804 NORTHEAST MAUNA LOA AQUIFER SECTOR AREA

804.1 SECTOR AREA PROFILE

804.1.1 General

The Northeast Mauna Loa Aquifer Sector Area (ASEA) includes the Hilo [80401] and the Keeau [80402] Aquifer System Areas (ASYA). Geographically, the sector area covers a rectangular area from a western limit along the summit of Mauna Loa to the base of Mauna Kea to the coastline stretching from Hilo Bay south to Keeau. The sector includes the southern halves of the North Hilo and South Hilo districts, as well as northernmost slices of the Puna and Kau districts. The bulk of urban Hilo and Keeau fall within this sector area.

Coastal areas average less than 150 inches a year in rainfall increasing to over 250 inches per year in the higher elevations of Kaumana. Near the summit of Mauna Loa, rainfall averages less than 15 inches per year. The sustainable yield (SY) of the Hilo ASYA is 347 mgd, and the SY of the Keeau ASYA is 393 mgd, combining for a total SY of 740 mgd for the entire sector area, the highest of all aquifer sector areas on the island.

804.1.2 Economy and Population

804.1.2.1 Economy

Hilo is the center of business, industry and government in Hawaii County. Although visitor accommodations have steadily declined in the last 30 years, Hilo still attracts upward of 30 percent of the County's visitors. The continued growth of the cruise ship industry, with annual expenditures in the $20 million range, has also made a significant impact on the economy. Other major sources of income include the international airport, the University of Hawaii at Hilo, and two shopping centers. Manufacturing operations, such as the processing of fruit, food and livestock, and garment manufacturing are also located in Hilo.

Sugar used to be the largest single industry in the South Hilo district. Today, the commercial growing of ornamental plants is the most significant agricultural product, accounting for over half of the County's revenues from flowers and nursery products. Bananas and papayas are also significant agricultural products.

According to the General Plan, "Hilo with its population size, harbor and airport facilities, higher education complex, and new investment has potential for economic growth. However, many public facilities…rely heavily on state funds and must compete with other areas of the State," and "New economic based activities in East Hawaii are needed if the City is to continue its role as the island's commercial and service center in the future." The General Plan indicates several projects that could boost the economy, including improvements to Saddle Road, and a post-harvest fruit treatment plant and a call center, both already in operation.

804.1.2.2 Population

Most of the population contributing to the demands from the Northeast Mauna Loa ASEA is within the South Hilo District, specifically within urban Hilo. Much of the growth within the sector occurred in the Puna District due to the affordability of residences outside Hilo and the job opportunities in Hilo.

Table 804-1: Historical Population

1980	1990	2000	1980-90 % Change	1990-2000 % Change
37,559	40,860	44,707	8.8	9.4

Data Source: 2000 U.S. Census
Data redistributed and evaluated for Northeast Mauna Loa Aquifer Sector Area

Table 804-2: Population Projection

Growth Rate	2000	2005	2010	2015	2020	2000-10 % Change	2010-20 % Change
A – Low	44,707	44,341	45,995	47,699	49,622	2.9	7.9
B – Medium	44,707	44,483	46,401	48,402	50,614	3.8	9.1
C – High	44,707	46,339	49,311	52,203	55,171	10.3	11.9

Data Source: County General Plan, February 2005
Data redistributed and evaluated for Northeast Mauna Loa Aquifer Sector Area

804.1.3 Land Use

804.1.3.1 Hawaii County General Plan

The Hawaii County General Plan Land Use Pattern Allocation Guide Map (LUPAG) for the Northeast Mauna Loa ASEA is shown on **Figure 804-1**. The estimated land use allocation acreage for each LUPAG designation within the sector area is listed in **Table 804-3**.

PACIFIC OCEAN

Leleiwi Pt.

Hilo
80401

Keaau
80402

Hawaii County
Department of Water Supply

DWS UPDATE TO THE WATER USE AND DEVELOPMENT PLAN

Job No. 2003-818

LEGEND:

- Developed Properties
- Hawaiian Home Lands

Land Use Pattern Allocation Guide

- Extensive Agriculture
- Important Agricultural Land
- Orchard
- High Density Urban
- Medium Density Urban
- Low Density Urban
- Industrial
- Urban Expansion
- Resort
- Resort Node
- Rural
- Conservation
- Open
- University Use
- Pond
- Break Water

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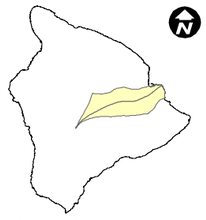
Miles



INDEX MAP - Island of Hawaii

FIGURE 804-1

AQUIFER SECTOR
N.E.MAUNA LOA - 804
Aquifer Systems
Hilo - 80401
Keaau - 80402

2005 Revised General Plan Land Use Pattern Allocation Guide

FUKUNAGA & ASSOCIATES, INC.
Consulting Engineers
1388 Kapiolani Boulevard, Honolulu, Hawaii 96814

Table 804-3: LUPAG Map Estimated Land Use Allocation Acreage – Northeast Mauna Loa Aquifer Sector Area

LAND USE PATTERN	ACREAGE	% of TOTAL
High Density Urban	850	0.3
Medium Density Urban	1,396	0.6
Low Density Urban	9,350	3.7
Industrial	4,836	1.9
Important Agricultural Land	17,591	7.1
Extensive Agriculture	26,241	10.5
Orchard	0	0
Rural	3,377	1.4
Resort/Resort Node	77	0.0
Open	1,364	0.6
Conservation	178,453	71.6
Urban Expansion	4,922	2.0
University Use	667	0.3
TOTAL	249,124	100.0

The water utility courses of action for South Hilo and Puna in the Hawaii County General Plan relevant to the Northeast Mauna Loa ASEA are as follows:

(a) *Continue to implement water system maintenance and improvement programs in order to provide the city with a dependable and consistently safe drinking water supply.*
(b) *Investigate groundwater sources in the Upper Waiakea Uka area.*
(c) *Further investigate future groundwater sources.*
(d) *Investigate additional groundwater sources in the Olaa area.*

804.1.3.2 Hawaii County Zoning

Hawaii County Zoning for the Northeast Mauna Loa ASEA is shown on **Figure 804-2**. The estimated land use allocation acreage for each zoning class within the Northeast Mauna Loa ASEA is listed in **Table 804-4**.

Table 804-4: County Zoning Estimated Class Allocation Acreage – Northeast Mauna Loa Aquifer Sector Area

ZONING CLASS	ACREAGE	% of TOTAL
Single Family Residential	5,635	2.3
Multi-Family Residential (including duplex)	278	0.1
Residential-Commercial Mixed Use	0	0.0
Resort	125	0.1
Commercial	456	0.2
Industrial	2,662	1.1
Industrial-Commercial Mixed	56	0.0
Family Agriculture	48	0.0
Residential Agriculture	473	0.2
Agriculture	57,992	23.3
Open	6,839	2.7
Project District	0	0.0
Forest Reserve	171,792	68.9
(pond)	45	0.0
(river)	11	0.0
(road)	2,730	1.1
TOTAL	249,142	100.0

804.2 EXISTING WATER RESOURCES

804.2.1 Ground Water

Northeast Mauna Loa ASEA has a sustainable yield of 740 mgd. According to the CWRM database, there are 41 production wells in the sector area, including 15 municipal, 1 irrigation, 19 industrial, 5 other, and 1 domestic. There are also 16 wells drilled and categorized as "unused." Refer to **Appendix B** for this database. **Figure 804-3** shows the well locations.

804.2.2 Surface Water

There are 3 streams classified as perennial in the Northeast Mauna Loa ASEA, the Wailuku River, the Wailoa River, and the Kaahakini Stream. The USGS has 3 active surface water gages in the sector area, which were listed in **Table 1-8**. Two of the gages are on the Waiakea Stream, which flows into the Wailoa River.

There are 10 declared stream diversions in CRWM database listed in **Table 804-5** and shown on **Figure 804-4**. The only two diversions with declared flows are those owned by DWS.

PACIFIC OCEAN

Leleiwi Pt.

Hilo
80401

Keaau
80402

Hawaii County
Department of Water Supply

DWS UPDATE TO THE WATER USE AND DEVELOPMENT PLAN

Job No. 2003-818

LEGEND:

- Hawaiian Home Lands
- Developed Parcels

Zoning Designations:

A-1a+	Agricultural - 1 thru 10 acres
A-20a	Agricultural - 20 acres
A-35a	Agricultural - 35 acres
A-40a	Agricultural - 40 acres
A-80a	Agricultural - 80 acres
A-200+	Agricultural - 200 thru 255 acres
A-500a	Agricultural - 500 acres
A-600a	Agricultural - 600 acres
A-800a	Agricultural - 800 acres
A-900a	Agricultural - 900 acres
APD	Agricultural Project Districts
CDH	Downtown Hilo Commercial District
CG	Commercial, General
CN	Commercial, Neighborhood
CV	Commercial, Village
FA	Family Agricultural
FR	Forest Reserve
MCX	Industrial - Commercial
MG	Industrial, General
ML	Industrial, Limited
O	Open
PD	Project Districts
RA	Residentail and Agricultural
RCX	Residential - Commercial Mixed Use
RD	Residential Double-Family
RM-7.5+	Res. Multi-Family - 7500-8000 sf
RM-14.5+	Res. Multi-Family - 14,500-20,000 sf
RS-7.5+	Res. Single Family - 7500-10,000 sf
RS-15+	Res. Single Family - 15,000-20,000 sf
V	Hotel/Resort

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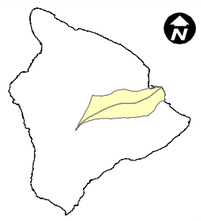

INDEX MAP - Island of Hawaii

FIGURE 804-2

AQUIFER SECTOR
N.E. MAUNA LOA - 804

Aquifer Systems
Hilo - 80401
Keaau - 80402

County Zoning

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Consulting Engineers
1388 Kapiolani Boulevard, Honolulu, Hawaii 96814

Figure 804-3 Well and Tunnel Location

MAP CURRENTLY NOT AVAILABLE ON-LINE

Figure 804-4 Streams & Diversions

MAP CURRENTLY NOT AVAILABLE ON-LINE

Table 804-5: Stream Diversions – Northeast Mauna Loa Aquifer Sector Area

FILE REFERENCE	TMK	STREAM NAME	
CALDWELL P	2-3-015:010	Waiuku River	Stream diversion, pipe from Waikapu Stream.
HAWAII ELEC LT	2-3-027:003	Wailuku River	Stream diversion, Puueo Hydro Intake. Declared Q was estimated by the declarant from the number of kilowatt hours produced.
HAWAII DWS	2-5-009:012	Kahoama	Stream diversion, pipe from Kahoama Stream. Declared Q = 4.6 MGD.
MAKANUI C	2-5-014:042	Unnamed Spring	Spring div, trench from Unnamed spring.
WENKO ENERGY	2-5-024:016	Unnamed/ Unmapped	Stream diversion for hydro plant, ditch at upper end of property takes water from Ainako Stream, flows to Hydro plant on property and returns water to stream at the lower end of the property.
OKINO PAE	2-5-025:003	Unnamed/ Unmapped	Stream diversion, channel though yard and back to stream. Diversion is a small inlet from the stream to the garden. Water returns to the stream a short distance downstream at edge of parcel.
HAWAII ELEC LT	2-6-009:025	Wailuku River	Stream diversion, Waiau Hydro Intake. Declared Q was estimated by the declarant from the number of kilowatt hours produced.
HAWAII DWS	2-6-018:004	Hookelekele	Stream diversion, pipe from Hookelekele Stream. Declared Q = maximum of 5.0 MGD.
MALU AINA FARM	1-7-002:002	Unnamed/ Unmapped	Stream diversion, Waterway #2 through parcel (new entry).
MALU AINA FARM	1-7-002:002	Unnamed/ Unmapped	Stream diversion, Waterway #3 through parcel (new entry).

804.2.3 Reclaimed Wastewater

There are no wastewater reclamation facilities within the Northeast Mauna Loa ASEA.

804.3 EXISTING WATER USE

804.3.1 General

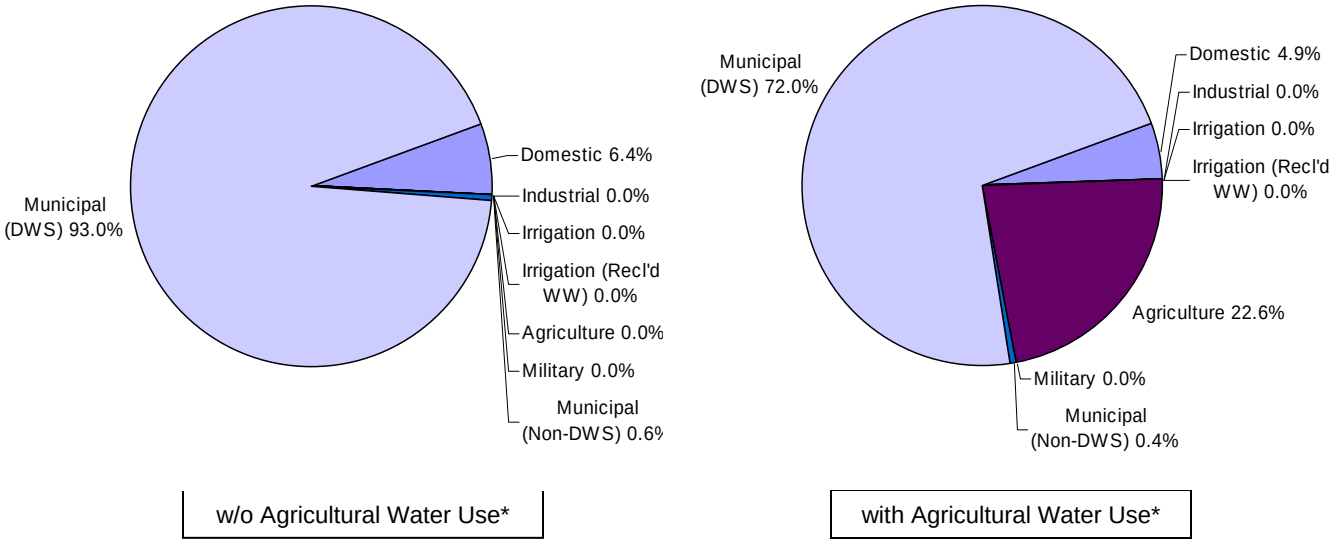
The total estimated average water use within the Northeast Mauna Loa ASEA from November 2004 through October 2005 based on DWS meter data, available GIS data, estimates from the *2003 SWPP,* and CWRM pumpage data is listed in **Table 804-6** and summarized in **Figure 804-5** in accordance with CWRM categories and indicate the quantities supplied excluding agricultural demands, and the quantities supplied including worst case agricultural demands (as described in Chapter 2) by the DWS system and non-DWS systems. The quantity listed under the "Industrial (recharge)" category represents brackish groundwater drawn at the HELCO Hill and Puna Plants and recharged back to the aquifer by injection. This quantity is not counted towards the existing or projected water use.

Table 804-6: Existing Water Use by Categories – Northeast Mauna Loa Aquifer Sector Area

CWRM Water Use Category	Water Use (MGD)	Percent of Total without Ag*	Percent of Total with Ag*
Domestic	0.41	6.4	4.9
Industrial	0.00	0.0	0.0
Industrial (recharge)	44.95	N/A	N/A
Irrigation	0.00	0.0	0.0
Reclaimed WW	0.00	0.0	0.0
Agriculture	1.87	0.0	22.6
Military	0.00	0.0	0.0
Municipal			
DWS System	5.96	93.0	72.0
Private Public WS	0.04	0.6	0.4
Total without Ag*	6.41	100.0	
Total with Ag*	8.27		100.0

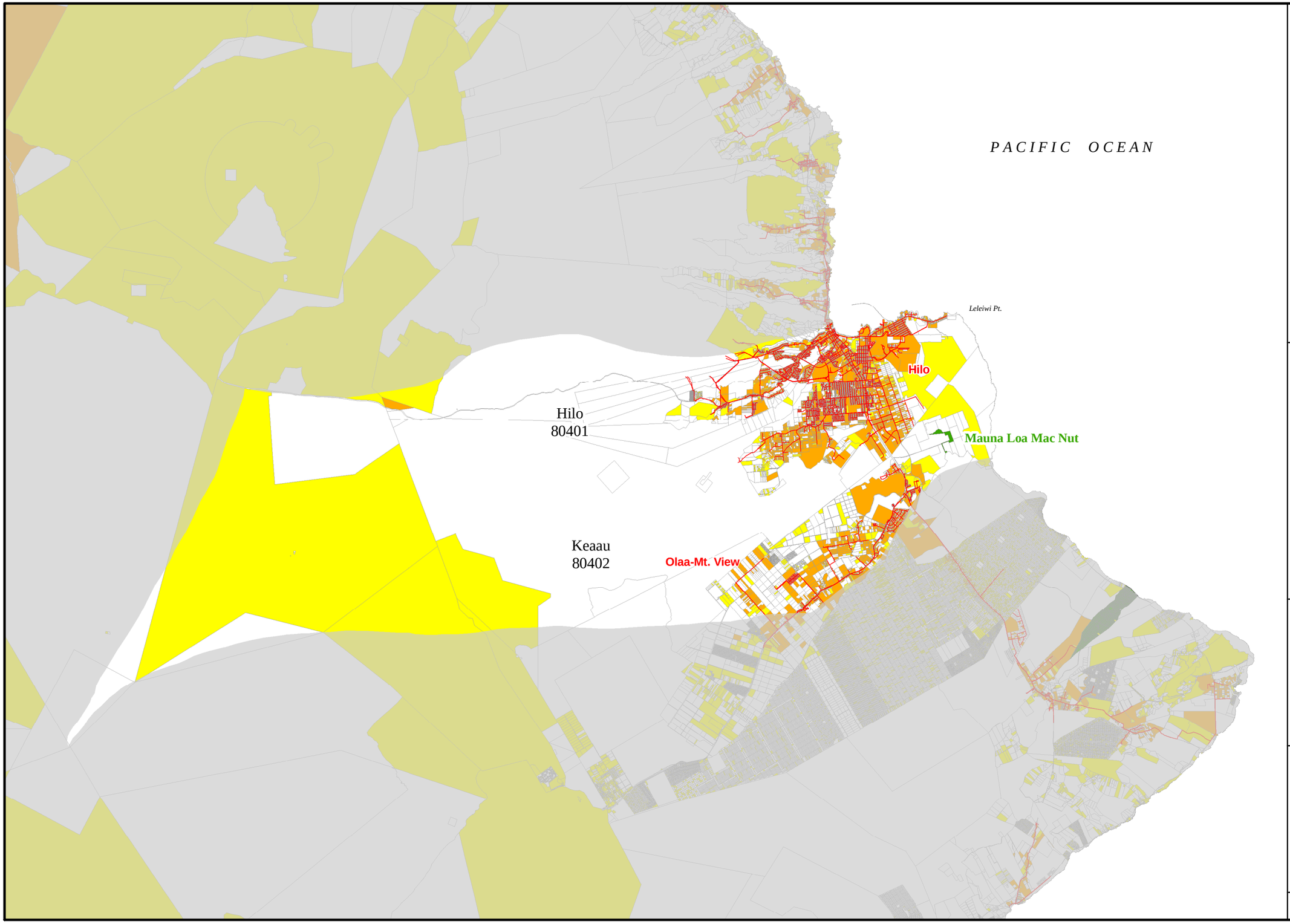
* Demand scenarios without and with agricultural demands represent the potential minimum and maximum agricultural demand, respectively, with the expectation that the actual demand will fall somewhere in between.

Figure 804-5: Existing Water Use by Categories – Northeast Mauna Loa Aquifer Sector



* Demand scenarios without and with agricultural demands represent the potential minimum and maximum agricultural demand, respectively, with the expectation that the actual demand will fall somewhere in between.

Figure 804-6 generally shows the service area for the various water systems and indicates the extent of the DWS water system.



Hawaii County

Department of Water Supply

DWS UPDATE TO THE WATER USE AND DEVELOPMENT PLAN

Job No. 2003-818

LEGEND:

- DWS Water System Service Area
- Possible Catchment Area (Building Value > $10000)
- Private Water System Service Area
- Aquifer Systems
- DWS Water System

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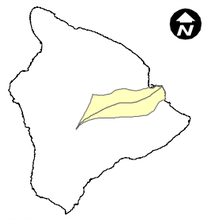

INDEX MAP - Island of Hawaii

FIGURE 804-6

AQUIFER SECTOR
N.E. MAUNA LOA - 804
Aquifer Systems
Hilo - 80401
Keaau - 80402

Water System and Service Area

FUKUNAGA & ASSOCIATES, INC.
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804.3.2 Domestic Use

Domestic use or water use by individual households is assumed to be supplied by private individual rainwater catchment systems or private wells. Based on available GIS data, there are over 1,000 such developed parcels, which is approximately 2,800 people, or 6 percent of the sector area population. The estimated demand is 0.41 mgd. The single well classified as "Domestic" in the CWRM database does not report pumpage.

804.3.3 Industrial Use

HELCO has seven wells for use at their Hill power generation plant south of Hilo International Airport. Two wells reported to the CWRM a pumpage of 36.7 mgd for use in the Hill 5 and Hill 6 steam turbines. HELCO also has three wells dedicated to the Puna Generating Plant in Keeau used for cooling. One well reported a pumpage of 8.3 mgd. Because the extracted water for both plants is returned to the aquifer via injection wells, the pumpage from these wells were not included in the existing and 20-year projected demand. HELCO has three Shipman wells that extract saltwater for cooling, and possesses an NPDES permit to pump the water back into Suisan Harbor.

Jas Glover Limited owns two wells categorized as "Industrial" in the CWRM database for use at the Glover Quarry; however, pumpage has not been reported.

There are three hydropower plants located on the Wailuku River northeast of Hilo. HELCO's Waiau and Puueo plants each utilize a single stream diversion to power their 2 turbines. The Wailuku River Hydroelectric Power Company sells to HELCO power generated at their 11 MW facility located at the junction of the Wailuku River and the Kaloheahewa Stream. Wenko Energy Company utilizes a stream diversion on the Ainako Stream, a tributary to the Wailuku River, for its hydropower plant and also sells power to HELCO.

804.3.4 Irrigation Use

There are two golf courses in the sector area, the Hilo Municipal Golf Course and the Naniloa Country Club. Both courses are within the service area of DWS Hilo Water System. Irrigation systems are not necessary due to the ample rainfall in the region. Fire trucks are used in the unlikely event of a drought. There are no known irrigation uses dedicated to other landscaping activities.

804.3.5 Agricultural Use

There is no flow data available on Agricultural use within the sector area. The abundance of rainfall in the sector provides sufficient moisture for most crops. There is a small amount drawn from the DWS Hilo Water System from accounts classified as "Agricultural".

Malu Aina Farm is a 22-acre spiritual retreat also engaging in organic farming and aquaculture, located southwest of Kurtistown on the border of the Northeast Mauna Loa and the Kilauea

ASEAs. According to the CWRM database, the farm has three stream diversions, two of which are in the sector area, and listed previously in **Table 804-5**. The farm grows a wide variety of fruits and vegetables.

804.3.6 Military Use

There is no military use in the Northeast Mauna Loa ASEA.

804.3.7 Municipal Use

Municipal use can be subcategorized into the other water use categories, namely Domestic, Industrial, Irrigation, Agriculture, and Military, if detailed information is available.

804.3.7.1 County Water Systems

The DWS has 2 water systems in the Northeast Mauna Loa ASEA.

The Hilo Water System is the largest on the island, serving all of urban Hilo and surrounding areas, extending north to Honolii, south to Panaewa, and west to Kaumana City and Waiakea Homesteads. Seven deep well sources are utilized. These include three Piihouna Wells along Waianuenue Ave, and three Panaewa Wells off of Hawaii Belt Highway. The Piihonuna Wells service the northern portion of the system, while the Panaewa Wells service the southern portion. The Saddle Road A Well servicing the Panaewa area became operational in 2002. The system was formerly supplied by several spring and surface water sources that are no longer in service, including the Waiakea-Uka Tunnels, Olaa Flume Spring, Lyman Spring, Kaohama Intake, Pukamaui Intake and Lauole Intake. The Hilo WS also supplements the adjacent Papaikou system.

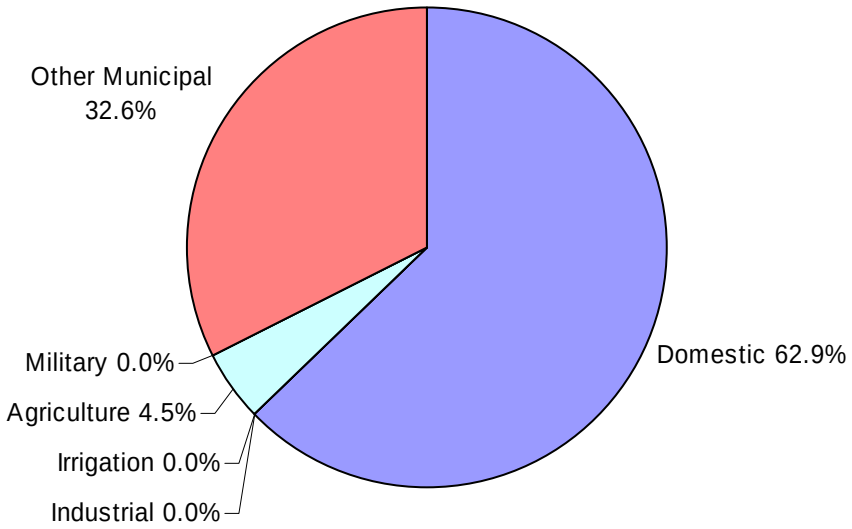
The Olaa-Mt. View Water System is located in the Puna District along Hawaii Belt Road from Keeau to the Olaa Reservation Lots, and along Keeau-Pahoa Road, servicing areas in the Kilauea ASEA. The system's sources are two deep Keeau Wells at the former Puna Sugar Mill, and one deep well, Olaa 3, further south along Hawaii Belt Road. Water is pumped through a series of eight booster pump stations and storage tanks spanning 11 service areas.

DWS water use is subcategorized in **Table 804-7** to the extent possible based on available meter data and is depicted in **Figure 804-7**. "Other Municipal" includes facilities such as schools, and various commercial, government, medical and nonprofit entities which have mixed water use and cannot be specifically allocated to the other categories.

Table 804-7: DWS Existing Water Use by Categories – Northeast Mauna Loa Aquifer Sector Area

CWRM Water Use Category	DWS Purveyed Water Use (MGD)	Percent of Total
Domestic	3.75	62.9
Industrial	0.00	0.0
Irrigation	0.00	0.0
Agriculture	0.27	4.5
Military	0.00	0.0
Other Municipal	1.94	32.6
Total	5.96	100.0

Figure 804-7: DWS Existing Water Use by Categories – Northeast Mauna Loa Aquifer Sector Area



804.3.7.2 State Water Systems

The Kulani Correctional System is owned by the Department of Public Safety (DPS). It is located in Kulani, off Stainback Highway. The source of water is a rubber lined sloped catchment area covering approximately 5 acres. The water is stored in an open rubber lined 5.0 mgd reservoir and treated with a packaged treatment plant. The distribution system includes a 0.36 MG steel storage tank and 12-inch and 8-inch watermains, serving the camp facilities which include dormitories, administration building, kitchen, mess hall, laundry boiler, saw mill, garage,

gym, lumber shed, woodwork shop, program building and craft display. The estimated consumption according to the SWPP based on an inmate population of 217 and a staff of 85 is 0.037 mgd, with a maximum day demand of 0.06 mgd.

804.3.7.3 Federal Water Systems

There are no Federal water systems in the Northeast Mauna Loa ASEA regulated by the DOH.

804.3.7.4 Private Public Water Systems

The Mauna Loa Macadamia Nut Water System is the only private public water system in the sector area regulated by the DOH. The water system is located on a 114-acre parcel of land southeast of Hilo, which has a visitor center, processing plant, snack bar and gift shop. There is also a "nature walk" showcasing the trees and plants that produce various fruits and vegetables. The primary well source has a pumping capacity of 350 gpm and the secondary source has a capacity of 500 gpm. The system is disinfected with sodium chloride and utilizes a 5,000 gallon hydropneumatic tank. DOH records indicate that there are 4 service connections serving a population of 100. The wells did not report pumpage to the CWRM.

804.3.8 Water Use by Resource

804.3.8.1 Ground Water

Table 804-8 summarizes the current production, potential production (16 and 24-hour operation), sustainable yield (SY), and percentage of SY for the various productions calculated. Current production is represented by the highest 12-month moving average (MAV) or the highest annual average yield calculated from the actual pumpage data. Potential well production is based on installed pump capacities, and calculated for both 16 hours of operation a day and 24 hours of operation a day. Data is based on pumpage data reported to CWRM.

Table 804-8: Sustainable Yield – Northeast Mauna Loa Aquifer Sector Area

Sys Code	System Area	High 12-Month MAV (MGD)	Potential 16 -Hour Production (MGD)	Potential 24-Hour Production (MGD)	SY (MGD)	High 12-Month MAV SY (%)	Potential 16-Hour Production SY (%)	Potential 24-Hour Production SY (%)
		59.05	**62.95**	**94.43**	**740**	**7.98**	**8.51**	**12.76**
80401	Hilo	42.78	42.15	63.22	347	12.33	12.15	18.22
80402	Keeau	16.27	20.81	31.21	393	4.14	5.29	7.94

804.3.8.2 Surface Water

Malu Aina Farm described in Section 804.3.5 uses two stream diversions, however flow data is not available.

804.3.8.3 Rainwater Catchment

Water consumption calculated for developed parcels that are not supplied by groundwater or surface water is assumed to be supplied by rainwater catchment. The water use categorized as Domestic Use previously in **Table 804-6** is assumed to be supplied by individual catchment systems.

Kulani Correctional Facility described previously in Section 804.3.7.2 utilizes a rainwater catchment system. According to the *2003 SWPP*, the design capacity is 0.024 mgd, which does not meet the estimated demand.

The Malu Aina Farm uses rainwater catchment tanks for its potable water supply, however consumption data is not readily available.

804.3.8.4 Reclaimed Wastewater

There are no wastewater reclamation facilities within the Northeast Mauna Loa ASEA.

804.4 FUTURE WATER NEEDS

804.4.1 General

Table 804-9 summarizes the LUPAG, Zoning and 5-year incremental water demand projection scenarios for the total aquifer sector area and the individual aquifer system areas. The sustainable yield (SY) is presented to draw comparisons.

Table 804-9: Summary of Demand Projections

Without Agricultural Demand*	SY (mgd)	LUPAG (mgd)	Zoning (mgd)	Growth Rate B Demand Projections (mgd)				
				2005	2010	2015	2020	2025
Total N.W. Mauna Loa ASEA	740	118.6	26.3	6.4	6.7	7.0	7.3	7.7
80401 – Hilo ASYA	347	69.2	21.9	4.7	4.8	4.9	5.0	5.2
80402 – Keeau ASYA	393	49.4	4.4	1.7	1.9	2.1	2.3	2.5
With Agricultural Demand*	**SY (mgd)**	**LUPAG (mgd)**	**Zoning (mgd)**	**Growth Rate B Demand Projections (mgd)**				
				2005	**2010**	**2015**	**2020**	**2025**
Total N.W. Mauna Loa ASEA	740	202.6	107.4	8.3	8.7	9.2	9.8	10.4
80401 – Hilo ASYA	347	70.7	28.0	4.7	4.8	4.9	5.1	5.2
80402 – Keeau ASYA	393	132.0	79.4	3.6	3.9	4.3	4.7	5.2

* Demand scenarios without and with agricultural demands represent the potential minimum and maximum agricultural demand, respectively, with the expectation that the actual demand will fall somewhere in between.

For both aquifer system areas, full build-out and 2025 projection water demands excluding agricultural demands are a small fraction the SY. Therefore, analysis of the three demand scenarios does not need to be broken down by aquifer system areas and thus will be presented for the aquifer sector area only.

804.4.2 Full Build-Out Water Demand Projections

The full build-out water demand projections based on the General Plan and County Zoning for the Northeast Mauna Loa ASEA are listed in **Tables 804-10** and **804-11**, and reflect refinement as discussed below. Each land use class is associated with the most appropriate CWRM water use category.

Table 804-10: Hawaii County General Plan Full Build-Out Water Demand Projection – Northeast Mauna Loa Aquifer Sector Area

LUPAG Class	CWRM Category	Water Demand (mgd)
Urban	Domestic/Irrigation/Municipal	64.7
Urban Expansion	Domestic/Irrigation/Municipal	29.6
Resort	Irrigation/Municipal	1.3
Industrial	Industrial	17.0
Agriculture	Agriculture	84.0
University	Irrigation/Municipal	2.7
Rural	Irrigation/Municipal	1.4
DHHL	Irrigation/Municipal	2.0
TOTAL w/o Ag*		118.6
TOTAL w/ Ag*		202.6

* Demand scenarios without and with agricultural demands represent the potential minimum and maximum agricultural demand, respectively, with the expectation that the actual demand will fall somewhere in between.

Table 804-11: County Zoning Full Build-Out Water Demand Projection – Northeast Mauna Loa Aquifer Sector Area

Zoning Class	CWRM Category	Water Demand (mgd)
Residential	Domestic/Irrigation/Municipal	11.0
Resort	Irrigation/Municipal	2.9
Commercial	Municipal	1.0
Industrial	Industrial	9.4
Agriculture	Agriculture	81.2
DHHL	Irrigation/Municipal	2.0
TOTAL w/o Ag*		26.3
TOTAL w/ Ag*		107.4

* Demand scenarios without and with agricultural demands represent the potential minimum and maximum agricultural demand, respectively, with the expectation that the actual demand will fall somewhere in between.

804.4.2.1 Refine Land Use Based Projection

804.4.2.1.1 State Water Projects Plan

The total projected demand to the year 2020 for 46 State Water Projects within the sector area is 4.60 mgd, using 0.86 mgd potable, 3.69 mgd nonpotable, and 0.05 nonpotable using potable sources. These demands may account for approximately 30 percent of the total water demand in the sector area. The projects that will generate the most significant demands, with the exception of DHHL projects, which are covered separately, are listed in **Table 804-12**. Projects with large demands greater than 1 mgd may require State funding to develop resources and infrastructure necessary to provide water service.

Table 804-12: Future State Water Projects to Generate Significant Demands

Project Name	Primary Use	State Department	2020 Demand (mgd)
Pacific Aquaculture and Coastal Resources Center	Nonpotable	University of Hawaii	1.65
Pacific Aquaculture and Coastal Resources Center, UHH Farm @ Panaewa	Nonpotable	University of Hawaii	0.75
Panaewa Farm Well and Pump	Nonpotable	University of Hawaii	0.35

804.4.2.1.2 State Department of Hawaiian Home Lands

The Keaukaha-Waiakea-Panaewa Tracts are located in urban Hilo between Hilo Bay and the Puna boundary. The Keaukaha Tract is a mostly vacant 1,700-acre area divided into two tracts along the northeast coast of Hilo Bay. The Waiakea-Panaewa Tract is south of Hilo airport with existing residential and farm lots. New post-1994 land transfers include the Old Airport Terminal, the National Guard Tract and the Puna Boundary lots. The proposed land uses are a combination of residential, agricultural and industrial uses. The total estimated demand for the tracts is 2.01 mgd, which would be supplied by the DWS Hilo Water System. The *DHHL Special Report #2* indicates that the Hilo WS may currently have sufficient supply to meet part of the proposed water requirements; however, full build-out would require additional supply source to supplement the present capacity of the system.

The Hilo Scattered Lots are comprised of 83 scattered lots throughout urban Hilo. 56 lots were transferred from the State in 1994, some of which were subdivided. Water service from the Hilo Water System was already in place for most of the lots. 81 of the 83 lots are proposed for residential use, with an estimated demand of 0.04 mgd.

804.4.2.1.3 Agricultural Water Use and Development Plan

There is no information available in the AWUDP specific to activity within the sector area to further refine projections.

804.4.3 Water Use Unit Rates

Water use unit rates are based on the *Water System Standards* as discussed in Chapter 1.

804.4.4 5-Year Incremental Water Demand Projection to the Year 2025

The following section presents 5-year incremental water demand projections to the year 2025 for the Northeast Mauna Loa ASEA. The projected low, medium, and high growth rates are listed in **Table 804-13**, and are graphed in **Figure 804-8**. Potable and nonpotable water demands are also differentiated.

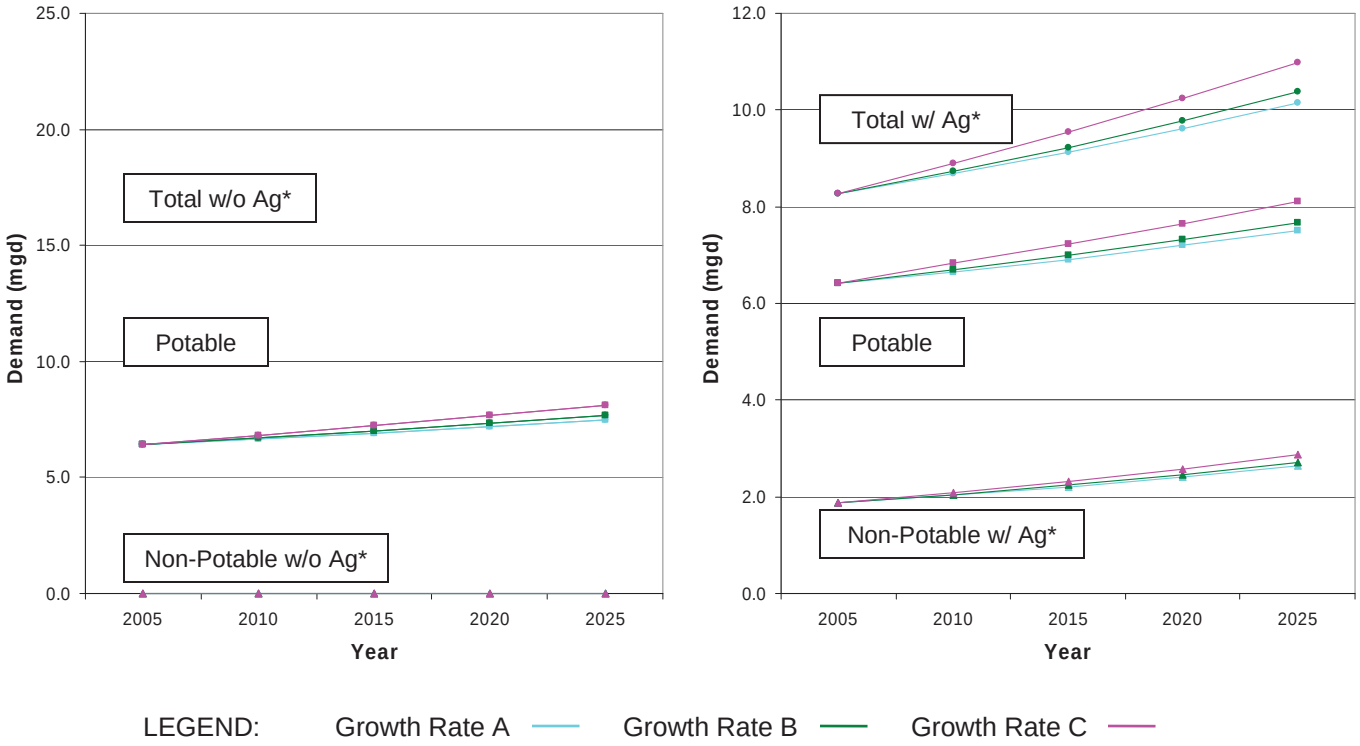
Figure 804-9 illustrates the magnitude of the sustainable yield, both LUPAG and Zoning full build-out water use, and water use projection through the year 2025 focusing on Medium Growth Rate B. **Figure 804-10** shows the breakdown of water demand projections by CWRM categories through the year 2025. **Table 804-14** summarizes these figures.

Table 804-13: Water Demand Projection – Northeast Mauna Loa Aquifer Sector Area

	Without Agricultural Demands* (mgd)					With Agricultural Demands* (mgd)				
GROWTH RATE A	**2005**	**2010**	**2015**	**2020**	**2025**	**2005**	**2010**	**2015**	**2020**	**2025**
Total	6.4	6.7	6.9	7.2	7.5	8.3	8.7	9.1	9.6	10.2
Potable	6.4	6.7	6.9	7.2	7.5	6.4	6.7	6.9	7.2	7.5
Nonpotable	0.0	0.0	0.0	0.0	0.0	1.9	2.0	2.2	2.4	2.7
GROWTH RATE B	**2005**	**2010**	**2015**	**2020**	**2025**	**2005**	**2010**	**2015**	**2020**	**2025**
Total	6.4	6.7	7.0	7.3	7.7	8.3	8.7	9.2	9.8	10.4
Potable	6.4	6.7	7.0	7.3	7.7	6.4	6.7	7.0	7.3	7.7
Nonpotable	0.0	0.0	0.0	0.0	0.0	1.9	2.0	2.2	2.5	2.7
GROWTH RATE C	**2005**	**2010**	**2015**	**2020**	**2025**	**2005**	**2010**	**2015**	**2020**	**2025**
Total	6.4	6.8	7.2	7.7	8.1	8.3	8.9	9.5	10.2	11.0
Potable	6.4	6.8	7.2	7.7	8.1	6.4	6.8	7.2	7.7	8.1
Nonpotable	0.0	0.0	0.0	0.0	0.0	1.9	2.1	2.3	2.6	2.9

* Demand scenarios without and with agricultural demands represent the potential minimum and maximum agricultural demand, respectively, with the expectation that the actual demand will fall somewhere in between.

Figure 804-8: Water Demand Projection Summary – Northeast Mauna Loa Aquifer Sector Area



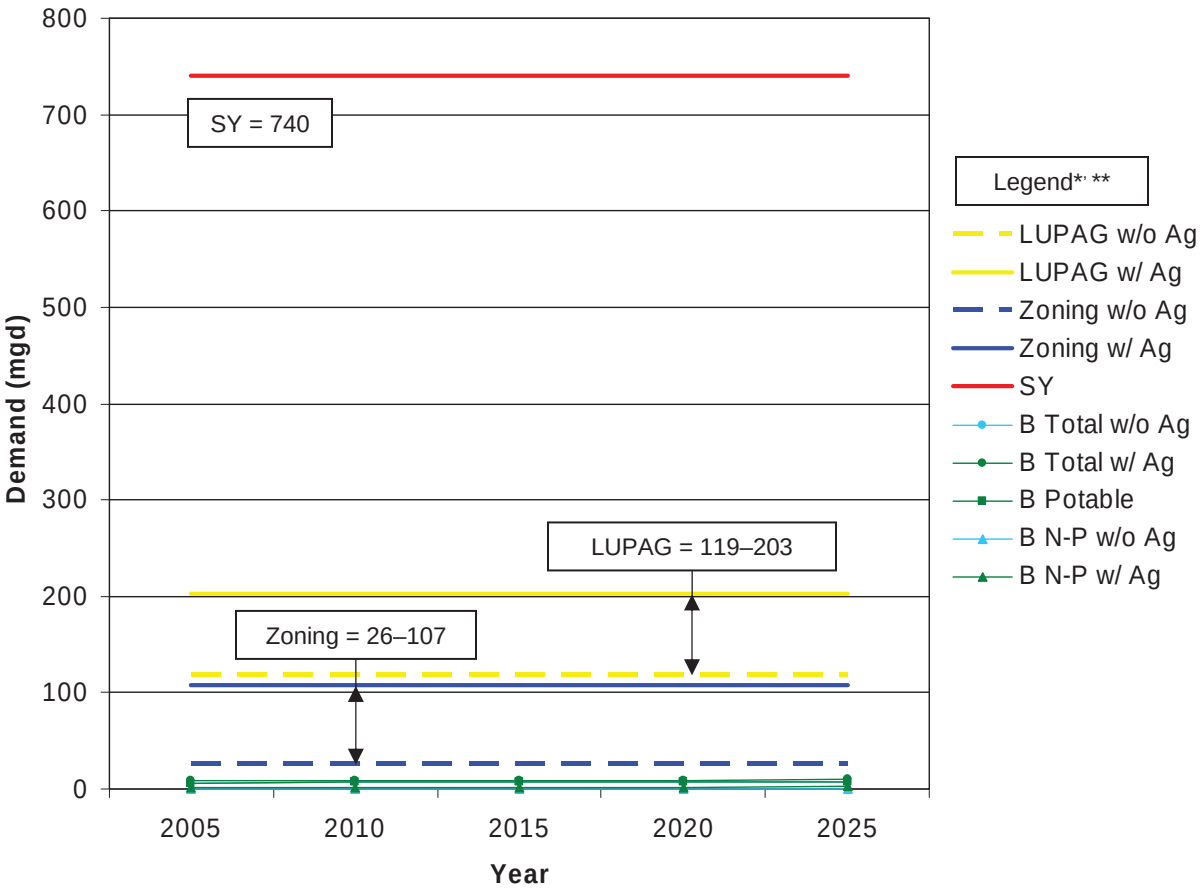
* Demand scenarios without and with agricultural demands represent the potential minimum and maximum agricultural demand, respectively, with the expectation that the actual demand will fall somewhere in between.

Table 804-14: Medium Growth Rate B Water Demand Projection by Category – Northeast Mauna Loa Aquifer Sector Area

Water Use Category	2005 (mgd)	2010 (mgd)	2015 (mgd)	2020 (mgd)	2025 (mgd)
Total without Ag*	6.4	6.7	7.0	7.3	7.7
Total with Ag*	8.3	8.7	9.2	9.8	10.4
Domestic	0.4	0.4	0.5	0.5	0.5
Industrial	0.0	0.0	0.0	0.0	0.0
Irrigation	0.0	0.0	0.0	0.0	0.0
Agriculture	1.9	2.0	2.2	2.5	2.7
Military	0.0	0.0	0.0	0.0	0.0
Municipal	6.0	6.3	6.5	6.8	7.2
Potable	6.4	6.7	7.0	7.3	7.7
Nonpotable w/o Ag*	0.0	0.0	0.0	0.0	0.0
Nonpotable w/ Ag*	1.9	2.0	2.2	2.5	2.7
DWS	6.0	6.2	6.5	6.8	7.1

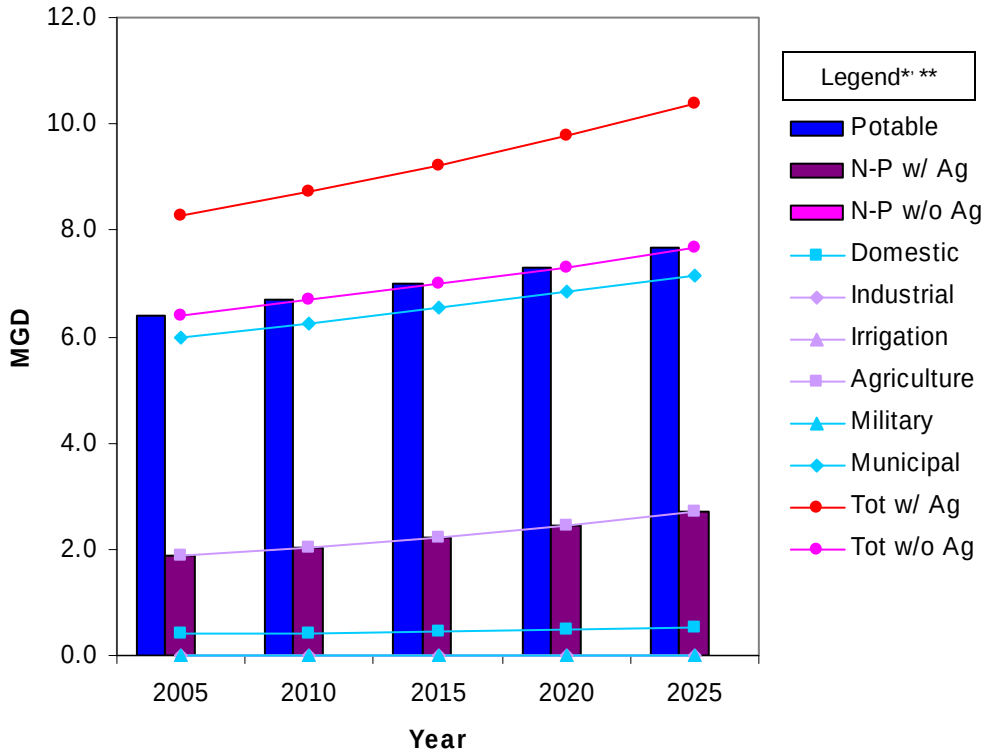
* Demand scenarios without and with agricultural demands represent the potential minimum and maximum agricultural demand, respectively, with the expectation that the actual demand will fall somewhere in between.

Figure 804-9: Medium Growth Rate B Water Demand Projections and Full Build-Out – Northeast Mauna Loa Aquifer Sector Area



* Demand scenarios without and with agricultural demands represent the potential minimum and maximum agricultural demand, respectively, with the expectation that the actual demand will fall somewhere in between.
** The LUPAG and Zoning scenarios represent demand from full build-out to the maximum density allowed and are not associated with a timeline. The B scenario represents the 5-year incremental demand based on Growth Rate B population projections, with "Potable" representing the potable component, "N-P" representing the nonpotable component and "Total" representing the sum of the two.

Figure 804-10: Medium Growth Rate B Water Demand Projection by Category – Northeast Mauna Loa Aquifer Sector Area

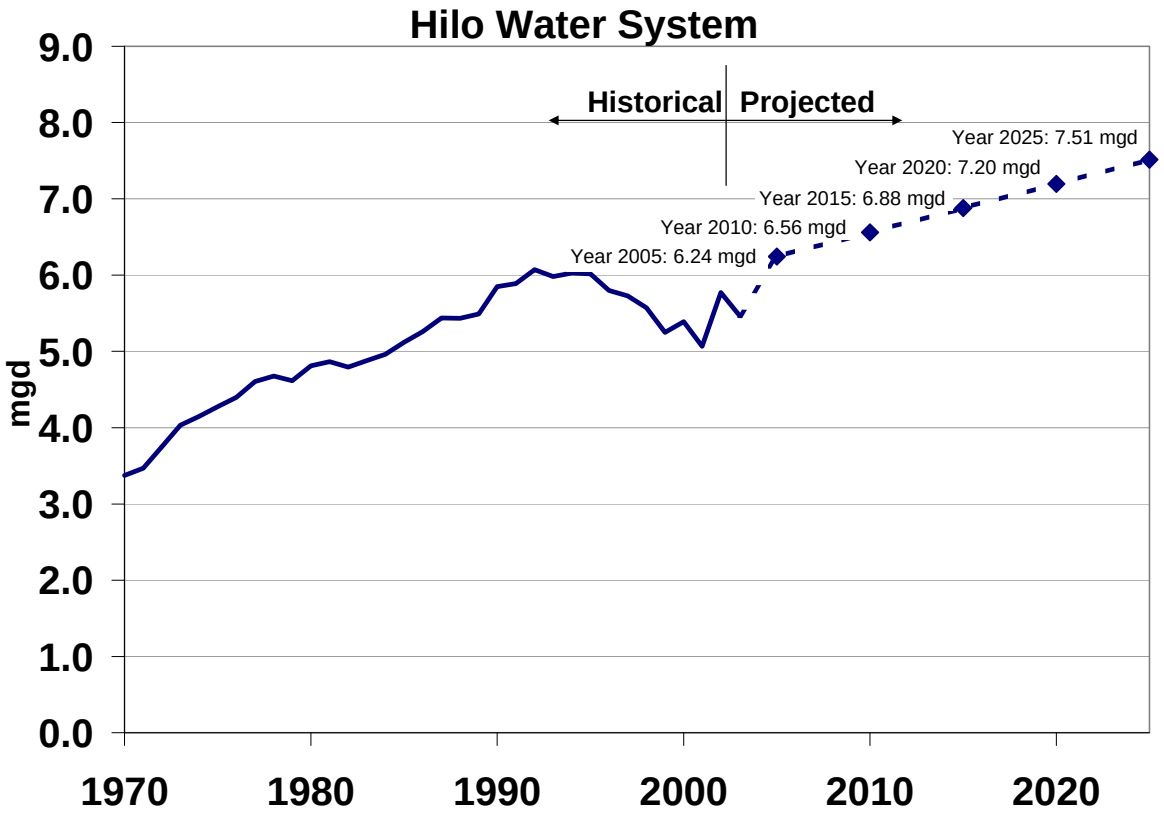


* Demand scenarios without and with agricultural demands represent the potential minimum and maximum agricultural demand, respectively, with the expectation that the actual demand will fall somewhere in between.
** "N-P" represents the nonpotable component of the demand.

804.4.5 DWS Historical Water Consumption Data Projections

DWS supplied water consumption was projected in 5-year increments to the year 2025 based on DWS historical water system consumption data from 1970 to 2003, as shown on **Figure 804-11**.

Figure 804-11: DWS Water Demand Projection – Northeast Mauna Loa Aquifer Sector Area



Historical data provided by RW Beck, Inc.

Projections based on historical DWS water consumption data cannot be compared to projections based on population growth rate, because the latter includes part of the Mt. View-Olaa Water System. However, the rate of increase of the two projections is very close. DWS may need to supply potable water equivalent to as much as half of the total projected water supply for the sector area.

804.5 RESOURCE AND FACILITY RECOMMENDATIONS

804.5.1 Water Source Adequacy

804.5.1.1 Full Build-Out

Full development to the maximum density of the County General Plan and Zoning land use within the Northeast Mauna Loa Aquifer Sector Area (ASEA) can be sustained by conventional water resources. If agricultural demands are excluded, LUPAG water demands are approximately 15 percent of the sustainable yield (SY) of the sector area, and existing zoning requires approximately 3 percent of the SY. Including worst case agricultural demands, the LUPAG demand is 27 percent of the SY, and the Zoning demand is 14 percent of the SY.

804.5.1.2 Twenty-Year Projection

20-year projected water demands are approximately 1 percent of the sector area SY.

804.5.2 Source Development Requirements

804.5.2.1 Supply-Side Management

Supply-side management, including conventional water resource measures and alternative water resource enhancement measures, are evaluated to meet projected water demands.

804.5.2.1.1 Conventional Water Resource Measures

804.5.2.1.1.1 Ground Water

At 740 mgd, the Northeast Mauna Loa ASEA has the highest sustainable yield of all aquifer sector areas on the island. According to the 1990 WRPP, it is reflective of the high annual rainfall and the infiltrability of the surface rocks. Basal water occurs several miles inland, followed by high level dike and perched water. Both sources are available in great quantities. DWS recently commissioned the Saddle Road A Well, which encountered water at an elevation of nearly 1,000 feet. Whether high level or basal sources are developed will depend on the location of future development.

The usage of nonpotable groundwater for industrial purposes at the power plants may increase if expansions to the facilities are warranted. Because most of the water drawn for industrial purposes is returned to the aquifer, it is expected that such increased usage will not adversely affect the aquifer; however, it would be prudent to confirm the effects of recharge.

804.5.2.1.1.2 Surface Water

As mentioned previously, there are several surface water sources in the sector area formerly used by DWS. New sources are not likely to be developed since groundwater is far more abundant and is less costly to develop due to the requirements for treatment and monitoring of surface water, making groundwater the preferred source. Abandoned surface water sources may be reactivated to meet localized nonpotable demands.

804.5.2.1.1.3 Water Transfer

Water transfer is already taking place; the Hilo Water System (WS) supplements the Papaikou Water System in the East Mauna Kea ASEA (802). The transfer of water is borne out of economics due to the magnitude of the Hilo WS, which can easily supplement the much smaller Papaikou WS, not because of lack of available sources in ASEA 802 in the vicinity of the Papaikou WS. Since both sector areas have ample source water, the effect of the transfer is miniscule.

804.5.2.1.2 Alternative Water Resource Enhancement Measures

804.5.2.1.2.1 Rainwater Catchment Systems

Except for the uninhabited areas towards the summit of Mauna Loa, all areas within the sector area receive enough rainfall to support rainwater catchment systems. A small percentage of domestic users already rely on catchment, and may continue to do so if extension of the municipal water system is not feasible.

804.5.2.1.2.2 Wastewater Reclamation

The magnitude of the Hilo Water System would lend nicely to a large scale wastewater reclamation facility. However, a far-reaching nonpotable reclaimed water system would likely not be implemented due to the availability of other water sources in most of the sector area, therefore usage would be confined to locations in close proximity. The need for such a facility would be contingent on development requiring a significant quantity of nonpotable water in the immediate vicinity that cannot be sustained by the ambient rainfall.

804.5.2.1.2.3 Desalination

According to the CWRM Well Database, chloride contents of existing wells up to 2 miles inland are no greater than 300 ppm. Facilities for desalination of brackish groundwater would only be considered along the coast, out of the service area of the municipal water system. Due to the high cost of desalination, extension of the existing water system is more practical.

804.5.2.2 Demand-Side Management

804.5.2.2.1 Development Density Control

Full build-out demands associated with LUPAG maximum density are over four times greater than that of Zoning. This is in part due to higher maximum density unit rates for Urban areas, and in part due to the significant amount of land designated as "Urban Expansion." However, because of the magnitude of the SY compared to the projected demands, development density control is not considered critical.

804.5.2.2.2 Water Conservation

The average water consumption per connection to the DWS water system in the sector area is 400 gpd, and the average current potable water consumption per capita from all sources is 145 gpd, both of which are exactly the island average. Demand side water conservation should continue, but further measures are not considered necessary at this point.

The Hilo Water System is the most inefficient water system on the island. Between 2001 and 2003, in the neighborhood of 50 percent of the source water produced was unaccounted for, which amounts to approximately 5 mgd. Although this is minimal in comparison to the sustainable yield of the aquifer sector area, significant long-term cost savings could be achieved by implementing supply-side conservation measures. These measures include meter inspection and replacement/repair, leak detection and remediation, and non-revenue water analysis.

804.5.3 Recommended Alternatives

Groundwater should continue to be developed as the primary potable water source in locations of anticipated development. Specifically, as recommended in the General Plan, groundwater sources should be investigated in the Waiakea Uka and Saddle Road areas.

Careful monitoring of the aquifer should accompany increased nonpotable water usage through the HELCO Wells should be due to the enormous quantity drawn and returned to the aquifer through recharge.

DWS should consider supply-side water conservation measures to reduce the unaccounted water to acceptable levels. The quantity of production water saved would be less than 1 percent of the sustainable yield; therefore, these measures would be implemented primarily for cost control.