



ORIGINAL

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

APPLICATION FOR SURFACE WATER USE PERMIT
FOR EXISTING USE IN THE NA WAI EHA, MAUI, SURFACE WATER
MANAGEMENT AREAS

FORM SWUPA-E (NA WAI EHA, MAUI)

For Official Use Only:
RECEIVED
COMMISSION ON WATER
RESOURCE MANAGEMENT
2009 APR 22 PM 4:0
Event ID:

For detailed instructions on filling out this application, refer to the attached instructions.

APPLICANT INFORMATION: Note: In accordance with §174C-51(1)(B), HRS, in the event a lessee, licensee, developer, or any other person with a terminable interest or estate in the land, which is the water source of the permitted water, applies for a water permit, the landowner shall also be stated as a joint applicant for the water permit.

1. APPLICANT'S NAME: Hawaiian Commercial & Sugar Company
Applicant's Contact: Garret Hew
2. SOURCE LANDOWNER'S NAME: Wailuku Water Company
Source Landowner's Contact: Clayton Suzuki
Applicant's Mailing Address: P.O. Box 266, Puunene, Hawaii 96784
Source Landowner's Mailing Address: 255 East Waiko Road, Wailuku, HI 96793
Applicant's Phone: 808-877-6950
Applicant's Fax: 808-871-2149
Applicant's E-mail: ghew@hcsugar.com
Source Landowner's Phone: 808-244-2208
Source Landowner's E-mail: csuzuki@wailukuwater.com

EXISTING SOURCE INFORMATION

The following must be attached before this application is accepted as complete:
• Portion of 7.5-Minute Series USGS topographic map (scale 1:24,000) labeled with stream and diversion locations and quad map name.
• Property Tax Map Key (TMK), showing stream or diversion location, and location of water use referenced to established property boundaries.
• Photograph(s) of the surface water diversion works and end use.

3. SURFACE WATER HYDROLOGIC UNIT AND CODE: [X] Waihee/6022 [X] Waiehu/6023 [X] Iao/6024 [X] Waikapu/6001

4. DIVERSION LOCATION: Choose the appropriate category and enter information in either 4a or 4b.

4a. TMK OF STREAM DIVERSION LOCATION: Zone Sector Plat Parcel

4b. TMK OF DITCH DIVERSION LOCATION: Zone Sector Plat Parcel

See attached

5. STREAM DIVERSION: How is water diverted from the stream to your property? Check all that apply.

[] Pipe [] Pump [X] Ditch/auwai [X] Other Describe: Reservoirs

Is the diverted water returned to the stream or ditch? [] Yes [X] No. If yes, how much water is returned?

6. FLOW MEASUREMENT INFORMATION:

Does the stream diversion have a flowmeter with totalizer or other device to measure diverted amounts?

[] Yes. Enter the installation date:

Describe the device and enter measured amounts in Table 1.

[X] No. Explain how you are measuring flow to justify amounts shown in Table 1 in the space below

See explanation in Table 1 under Other column

EXISTING USER INFORMATION

7. APPURTENANT RIGHT: Do you claim an appurtenant right for your water use? [] Yes [X] No

If yes, has the appurtenant right been established by the courts or the Commission? [] Yes [] No

8. END USER INFORMATION: Are you an end user on an existing water system? [X] Yes [] No

If yes, who is the operator of the water system? Hawaiian Commercial and Sugar Company and Wailuku Water Co.

9. REGISTRATION AND DECLARATION OF WATER USE: Do you have a Registration and Declaration of Water Use with the Commission?

[X] Yes. List the file reference name(s): HC&S

[] No

10. STREAM DIVERSION WORKS PERMIT (SDWP):

Have you ever been issued a SDWP by the Commission?

[] Yes. List the permit number(s):

[X] No

NOTE: Signing below indicates that the signatories understand and affirm that the information provided on this application is accurate and true to the best of their knowledge. Furthermore, the signatories understand that: 1) if necessary, further information may be required before the application is considered complete; 2) if a water use permit is granted by the Commission, this permit will be subject, but not limited, to any existing legal uses, changes in sustainable yields and instream flow standards, Hawaiian Home Lands uses, and any other conditions imposed by the Commission; and 3) the applicant is responsible for paying the required public notice fees associated with this application.

11. APPLICANT

Signature: [Handwritten Signature]

Chris Benjamin

Print

April 22, 2009

Date

12. SOURCE LANDOWNER

Signature

Print

Date

**SURFACE WATER USE PERMIT APPLICATION
EXISTING USE (NA WAI EHA, MAUI)**

TABLE 1: 12-MONTH AVERAGE DAILY USE
Measured or Calculated Use of Water at the Source: (Check one) Stream Ditch Auwai
As of the Effective Date of Designation, April 30, 2008

MONTH / YEAR	AVERAGE DAILY USE FOR THE MONTH IN GALLONS PER DAY (GPD)	Check one item per box				OTHER Please describe
		METERED	ESTIMATED	ACTIVE BUT UNKNOWN	INACTIVE	
May 2007	6.79 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Each individual field has water meters that is read by Wailuku Water Company each month. The information is compiled and is made available to HC&S.
June 2007	5.84 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
July 2007	12.64 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
August 2007	10.26 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
September 2007	9.17 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
October 2007	12.50 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
November 2007	10.70 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
December 2007	4.01 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
January 2008	8.56 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
February 2008	10.12 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
March 2008	8.74 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
April 2008	8.35 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
SUM OF AVERAGE DAILY USE FOR THE MONTH	107.68 mgd	GPD				
AVERAGE DAILY USE (Average of the above)	8.97 mgd	GPD				

**SURFACE WATER USE PERMIT APPLICATION
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TABLE 2: LAND USE CONSISTENCY/EFFICIENCY
(Attach additional copies of Table 2 if necessary)

LAND USE CONSISTENCY						EFFICIENCY OF USE			
1. PURPOSE / WATER USE CATEGORY	2. USE TMK ATTACH THE FOLLOWING: • Property tax map, showing use location in reference to established property boundaries • Photograph of the area of use	3. STATE LAND USE DISTRICT	4. CDUP REQ'D Enter either: Yes and Date approved, or Yes and not acquired, or No	5. COUNTY ZONING CODE	6. SMAP REQ'D Enter either: Yes and Date approved, or Yes and not acquired, or No	7. REQUESTED QUANTITY OF USE Gallons per Day (GPD)	8. SUB-METERED? (Yes or No)	9. UNITS OR NET ACREAGE	10. APPLICANT'S JUSTIFICATION FOR REQUESTED QUANTITY OF USE FOR ITEM 7. If applicable, attach sheets to show how this number was calculated. For irrigation uses, fill in Table 3.
Uses that require potable (drinking) water									
	____ - ____ - ____ : ____ Zone Sector Plat Parcel								
	____ - ____ - ____ : ____ Zone Sector Plat Parcel								
	____ - ____ - ____ : ____ Zone Sector Plat Parcel								
	____ - ____ - ____ : ____ Zone Sector Plat Parcel								
TOTAL POTABLE USE						<input style="width: 50px;" type="text"/>	GPD		
Uses that do not require potable water									
	____ - ____ - ____ : ____ Zone Sector Plat Parcel								SEE ATTACHED NARRATIVE
	____ - ____ - ____ : ____ Zone Sector Plat Parcel								
	____ - ____ - ____ : ____ Zone Sector Plat Parcel								
	____ - ____ - ____ : ____ Zone Sector Plat Parcel								
TOTAL NON-POTABLE USE						<input style="width: 50px;" type="text"/>	GPD		
TOTAL USE REQUESTED (Sum of Total Potable Use and Total Non-Potable Use above) =						<input style="width: 50px;" type="text"/>	GPD		
If total use requested is not equal to the total monthly average in Table 1, please explain.									
In accordance with §174C-51(5), please explain if there are any limitations (legal, contractual, etc.) on the use(s) of water described above.									

**SURFACE WATER USE PERMIT APPLICATION
EXISTING USE (NA WAI EHA, MAUI)**

TABLE 3: IRRIGATION INFORMATION

List all crops as separate line items and include landscape and golf course irrigation, grown in the 12 months prior to April 30, 2008. Attach additional copies of Table 3 if necessary.

1. USE TAX MAP KEY (TMK) Attach map outlining area and photo.	2. CROP	3. TOTAL ACREAGE	4. NET IRRIGATED ACREAGE	5. BEGIN ROWTH PERIOD (Month)	6. END GROWTH PERIOD (Month)	7. IRRIGATION SYSTEM (Refer to instructions.)	8. IRRIGATION PRACTICE (Refer to instructions.)
____ - ____ - ____ : ____ Zone Sector Plat Parcel							SEE ATTACHED NARRATIVE
____ - ____ - ____ : ____ Zone Sector Plat Parcel							
____ - ____ - ____ : ____ Zone Sector Plat Parcel							
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____ - ____ - ____ : ____ Zone Sector Plat Parcel							

**SURFACE WATER USE PERMIT APPLICATION
EXISTING USE (NA WAI EHA, MAUI)**

TABLE 4: ALTERNATIVES ANALYSIS

	Potable Alternatives Attach additional sheets if necessary.	Non-Potable Alternatives Attach additional sheets if necessary.
Municipal sources		SEE ATTACHED NARRATIVE
Wastewater reuse		
Ditch system		
Desalinization		
Ground water		
Other (specify)		

PUBLIC INTEREST

§174C-2(c) states that: *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.*

Explain below how the uses in your application are consistent with the public interest as described above. Attach additional sheets if necessary.
SEE ATTACHED NARRATIVE

**SURFACE WATER USE PERMIT APPLICATION
EXISTING USE (NA WAI EHA, MAUI)**

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	Potable Alternatives Attach additional sheets if necessary.	Non-Potable Alternatives Attach additional sheets if necessary.
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Other (specify)		

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Explain below how the uses in your application are consistent with the public interest as described above. Attach additional sheets if necessary.
SEE ATTACHED NARRATIVE

**APPLICATION BY HC&S FOR WATER USE PERMIT IN
NA WAI EHA SURFACE WATER MANAGEMENT AREA FOR
EXISTING AGRICULTURAL USES (IAO-WAIKAPU FIELDS)**

Hawaiian Commercial & Sugar Company ("HC&S") requests a water use permit for the continued use of 10.58 mgd (12-MAV) of Na Wai Eha surface water for agricultural uses supplied through Wailuku Water Company ("WWC"). HC&S has been continuously using the waters of Na Wai Eha for over a century for sugar cane production and, therefore, is an existing use.

The portion of HC&S's approximately 35,000-acre sugar plantation that is irrigated with Na Wai Eha stream water consists of two groups of fields on the western side of the plantation. One group, consisting of approximately 1,491 acres, is designated by HC&S internally as the 'Iao-Waikapu Fields and is the subject of this application.

The other group, denominated as the Waihe'e-Hopoi Fields, consists of approximately 4,408 acres that receives most of its irrigation water via the Waiale Reservoir. It is the subject of a separate water use permit application.

I. TIMELY APPLICATION

Pursuant to Hawaii Revised Statutes ("HRS") § 174C-50(c), applications for existing uses shall be made within one year of the effective date of designation of the water management area. The effective date of the Na Wai Eha surface water management area is April 30, 2008. This application for an existing use permit is timely.

II. BACKGROUND

A. HC&S's Plantation and Irrigation System

Alexander & Baldwin, Inc. ("A&B"), parent company of HC&S, has been engaged in the cultivation of sugar on Maui since 1870. At one time, in the late 1800s, there were nearly 100 sugar plantations, and at its peak, sugar cane cultivation was spread across 200,000 acres of the Hawaiian Islands. HC&S is the result of a series of mergers over many years that combined 14 predecessor sugar plantations, including the original plantation of Samuel T. Alexander and Henry P. Baldwin, whose partnership grew into A&B. Today HC&S is the sole surviving sugar plantation in Hawaii. The HC&S plantation consists of over 43,000 acres of land in central Maui, of which about 35,000 are under cultivation.

Two irrigation systems constructed over 100 years ago provide HC&S with the reliable source of water necessary for the success of the sugar plantation. Both were designed and constructed to utilize the force of gravity to transport water via ditches and pipelines from the stream diversions which collect surface water to the lower elevations where it is applied to the fields. The larger East Maui Irrigation System (EMI) collects water from a number of streams in East Maui.

Although the EMI System provides the bulk of irrigation water for the plantation, its gravity flow dependent infrastructure cannot deliver water across the low point in “saddle” of the Central Maui isthmus to HC&S’s fields on the western side of the plantation. HC&S’s Waihe`e-Hopoi Fields and `Iao-Waikapu Fields thus rely on Na Wai Eha water collected and transported, also by the force of gravity, through the West Maui Irrigation System, which is jointly owned and operated by HC&S and WWC. See Section II.B., below.

As back-up to these two irrigation systems, to cushion the plantation against weather variability and enable HC&S to continue to irrigate in times of low rainfall, the plantation also relies upon brackish groundwater pumped from several wells. Infrastructure is not available to deliver water from these wells to the `Iao-Waikapu Fields.

Irrigation methods progressed from furrow irrigation to a short period in the early 1970s when HC&S converted to sprinkler irrigation. In 1986, HC&S completed a 12-year project to install a drip irrigation system across its plantation – a \$30 million investment in water efficiency that, if made today, would cost \$90 million. Drip remains today the most efficient irrigation technology available. (A small section of the plantation has been converted back to overhead sprinklers in order to utilize recycled mill water.) HC&S further recycles its mill wash water for use in the fields.

B. West Maui Irrigation System

The West Maui Irrigation System is a complex system that collects water from central Maui streams – Waihe`e, Waiehu, `Iao, and Waikapu – generally referred to collectively as Na Wai Eha. Some portions of the system are jointly owned and maintained by HC&S and WWC, other portions are owned and maintained solely by either WWC or HC&S.

In the late 1800s, HC&S and Wailuku Sugar Company were actively competing for cane lands and water rights, which competition spawned years of litigation. After many years of controversy, the two companies settled their differences through an exchange of lands and other property rights and an agreement on the sharing of water. Through the West Maui Irrigation System, Wailuku Sugar Company and HC&S have irrigated their respective cane fields in the central Maui isthmus.

Within the West Maui Irrigation System, the two primary ditches are Waihe`e Ditch and Spreckels Ditch.

Waihe`e Ditch Upstream of Hopoi Chute. Water from Waihe`e Stream is diverted into the Waihe`e Ditch. An amount of water determined by WWC to be necessary for it to service kuleanas in Waihe`e Valley is dropped into Spreckels Ditch, from where it is then directed into the ditch that services the kuleanas. Water from the northern tributary of Waiehu Stream is diverted into North Waiehu Ditch, from which various other kuleanas served by WWC withdraw water. Any excess water remaining in North Waiehu Ditch is fed into Waihe`e Ditch. `Iao Stream is diverted into the `Iao-Maniania Ditch, which services various kuleanas and other WWC customers. Any excess water remaining in the `Iao-Maniania Ditch is fed into the Waihe`e Ditch. At Hopoi, some or all the water in the Waihe`e Ditch at that point can

be diverted via the Hopoi Chute Ditch into HC&S's Waiale Reservoirs. Any water not diverted into the Hopoi Chute Ditch remains in the Waihe'e Ditch.

From the early 1900s to 1988, the Waihe'e Ditch water was shared between WWC and HC&S in accordance with the following allocation: 7/12 to WWC and 5/12 to HC&S. This was administered by WWC opening the gate to the Hopoi Chute Ditch from 7:00 p.m. to 5:00 a.m. and closing it from 5:00 a.m. to 7:00 p.m. daily. After 1988, however, when WWC's predecessor stopped cultivating sugar cane thus minimizing WWC's need for water downstream of the Hopoi Chute, WWC generally left the gate open and the water formerly used by WWC has flowed into the Waiale Reservoirs for use by HC&S.

Waihe'e Ditch Downstream of Hopoi Chute. 'Iao Stream is also diverted into the 'Iao-Waikapu Ditch, which services some of WWC's customers. Any excess water remaining in the 'Iao-Waikapu Ditch is fed into the Waihe'e Ditch downstream of the Hopoi Chute. Water remaining in Waihe'e Ditch below Hopoi Chute and water from the South Waikapu Ditch are deposited into Wailuku Water Company's Reservoir 6. The 'Iao-Waikapu Fields are irrigated with water from Reservoir 6.

Spreckels Ditch: Waihe'e Stream to South Waiehu Stream. The Spreckels Ditch diversion on Waihe'e Stream feeds water directly into Spreckels Ditch. At a point downstream of this diversion, as noted above, WWC drops an amount of water determined by WWC to be necessary to service kuleanas in Waihe'e Valley from Waihe'e Ditch into Spreckels Ditch, from which it can be directed into the ditch that services the kuleanas.

From the early 1900s to 1988, when WWC's predecessor stopped cultivating sugar cane, the Waihe'e Stream water collected in Spreckels Ditch, where, after satisfying kuleana users, the water was shared equally between WWC and HC&S. This was administered by WWC closing its intakes off of the ditch that fed its reservoirs and fields below the Spreckels Ditch from 7:00 p.m. to 7 a.m. daily. After 1988, however, the water previously taken by WWC and not delivered to kuleana or other users has flowed down into the Waiale Reservoirs for use by HC&S.

Spreckels Ditch: South Waiehu Stream to Waiale Reservoir. HC&S diverts water from South Waiehu Stream via a stream diversion and short ditch that transports the diverted water into the Spreckels Ditch. Downstream of the South Waiehu intake, HC&S has a ground water development tunnel (Well No. 5330-02) which draws 'Iao Ground Water Management Area High-Level Source water into Spreckels Ditch via an underground network of pipes and tunnels. HC&S has filed a separate water use permit application for Well No. 5330-02. Further downstream in the Spreckels Ditch, HC&S diverts 'Iao Stream water into the Spreckels Ditch. Water from Spreckels Ditch is deposited into the Waiale Reservoirs for use by HC&S.

Waiale Reservoirs. From the Waiale Reservoirs, HC&S distributes water to approximately 4,408 acres through irrigation ditches and pipes owned, operated, and maintained by HC&S. (This is the subject of a separate water use permit application filed by HC&S.)

III. CRITERIA FOR EXISTING USE PERMIT

To obtain a water use permit for existing uses, HC&S must demonstrate that the use (1) was existing as of the effective date of designation and (2) is reasonable-beneficial. HRS § 174C-50(b). Case law further dictates that an analysis of alternative sources is required in determining whether a use is reasonable-beneficial.

A. Existing Use on Date of Designation

April 30, 2008 is the date of designation of Na Wai Eha as a surface water management area. For more than 100 years prior to that date, HC&S or its predecessors had been utilizing Na Wai Eha waters to grow sugar cane in the central Maui isthmus. The `Iao-Waikapu Fields were cultivated in sugar cane by Wailuku Sugar Company until 1988. After Wailuku Sugar ceased operations, HC&S took over cultivation of these lands.

1. Location of Use

The `Iao-Waikapu Fields consist of approximately 1,491 acres. HC&S leases all of these fields from the Atherton Group, except Field 920, which HC&S owns. Historically, the `Iao-Waikapu Fields, including Field 920, were cultivated by Wailuku Sugar Company. After Wailuku Sugar terminated operations in 1988, HC&S took over cultivation of these fields by taking back Field 920 and leasing the remaining fields.

HC&S plants and irrigates according to fields and not tax map keys (TMKs). Fields are not coterminus with TMKs; there may be many fields within one TMK, and in some cases, one field may straddle two TMKs. TMKs, therefore, are not the most appropriate designation for the location of use. Instead, please refer to the attached map identifying the location of use by field numbers, with a TMK overlay.

A modified Table 3 provides TMK, crop, and total acreage information cross-referenced to Field Numbers. (For the columns labeled “Begin Growth Period” and “End Growth Period,” see discussion in Section III.B.1.a., below. A discussion of irrigation systems and practices is contained in Section B.2, below.)

2. Amount of Use

Table 1 shows the average amount of water used to irrigate the `Iao-Waikapu Fields during the one-year period preceding the date of designation. The data was obtained from monthly meter readings taken by WWC and provided to HC&S.

B. Reasonable-Beneficial

“Reasonable-beneficial” is defined in HRS § 174C-3 as follows:

“Reasonable-beneficial use” means 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.

1. Quantity Requested

HC&S is requesting an allocation of 10.58 mgd (12-MAV) based upon the plantation's irrigation practices as described below. The quantity requested covers the existing use of irrigating 1,491 acres of sugar cane at an average daily rate of 7,098 gpad.

a. Sugar Cane Growth Cycles and HC&S Irrigation Practices

Sugar cane is a two-year crop. To maximize the efficiency of its harvesting and milling operations, HC&S, seeks to harvest and replant approximately half of its cultivated acres each year. The goal is to schedule the harvesting and planting operations relatively evenly over the approximately ten months that the mill is operating, which has historically been from approximately February through November of each calendar year. Harvesting and grinding typically is shut down in December and January in order to conduct maintenance and repair at the mill and to avoid the inefficiencies of harvesting when the muddiest conditions are most likely to be encountered. Accordingly, in any given month, the crop age of the sugar cane across the plantation is staggered, field by field, over the entire 24 month crop cycle as the result of this deliberate effort to maintain a consistent harvest schedule.

To cultivate sugar cane, first the land is prepared by breaking up the soil, which facilitates water movement. Then, specially designed machines create furrows, inject drip irrigation tubing into the soil and drop in seed pieces. For seven to ten days after first planting, the field is watered relatively heavily to keep the seed piece moist to ensure germination. This is continued, if sufficient water is available, through the next six to eight weeks to keep away the lesser cornstalk borer (*Elasmopalpis lignosellus*) from boring into the shoots. Thereafter, water is applied in accordance with HC&S's computerized water balance model in an amount intended to match the rate of evapo-transpiration. See discussion in III.B.2, below. During the last six months before harvesting, the amount of water applied is purposely reduced to induce the plant to produce sucrose. Finally, fields are usually not irrigated at all approximately 40 to 60 days prior to harvest.

A few weeks after harvesting, the cane stumps send out new shoots (ratoons). These shoots are cultivated for the second and subsequent crops. Before the ratoons emerge, however, areas of compacted soil are plowed. Then after the shoots are visible, the drip tubing is re-injected and seed is placed in any blank spaces of the cane line. Ratoon crops go through the same irrigation cycle.

After the ratoon crop is harvested, the crop cane cycle begins again. Generally, HC&S does not fallow the 'Iao-Waikapu Fields. (Field 920 is temporarily fallowed to improve its soil moisture retention properties. See below.)

Average Daily Water Usage. HC&S does not, in the ordinary course of its operations, calculate or use the average daily water use statistic because it can miscalculate the actual

irrigation requirement for sugarcane. HC&S's operations are geared toward meeting the specific needs of each of its fields based upon where it is in the crop cycle and real time measurements designed to monitor the soil moisture of each field on a daily basis. Irrigation water is applied based on the daily needs of each field, which frequently are dramatically higher or lower than what the daily average might be.

HC&S did, however, undertake an intensive effort to calculate the average daily use of the `Iao-Waikapu Fields from 2004 to 2006 for the purpose of the Na Wai Eha Contested Case Hearing pertaining to the setting of Interim Instream Flow Standards. This was done by retrieving data from HC&S irrigation database on hours of operation of the drip systems for the fields and then performing calculations based on flow rates and acres cultivated. For 2004, the average daily use for these fields was 7,696 gpad, for 2005 it was 7,168 and for 2006 it was 8,286. The average for these three years was 7,716 gpad.

These figures were skewed somewhat by the inclusion of Field 920 which had a higher usage rate due to very sandy soils. HC&S performed a second calculation to exclude Field 920. For 2004, the average daily use for these fields (excluding Field 920) was 6,533 gpad, for 2005 it was 6,769 and for 2006 it was 7,990. The average for these three years was 7,098 gpad.

In early 2007, HC&S added Field 767 to its lease from the Atherton Group and temporarily fallowed Field 920 in order to perform soil amendments which will improve its moisture retention properties. The total acreage for these fields, with Field 920 in production, is 1491, as compared to the 1350 being cultivated in 2006. HC&S believes that an average daily use of 7,098 gpad is indicative of the average daily requirement for the `Iao-Waikapu Fields as a whole.

b. Measuring Point

Each individual field has a water meter that is read by Wailuku Water Company each month. The information is compiled and made available to HC&S.

2. Economic and Efficient Utilization

a. Sugar Cane

The requested allocation represents 7,098 gpad for the cultivation of sugar cane applied over 1,491 acres.

HC&S utilizes drip irrigation for all of the `Iao-Waikapu Fields. Drip irrigation is the most efficient irrigation technology available today.

Section III.B.1.a., above describes the amounts of water that HC&S applies at different stages of the growth cycles of crop cane. These figures are approximations and averages because HC&S determines irrigation needs of each field on a day-to-day basis employing a computerized water balance model, thereby ensuring the most effective and efficient use of available water. Pan ratios, established by extensive industry research and documented in

Ekern and Chang¹ are used to estimate the amount of water required in various crop stages. The water balance model essentially calculates a water budget that accounts for “deposits” of water in the form of rainfall and irrigation and “withdrawals” in the form of evapo-transpiration. HC&S uses its water balance model as a managerial tool to determine what needs to be irrigated, thus using available water resources with the greatest efficiency.

Evaporation pans used in the past have been replaced by a system of weather stations across the plantation that provide evaporation and rainfall data. Fifteen major automated weather stations situated across the plantation transmit hourly data which is used to calculate daily evaporation data using a modified Penman equation. Rainfall data is recorded daily from 41 manual gauges. Two of the weather stations and 4 of the rainfall stations are located in the fields irrigated with Na Wai Eha water. The evaporation and rainfall data, along with the data on the soil moisture storage values, irrigation flow rates and the number of irrigation hours applied for each field constitute the variables used for the water balance model. The result is the water status for each field. The model then prioritizes the field needs, indicating which field should receive water next based on the estimated soil moisture status of each field.

Adequately meeting evapo-transpiration rates has been shown to be directly correlated with crop yield potential. Ekern², reporting on the consumptive use of water by sugarcane, found that pan evaporation alone was a suitable parameter for estimating water use by the plant. When the cane does not have adequate water, it does not grow, does not produce sugar. Hence at the time of harvest the cane has not reached its maximum growth age, which means lower sugar production. Additionally, under-irrigated cane is more susceptible to diseases, which also reduces sugar yield. Moreover, during prolonged drought conditions such as HC&S experienced over the last 15 years, replanting of harvested fields is delayed to conserve water, which then results in lost sugar production, thus reducing HC&S’s total yields.

The key agronomic driver in determining sugar production is per acre yields, which is measured in tons of sugar per acre (“TSA”). In order to remain viable, i.e., to generate sufficient revenues to carry its fixed and variable costs and return a reasonable profit on investments made in the plantation, HC&S has determined that, on a long-term basis, yields need to be between 12 and 14 TSA per crop cycle, which translates into over 200,000 tons of sugar per year given the acreage that HC&S has in cultivation.

3. Consistent with State and County Land Use Plans

All of the lands that are the subject of this application are classified as Agriculture under the State land use classification and zoned for agricultural use See Table 2.

¹ Ekern, Paul C. and J. Chang (1985) *Pan Evaporation: State of Hawaii 1894-1983*, DLNR Division of Water and Land Development Report 74, p. 49.

² Ekern, Paul C. (1970), *Consumptive Use of Water by Sugarcane* in Hawaii Water Resources Research Center Technical Report 37, p. 58.

4. In the Public Interest

a. Public Interest in Agriculture

The lands irrigated by the water sources which are the subject of this allocation application are an integral part of HC&S's approximately 35,000-acre sugar plantation, the sole surviving sugar plantation in Hawaii and the largest single agricultural operation in the State (in terms of acreage and number of employees).

Agriculture is clearly in the public interest. Article XI, § 3 of the state constitution states:

The State shall conserve and protect agricultural lands, promote diversified agriculture, increase agricultural self-sufficiency and assure the availability of agriculturally suitable lands.

Moreover, the State Water Code specifically declares that the use of water for "irrigation and other agricultural uses" is in the public interest. HRS § 174C-2(c).

b. Economic Importance of HC&S

According to Wilcox, "[t]he sugar industry was the prime force in transforming Hawaii from a traditional, insular, agrarian, and debt-ridden society into a multicultural, cosmopolitan, and prosperous one." Wilcox, *Sugar Water: Hawaii's Plantation Ditches* (1997) at 2.

Although Na Wai Eha water is used to irrigate only a portion of the plantation, the economic importance of HC&S is relevant to this application because key to HC&S's viability is economies of scale.

With approximately 800 full time workers, HC&S is one of the largest employers on Maui. EMI employs another 17 workers. About 650 HC&S employees are unionized and both HC&S and EMI enjoy low turnover rates. HC&S provides over \$47 million annually in wages and benefits to its Maui resident employees, and another \$5 million annually in benefits to over 900 HC&S retirees.

HC&S provides high quality job opportunities for positions such as farm supervisors, managers, research scientists, mechanics, welders, mill workers, machinery operators, and technicians. HC&S has also created many quality jobs for high school graduates through its apprenticeship program. Many of these individuals have gone on to secure jobs in the other industries.

With its 'buy local first' policy, HC&S purchases services and goods from many other businesses and support industries in Hawaii. Each year, HC&S spends more than \$100 million in the domestic economy, primarily on Maui.

c. Contributions to Energy Independence

HC&S generates its own electrical power. It is 100% self sufficient and also provides 7% of the power sold by the local utility, Maui Electric Company – power generated primarily from renewable resources.

HC&S's power is generated principally through a combination of burning of bagasse and other supplemental fuels (needed to provide year-round "firm power" to MECO, as explained below, during times when bagasse is not available) in its power plant and the operation of its hydropower turbines on its East Maui Irrigation System. The total power generation capacity of HC&S's combined system is 36 MW during cane grinding periods (30 MW from steam and 6 MW from hydropower).

HC&S has a firm power contract with Maui Electric Company pursuant to which HC&S is obligated to supply to MECO 12 MW of power from 7:00 a.m. to 9:00 p.m. daily except Sunday, and 8 MW at all other times. Continued power production by HC&S from the burning of bagasse is an important part of MECO's plan to reduce dependence on fossil fuels. Power produced by HC&S is also critical to MECO because it is firm power. Other forms of alternative energy, such as solar and wind power, cannot be consistently relied upon, and therefore, require standby generating capacity. This means that MECO needs to have on hand the ability to generate power whenever the solar and wind generating facilities are not producing. HC&S, with its firm power contracts, supplies this standby power. Reducing the amount of power provided to MECO and the Maui community would be counterproductive to the State's policy as articulated in the Hawaii Clean Energy Initiative of reducing the state's dependence on fossil fuels, developing renewable energy sources and increasing Hawaii's energy self-sustainability.

C. Alternative Sources

1. HC&S Well No. 7

Prior to the closure of Wailuku Sugar in 1988, when HC&S's share of ditch water was much less, HC&S pumped brackish ground water from Well No. 7 to irrigate some of its fields. When in use, water from Well No. 7 is pumped into the HC&S portion of the Waihe'e Ditch. The 'Iao-Waikapu Fields are all above the Waiale Reservoir, and thus, beyond the reach of HC&S's gravity-based irrigation system. Infrastructure to pump water from Well 7 into Reservoir 6 does not currently exist and would be cost-prohibitive for HC&S to construct.

2. Recycled Process Water from HC&S's Puunene Mill

HC&S recycles the process water from its Puunene Mill for re-use as irrigation water. In 1997, HC&S embarked on a project to use reclaimed process water from the Puunene Mill for certain fields in Puunene and Paia via drip irrigation. The project ran into difficulties in filtering the water to the level suitable for drip irrigation (so particulates did not plug up the drip tubing); the high nitrogen content of the water, which interfered with ripening of the cane; high cost of maintenance and repairs; and declining yields. Due to these problems,

HC&S had to invest in overhead sprinklers to utilize the mill water in fields near the mill and the filter station. While the `Iao-Waikapu Fields do not utilize any of the recycled mill water, it is mentioned here to make clear that the mill water is not available to reduce the amount of water requested in this application.

3. Recycled Wastewater from Maui Pineapple Company

All of the recycled wastewater from Maui Pineapple Company's cannery is utilized on the Waihe'e-Hopoi Fields. None is available for the `Iao-Waikapu Fields.

4. Recycled County Wastewater

There is no existing infrastructure to deliver recycled wastewater from the County's Kahului Wastewater Treatment facility to HC&S's fields. The cost of constructing such infrastructure would be cost-prohibitive for HC&S. Additionally, because the County wastewater treatment facility is a secondary treatment facility, the organic material that remains in the wastewater would negatively impact ripening sugar cane fields. The negative attributes will reduce yields and add cost to the current operations.

5. Desalinization

There are no desalinization plants on Maui. Given current technology and power costs, it would be cost-prohibitive to desalinate water for irrigation of sugar crops.

6. Other HC&S Wells

HC&S operates a number of wells that supplement surface water in the East Maui Irrigation System. These wells (except Well No. 7, discussed above) are not alternative sources to Na Wai Eha water as existing gravity flow dependent infrastructure feeds this water to HC&S's eastern fields, not to the `Iao-Waikapu Fields. The cost of constructing the infrastructure to pump water from the brackish wells uphill to west side fields would be cost prohibitive to HC&S. Moreover, the parts of the plantation serviced by the EMI System are already water short and cannot afford to lose this groundwater source.

IV. CONCLUSION

Based on the foregoing, HC&S respectively requests a water use permit allocating 10.58 mgd of surface water collected from the Na Wai Eha surface water management area through the West Maui Irrigation System for existing agricultural uses on HC&S's `Iao-Waikapu Fields.

**SURFACE WATER USE PERMIT APPLICATION
EXISTING USE (NA WAI EHA, MAUI)**

TABLE 1: 12-MONTH AVERAGE DAILY USE
Measured or Calculated Use of Water at the Source: (Check one) Stream Ditch Auwai
As of the Effective Date of Designation, April 30, 2008

MONTH / YEAR	AVERAGE DAILY USE FOR THE MONTH IN GALLONS PER DAY (GPD)	Check one item per box				OTHER Please describe
		METERED	ESTIMATED	ACTIVE BUT UNKNOWN	INACTIVE	
May 2007	6.79 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Each individual field has a water meter that is read by Wailuku Water Company each month. The information is compiled and is made available to HC&S.
June 2007	5.84 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
July 2007	12.64 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
August 2007	10.26 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
September 2007	9.17 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
October 2007	12.50 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
November 2007	10.70 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
December 2007	4.01 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
January 2008	8.56 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
February 2008	10.12 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
March 2008	8.74 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
April 2008	8.35 mgd	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
SUM OF AVERAGE DAILY USE FOR THE MONTH	107.68 mgd	GPD				
AVERAGE DAILY USE (Average of the above)	8.97 mgd	GPD				

Table 2: Land Use Consistency/Efficiency - Iao Waikapu

Land Use Consistency						Efficiency of Use
1. Purpose Water Use Category	2. Use TMK	3. State Land Use District	4. CDUP Required	5. County Zoning Code	6. SMAP Required	See Attached Narrative
AGRCP	3-6-002:001	Agriculture	No	Agriculture	No	
AGRCP	3-6-002:003	Agriculture	No	Agriculture	No	
AGRCP	3-6-004:003	Agriculture	No	Agriculture	No	
AGRCP	3-6-004:006	Agriculture	No	Agriculture	No	
AGRCP	3-8-005:023	Agriculture	No	Agriculture	No	

Table 3 Irrigation Information- Iao Waikapu

1. Use Tax Map Key (TMK)	2. Crop	3. Total Acreage	4. Net Irrigated Acreage	Field Numbers	Irrigation System and Practice
3-6-002:001	Sugar Cane	284.826	See Attached Iao Waikapu Field Acreage	753, 757, 767(portion)	See Attached Narrative
3-6-002:003	Sugar Cane	621.400		741, 743, 745, 747, 749, 751(portion)	
3-6-004:003	Sugar Cane	657.192		735(portion), 737(portion), 761, 763, 765, 767(portion)	
3-6-004:006	Sugar Cane	52.976		735(portion), 737(portion)	
3-8-005:023	Sugar Cane	342.400		920, 751 (portion)	

Tax Map Key of Stream Diversion Location - Iao Waikapu

Stream	Ditch Diversion	Tax Map Key
Waihee	Waihee	3-2-014:001
North Waiehu	North Waiehu	3-2-014:001
Iao	Iao Maniana	3-3-003:003
Iao	Iao Waikapu	3-3-003:003
Waikapu	Waihee	3-5-011:049
Waikapu	Reservoir 6	3-5-011:049
Waikapu	South Waikapu	3-6-003:001

Iao Waikapu Fields

Field Number	Cane Acres
735	64.7
737	68.4
741	55.4
743	70.7
745	54.6
747	91.4
749	131.6
751	187.3
753	148.3
757	69.7
761	46.2
763	56.2
765	56.3
767	123.0
920	267.3
Total	1491.1



Iao Maniania Ditch Gauge



Iao Waikapu Ditch Gauge



Waihee Ditch Intake North



Waihee Ditch Intake South



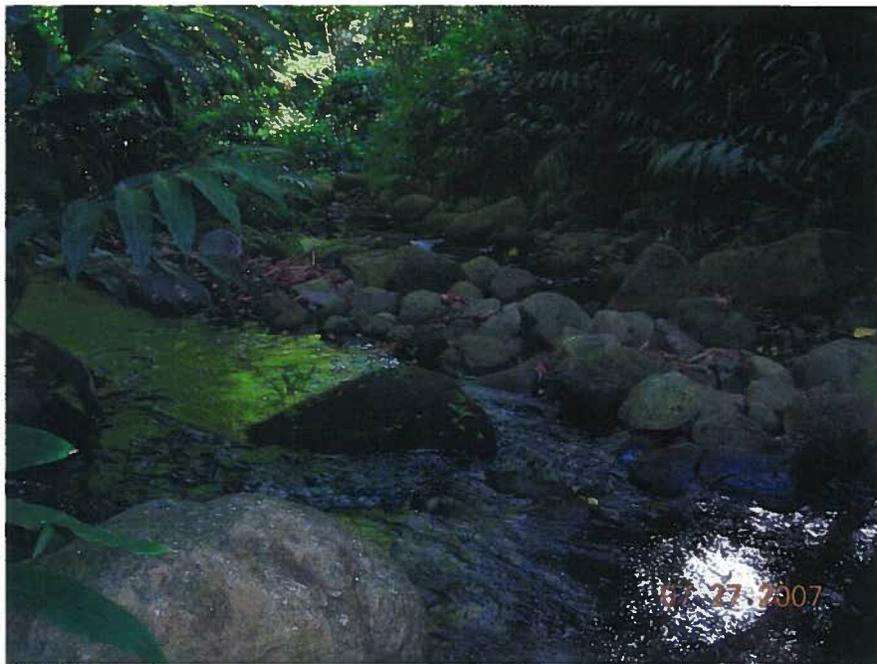
South Waikapu Intake



South Waikapu Ditch Gauge



Iao Intake



North Waiehu Ditch Intake



Spreckels Ditch Intake



Waihee Ditch Gauge



Spreckels Ditch Gauge



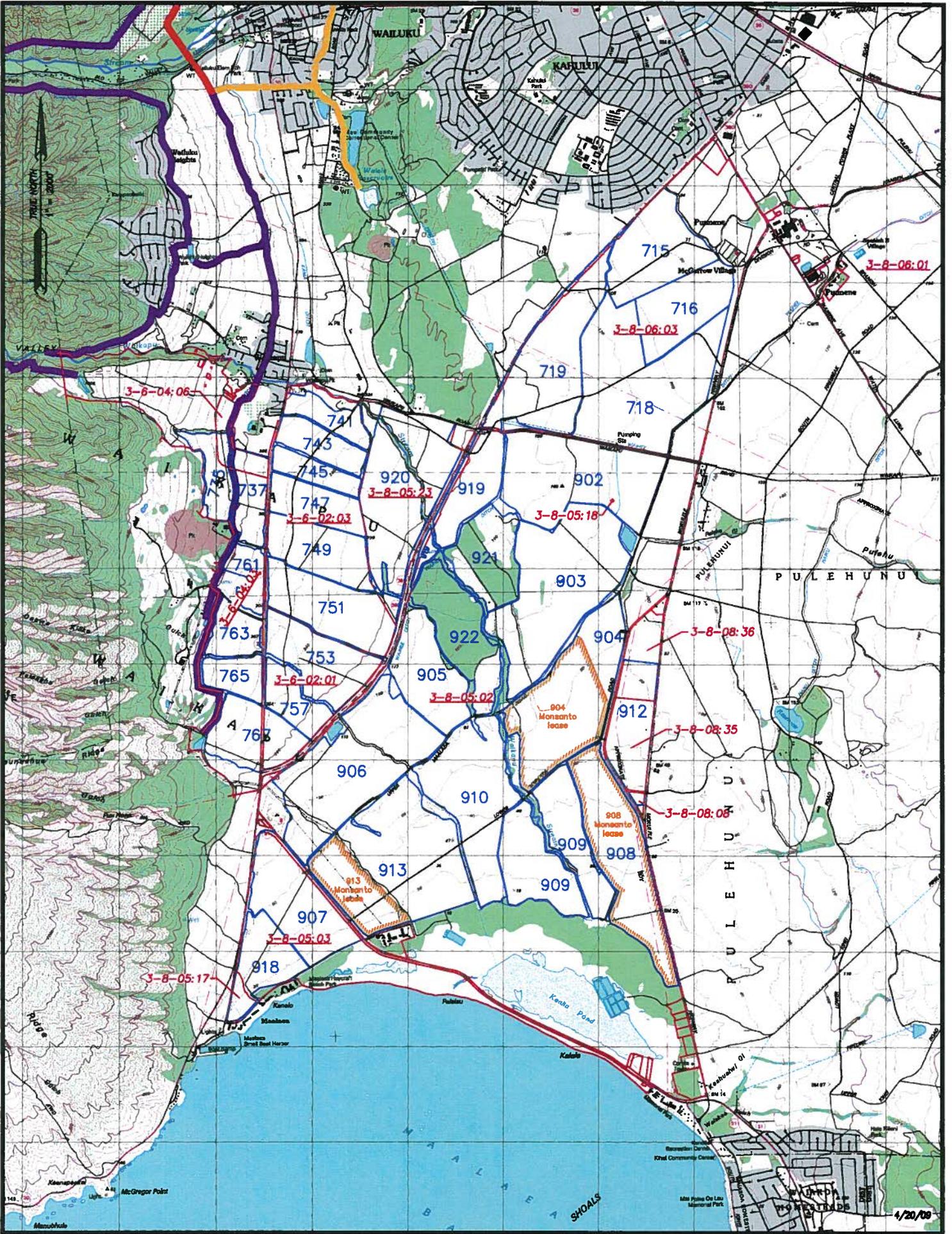
Reservoir #6 Intake

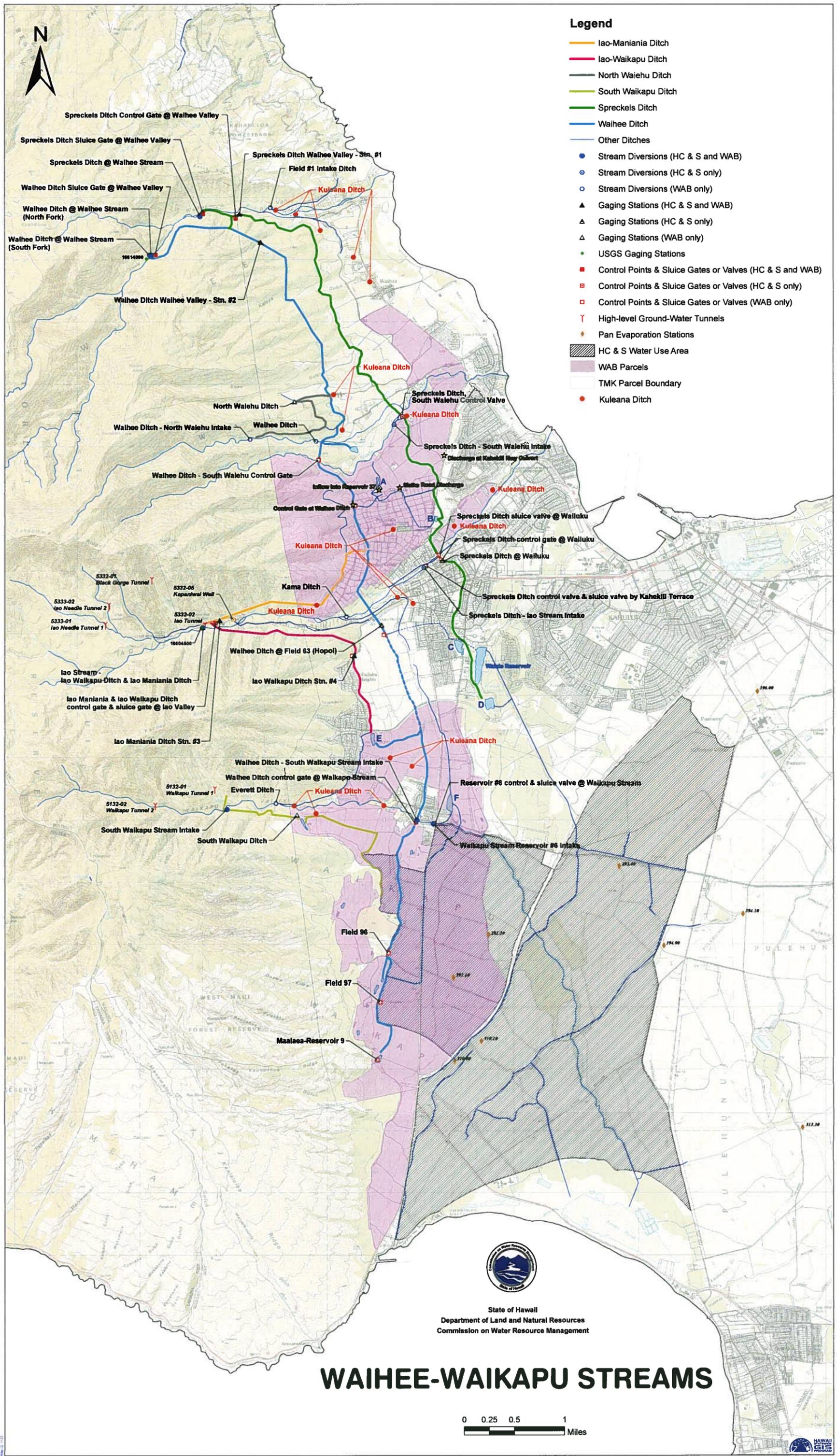


Waihee Ditch Intake on Waikapu Stream



South Waiehu Stream Diversion to Spreckels Ditch





Legend

- Iao-Maniania Ditch
- Iao-Waikapu Ditch
- North Waiehu Ditch
- South Waikapu Ditch
- Spreckels Ditch
- Waihee Ditch
- Other Ditches
- Stream Diversions (HC & S and WAB)
- Stream Diversions (HC & S only)
- Stream Diversions (WAB only)
- ▲ Gaging Stations (HC & S and WAB)
- ▲ Gaging Stations (HC & S only)
- ▲ Gaging Stations (WAB only)
- USGS Gaging Stations
- Control Points & Sluice Gates or Valves (HC & S and WAB)
- Control Points & Sluice Gates or Valves (HC & S only)
- Control Points & Sluice Gates or Valves (WAB only)
- Y High-level Ground-Water Tunnels
- ◆ Pan Evaporation Stations
- HC & S Water Use Area
- WAB Parcels
- TMK Parcel Boundary
- Kuleana Ditch



State of Hawaii
 Department of Land and Natural Resources
 Commission on Water Resource Management

WAIHEE-WAIKAPU STREAMS

