumpage will affect streamflow on a 1:1 basis in dike controlled areas, which includes the Waimanalo Aquifer System Area. Maunawili Stream is adjacent to the subject project (refer to Exhibit 1). The assumption that there is a 1:1 relationship between pumpage and streamflow also means that one can assume a 1:1 return back to the stream due to infiltration. Therefore, one can reasonably assume that pumpage minus infiltration is the impact (or return) to the stream. Based on this assumption, the applicant has stipulated that consumptive use is within the 5% that the Commission considers streamflow impacts to be de minimis; therefore, an amendment to the interim instream flow standards is not required. Refer to Exhibit 3 for the streamflow calculations. Staff finds this analysis as reasonable.

Therefore, while the issue of ground and surface water was not adequately addressed in the Final EA and subsequent FONSI of 2008, it was addressed adequately to staff in subsequent discussions and correspondence through the water use permit process. Further, pump tests done as a requirement of the Well Construction and Pump Installation Permits will further address any potential impacts of pumping. Well Construction and Pump Installation Permits can be issued once the applicant has selected a contractor, assuming that the Commission authorizes the project to proceed under the premise of the suitability of the analysis described in this section to satisfy Chapter 343 requirements.

For the purposes of disclosing environmental impacts for water resources, staff considers the analysis showing de minimis effects to the stream to allow the Commission to apply the exemption under §HAR11-200-8.A, 4) *Minor alterations in the conditions of land, water, or vegetation.*

Therefore, the applicant is exempt from the requirements under Chapter 343 for this project.

II. Land Division Lease

The Land Division of the Department of Land and Natural Resources stated that a water lease is required but has not been obtained. A copy of the completed permits will be forwarded to the Land Division for further action.

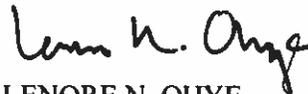
RECOMMENDATION:

Staff recommends that the Commission:

- A. Approve the issuance of water use permit no. 882 to Division of Forestry and Wildlife for the reasonable and beneficial use of 0.202 million gallons per day of fresh water for habitat maintenance from the Kawainui 1 to 11 Wells (Well No. 2235-05 to -11, 2345-02 to -05), subject to the standard water use permit conditions listed in Attachment B and the following special conditions:
 1. Should an alternate permanent source of water be found for this use, then the Commission reserves the right to revoke this permit, after a hearing.

2. In the event that the tax map key at the location of the water use is changed, the permittee shall notify the Commission in writing of the tax map key change within thirty (30) days after the permittee receives notice of the tax map key change.
 3. Cumulative pump tests of the entire system (i.e. all 11 pumps pumping together) must show that there are no adverse effects on other existing legal uses and/or surface water. If pump tests show any potential adverse effects, the pump capacities shall be reduced until such time as the cumulative pump test does not show any potential adverse effects.
- B. Declare that, after considering the effects of the proposed Water Use Permit as provided by Chapter 343 HRS and Chapter 11-200, HAR, this project will have minimal or no significant effect on the environment and is therefore exempt from the preparation of a supplemental EA.
- C. Authorize the chair to approve and issue well construction and pump installation permits at a later date, subject to pump test results and the standard conditions of Well Construction and Pump Installation Permits.

Respectfully submitted,



LENORE N. OHYE
Acting Deputy Director

Attachment(s): A (Water Use Permit Detailed Information)
 B (Water Use Permit Standard Conditions)

Exhibit(s): 1 (Location Map)
 2 (Existing Water Use Permits and 12-Month Moving Average Withdrawal)
 3 (Stream De Minimis Impact Calculations)

APPROVED FOR SUBMITTAL:



LAURA H. THIELEN
Chairperson

WATER USE PERMIT DETAILED INFORMATION

Source Information

AQUIFER:	Waimanalo System, Windward Sector, Oahu
Sustainable Yield:	10 mgd
Existing Water Use Permit & Reservation to DHHL:	1.656 mgd
Available Allocation:	8.344 mgd
Total other pending applications:	0 mgd
This application:	0.202 mgd
 WELL:	 Kawainui 1 to 11 Wells (Well No. 2235-05 to -11, 2345-02 to -05)
Location:	Kawainui Marsh, Oahu, TMK: 4-2-013:005, 4-2-013:022

Use Information

Quantity Requested:	0.202 mgd
Future Type of Water Use:	Habitat Maintenance
Place of Water Use:	Kawainui Marsh
TMK:	4-2-013:005, 4-2-013:022
 Waimanalo Aquifer System	
Current 12-Month Moving Average Withdrawal (See Exhibit 2):	0.620 mgd (as of Jan 07)

Nearby Surrounding Wells and Other Registered Ground Water Use

There are 6 other wells currently in use within 1 mile of the proposed Kawainui Wells. One of these wells (Well No. 2345-01) belongs to the DLNR’s Division of Forestry and Wildlife. Two of these wells are abandoned and sealed (Well Nos. 2246-01 and 2245-01). One well is an irrigation well (Well No. 2245-04) and two are domestic (Well Nos. 2245-02 and -03).

Public Notice

In accordance with HAR §13-171-17, a public notice was published in the Honolulu Star Bulletin on May 28, 2010 and June 4, 2010 and a copy of the notice was sent to the Mayor's office. Copies of the completed application were sent to the Department/Board of Water Supply, Planning Department (Maui), Department of Planning and Permitting (Oahu), Department of Health, Department of Hawaiian Home Lands, Office of Hawaiian Affairs, the various divisions within the Department of Land and Natural Resources, and other interested parties for comments. Written comments and objections to the proposed permit were to be submitted to the Commission by June 22, 2010.

Objections

The public notice specifies that an objector meet the following requirements: (1) state property or other interest in the matter; (2) set forth questions of procedure, fact, law, or policy, to which objections are taken; (3) state all grounds for objections to the proposed permits, (4) provide a copy of the objection letter(s) to the applicant, and (5) submit objections meeting the previous requirements to the Commission by June 22, 2010.

No objections have been made to this application.

STANDARD WATER USE PERMIT CONDITIONS

1. The water described in this water use permit may only be taken from the location described and used for the reasonable beneficial use described at the location described above. Reasonable beneficial uses means "the use of water in such a quantity as is necessary for economic and efficient utilization which is both reasonable and consistent with State and County land use plans and the public interest." (HRS § 174C-3)
2. The right to use ground water is a shared use right.
3. The water use must at all times meet the requirements set forth in HRS § 174C-49(a), which means that it:
 - a. Can be accommodated with the available water source;
 - b. Is a reasonable-beneficial use as defined in HRS § 174C-3;
 - c. Will not interfere with any existing legal use of water;
 - 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 policies; and
 - g. Will not interfere with the rights of the Department of Hawaiian Home Lands as provided in section 221 of the Hawaiian Homes Commission Act and HRS § 174C-101(a).
4. The ground-water use here must not interfere with surface or other ground-water rights or reservations.
5. The ground-water use here must not interfere with interim or permanent instream flow standards. If it does, then:
 - a. A separate water use permit for surface water must be obtained in the case an area is also designated as a surface water management area;
 - b. The interim or permanent instream flow standard, as applicable, must be amended.
6. The water use authorized here is subject to the requirements of the Hawaiian Homes Commission Act, as amended, if applicable.
7. The water use permit application and submittal, as amended, approved by the Commission at its August 25, 2010 meeting are incorporated into this permit by reference.
8. Any modification of the permit terms, conditions, or uses may only be made with the express written consent of the Commission.
9. This permit may be modified by the Commission and the amount of water initially granted to the permittee may be reduced if the Commission determines it is necessary to:
 - a. protect the water sources (quantity or quality);
 - b. meet other legal obligations including other correlative rights;
 - c. insure adequate conservation measures;

- d. require efficiency of water uses;
- e. reserve water for future uses, provided that all legal existing uses of water as of June, 1987 shall be protected;
- f. meet legal obligations to the Department of Hawaiian Home Lands, if applicable; or
- g. carry out such other necessary and proper exercise of the State's and the Commission's police powers under law as may be required.

Prior to any reduction, the Commission shall give notice of its proposed action to the permittee and provide the permittee an opportunity to be heard.

- 10. An approved flowmeter(s) must be installed to measure monthly withdrawals and a monthly record of withdrawals, salinity, temperature, and pumping times must be kept and reported to the Commission on Water Resource Management on forms provided by the Commission on a monthly basis (attached).
- 11. This permit shall be subject to the Commission's periodic review of the Waimanalo Aquifer System's sustainable yield. The amount of water authorized by this permit may be reduced by the Commission if the sustainable yield of the Waimanalo Aquifer System, or relevant modified aquifer(s), is reduced.
- 12. A permit may be transferred, in whole or in part, from the permittee to another, if:
 - a. The conditions of use of the permit, including, but not limited to, place, quantity, and purpose of the use, remain the same; and
 - b. The Commission is informed of the transfer within ninety days.

Failure to inform the department of the transfer invalidates the transfer and constitutes a ground for revocation of the permit. A transfer which involves a change in any condition of the permit, including a change in use covered in HRS § 174C-57, is also invalid and constitutes a ground for revocation.

- 13. The use(s) authorized by law and by this permit do not constitute ownership rights.
- 14. The permittee shall request modification of the permit as necessary to comply with all applicable laws, rules, and ordinances which will affect the permittee's water use.
- 15. The permittee understands that under HRS § 174C-58(4), that partial or total nonuse, for reasons other than conservation, of the water allowed by this permit for a period of four (4) continuous years or more may result in a permanent revocation as to the amount of water not in use. The Commission and the permittee may enter into a written agreement that, for reasons satisfactory to the Commission, any period of nonuse may not apply towards the four-year period. Any period of nonuse which is caused by a declaration of water shortage pursuant to section HRS § 174C-62 shall not apply towards the four-year period of forfeiture.

16. The permittee shall prepare and submit a water shortage plan within 30 days of the issuance of this permit as required by HAR § 13-171-42(c). The permittee's water shortage plan shall identify what the permittee is willing to do should the Commission declare a water shortage in the Waimanalo Ground-Water Management Area.
17. The water use permit shall be subject to the Commission's establishment of instream standards and policies relating to the Stream Protection and Management (SPAM) program, as well as legislative mandates to protect stream resources.
18. Special conditions in the attached cover transmittal letter are incorporated herein by reference.
19. The permittee understands that any willful violation of any of the above conditions or any provisions of HRS § 174C or HAR § 13-171 may result in the suspension or revocation of this permit.

Aquifer System Water Use Permit Index *(non-saltwater)*

ISLAND OF OAHU

<i>WUP No</i>	<i>Approved</i>	<i>Applicant</i>	<i>Well No.</i>	<i>Well Name</i>	<i>WUP (mgd)</i>	<i>12-MAV (mgd)</i>
WMA Aquifer System: WAIMANALO				Sustainable Yield =		10
567	11/17/1993	STATE DHHL		RESERVATION	0.124	
675	11/20/2003	HONOLULU BWS	1942-01	WAIMANALO III	0.2	
315	1/26/1994	HONOLULU BWS	1943-01	WAIMANALO WELL II	0.452	
315	1/26/1994	HONOLULU BWS	2043-02	WAIMANALO WELL I		
674	2/21/1996	HONOLULU BWS	2044-03	WAIMANALO TUN. I	0.7	
674	2/21/1996	HONOLULU BWS	2044-04	WAIMANALO TUN. II		
674	2/21/1996	HONOLULU BWS	2045-03	WAIMANALO TUN. III		
674	2/21/1996	HONOLULU BWS	2045-05	WAIMANALO TUN. IV		
196	10/27/1993	ROYAL HAWAIIAN CC	2045-06	ROYAL HAWAIIAN 6	0.155	
196	10/27/1993	ROYAL HAWAIIAN CC	2145-01	ROYAL HAWAIIAN 1		
196	10/27/1993	ROYAL HAWAIIAN CC	2145-02	ROYAL HAWAIIAN 2		
196	10/27/1993	ROYAL HAWAIIAN CC	2145-04	ROYAL HAWAIIAN 4		
337	3/16/1994	C&C DWWM	2545-01	KAILUA WWTP-PC PI	0.025	
<i>Summary for 'SYSTEM' = WAIMANALO (13 detail records)</i>						
Totalling					1.656	
Available					8.344	

Aquifer Code: Aquifer System: SY MGD: Beginning: Ending: Compute 12-Month Moving Average

Caprock? Tunnel? Saltwater?

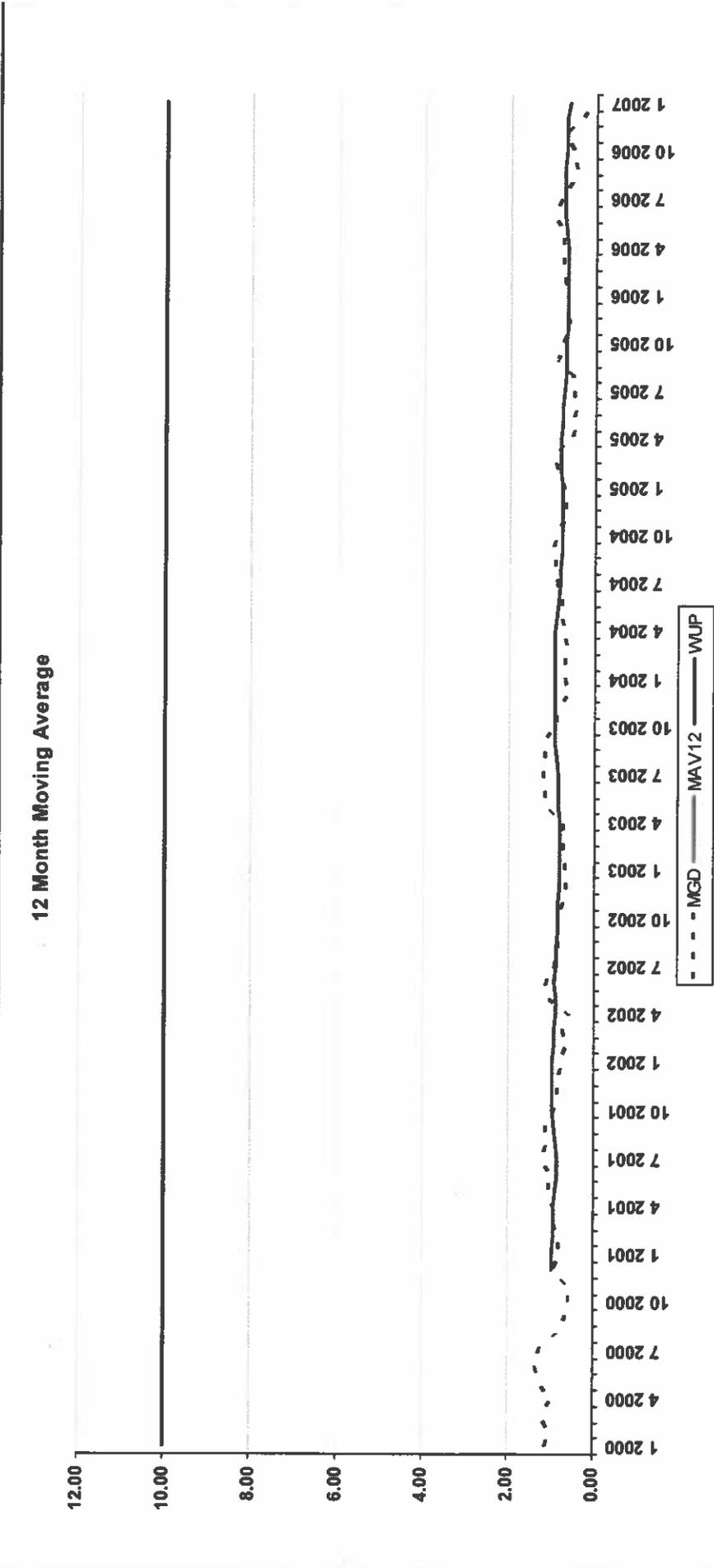
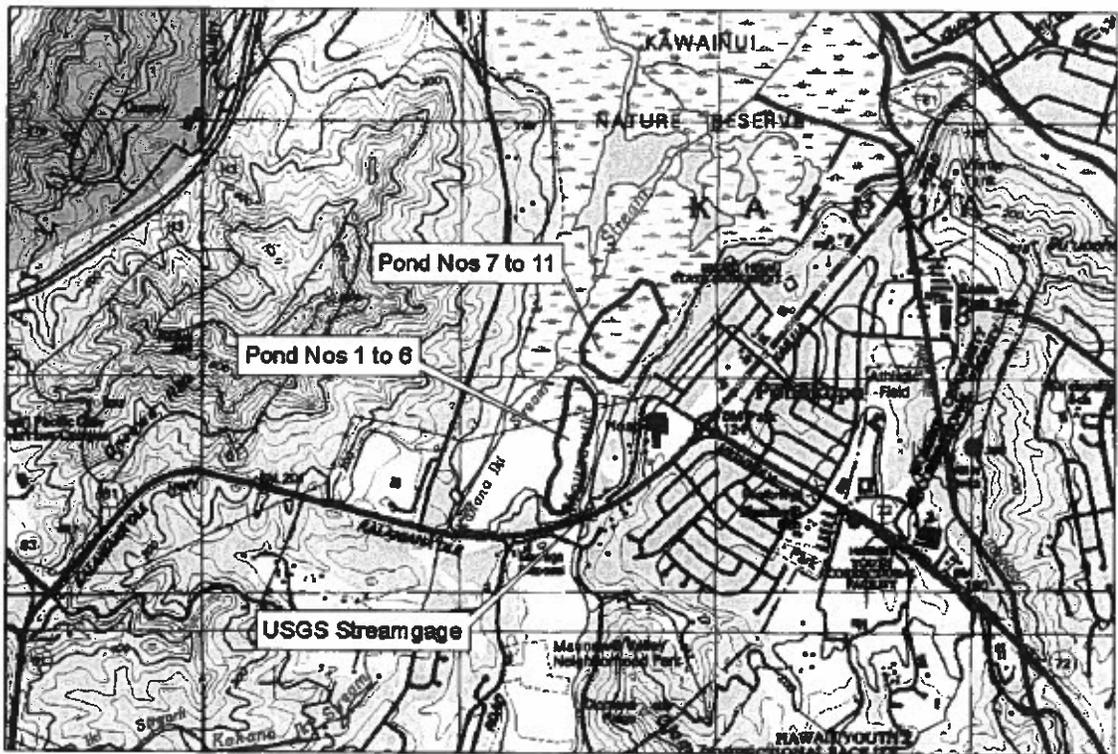


EXHIBIT 2: EXISTING WATER USE PERMITS AND 12-MONTH MOVING AVERAGE WITHDRAWAL

**Well Construction Permit
Potential Effects on Stream Flow
Kawainui Marsh Restoration Project
Koolaupoko, Oahu, Hawaii**

Eleven ponds with a total area of 24 acres will be constructed on the upper part of Kawainui Marsh. The ponds will function as habitat for native Hawaiian birds. The ponds will be perched above the groundwater table and will require groundwater for to maintain ponding conditions.

The project entails the construction of 11 wells, one well per pond. Each well will have a 30 gpm solar powered pump installed. The pumps will only be functioning during the daylight hours. Based on a twelve month moving average (12 MAV) the average groundwater demand will be 0.203 mgd. The project is located on the Windward side of Oahu in the Waimanalo Aquifer System area of the Koolaupoko Sector. There are two streams in the immediate area, Kahanaiki and Maunawili. Maunawili Stream runs through the middle of the project area (Figure 1) and is most likely to be impacted by the groundwater pumpage.



Kawainui Wetland Restoration
Project Location



Figure 1. Map showing the locations of the ponds and the Maunawili Stream Gage.

The established precedent for the Koolaupoko Aquifer Sector is that there is a 1:1 relationship between groundwater withdrawals and stream flow. Assuming a 1:1 relationship, the impact on stream flow is still de minimus. Consumptive groundwater use is less than five percent of calculated discharge in Maunawili Stream. Although the 0.203 mgd of groundwater will be pumped a significant portion of the water will infiltrate back into the same shallow groundwater system from the unlined ponds and the actual consumptive groundwater use will only be 0.041 mgd (12-MAV). There are three steps in demonstrating that the impact is de minimus. The first step is to calculate the consumptive groundwater use, the second step is to calculate various representative stream flow statistics for Maunawili Stream and the third step is to compare the consumptive groundwater use with the stream flow statistics.

The average annual groundwater demand and consumptive use varies monthly and is a function of average monthly evapotranspiration (ET) and rainfall (Table 1). Average annual rainfall is 0.079 mgd and average annual ET is 0.119 mgd. Pond infiltration (groundwater recharge) is expected to be steady at 0.25 inches/day. Assuming that all of the ponds are kept filled this equates to an annual average infiltration of 0.163 mgd. Consumptive groundwater use is defined as the total groundwater use minus the infiltration. The average annual consumptive groundwater use for the proposed project is approximately 0.203 mgd (total pumpage) – 0.163 (Infiltration) = 0.041 mgd. Note that there is an apparent rounding error because the consumptive groundwater use is calculated from the monthly not annual values.

	Rainfall (mgd)	Total Pumpage Demand (mgd)	Infiltration (mgd)	Evapo-transpiration ET (mgd)	Consumptive groundwater use (mgd)
	0.106	0.152	0.163	0.095	-0.011
	0.112	0.123	0.163	0.072	-0.040
	0.148	0.122	0.163	0.107	-0.041
	0.062	0.235	0.163	0.134	0.072
	0.055	0.239	0.163	0.132	0.076
	0.023	0.311	0.163	0.171	0.148
	0.033	0.267	0.163	0.137	0.104
	0.039	0.252	0.163	0.129	0.089
	0.043	0.282	0.163	0.162	0.119
	0.070	0.218	0.163	0.125	0.055
	0.132	0.125	0.163	0.094	-0.038
	0.122	0.115	0.163	0.073	-0.048
annual average (mgd)	0.079	0.203	0.163	0.119	0.041
annual average (gal/day)	78,677	203,420	162,914	119,182	40,505

Table 1 Consumptive groundwater use calculations for the 24-acre pond system

Stream flow data was obtained for Maunawili Stream from the USGS Maunawili Stream gage (USGS 16260500 MAUNAWILI STREAM AT HWY 61 NR KAILUA, OAHU, HI), located on at the Pali Highway, just upstream from the study area (Figure 1). The gage was in operation for two periods, January 1, 1967 to September 30, 1971 and April 23, 1991 to January 2, 1996. The daily stream flow data from both periods were used to calculate stream discharge statistics (Table 2).

The mean, median Q_{90} , Q_{95} and Q_{99} were used as stream discharge statistics. The mean and median probably do not properly represent low flow conditions in Maunawili Stream but these statistics were included because they are commonly used to represent stream flow. Q_{90} is a frequently used in Hawaii to quickly estimate low flow conditions in a stream. It represents the daily average flow that is exceeded 90 percent of the time. The daily Q_{90} for Maunawili Stream is 2.747 mgd. Q_{95} and Q_{99} are similar statistics which represent flow conditions exceeded 95 and 99 percent of the time. These are statistics probably under-represent the low flow conditions but they are included to show the potential proportionate effect of groundwater use on very low flow conditions.

Statistic	Maunawili Stream Discharge (cfs)	Maunawili Stream discharge (mgd)	Consumptive groundwater use as % of stream flow
Mean	14.54	9.396	0.4%
median	7.90	5.106	0.8%
Q_{90}	4.25	2.747	1.5%
Q_{95}	3.75	2.424	1.7%
Q_{99}	2.80	1.810	2.3%

Table 2 Stream discharge statistics and consumptive groundwater use as a percentage of stream flow

The stream flow and consumptive groundwater use should be compared to demonstrate that the affect is de minimus. As calculated earlier, the average annual consumptive groundwater use is 0.041 mgd. The affect of pumpage on stream flow is considered de minimus if the consumptive water use is less than five percent of stream flow. This percent value was calculated by dividing the stream flow statistic into 0.041 mgd. As shown in Table 2, the proportionate affect on Maunawili Stream is always less than five percent. Even at Q_{99} flows the consumptive water use is still only 2.3% of stream flow.