806 SOUTHWEST MAUNA LOA AQUIFER SECTOR AREA

806.1 SECTOR AREA PROFILE

806.1.1 General

The Southwest Mauna Loa Aquifer Sector Area (ASEA) includes the Manuka [80601], Kaapuna [80602] and the Kealakekua [80603] Aquifer System Areas (ASYA), encompassing the entire South Kona District, the southeastern portion of the North Kona District, and the western portion of the Kau District. The boundaries extend from the summit of Mauna Loa to the western shores near Kealakekua, and along the western coastline to the southern tip of the island at Ka Lae.

Rainfall varies from an average of less than 20 inches per year in some coastal areas to 125 inches per year in higher elevation areas above Honaunau. Rainfall in the Kaapuna and Kealakekua ASYAs are diurnal rather than orthographic due to Mauna Loa blocking the tradewinds. The three aquifer system areas have similar sustainable yields, with the Kaapuna ASYA at 50 mgd, the Manuka ASYA at 42 mgd, and the Kealakekua ASYA at 38 mgd. The total sustainable yield for the entire sector area is 130 mgd.

806.1.2 Economy and Population

806.1.2.1 Economy

Agriculture is the most important economic activity within the sector area. Coffee and macadamia nuts are the primary industries, with over 4,000 acres of macadamia nut orchards, and the famed "coffee belt" mauka of Mamalahoa Highway. Although the coffee industry has proven to be volatile; the number of coffee farms and corresponding sales have fluctuated, varying from a low of $3.7 million in 1992 to $16.2 million in 1997; nevertheless it remains one of the principals of Kona's economy. Both products' industries include processing operations. South Kona accounts for 20 to 25 percent of the macadamia nut processing statewide. Cattle ranching and growing of citrus fruits and bananas are also important within the sector area.

Tourism does not play a large part in the sector's economy. Visitor accommodations are limited; the 88-unit Manago Hotel in Captain Cook is the largest establishment for overnight visitors. The 730-lot and golf course Hokulia development and 80-unit lodge is under construction.

806.1.2.2 Population

More than three quarters of the population contributing to the demands from the Southwest Mauna Loa ASEA is within the South Kona District, and the balance is from the Kau District. The growth of the Ocean Point Community has and will continue to be significant.

Table 806-1: Historical Population

1980	1990	2000	1980-90 % Change	1990-2000 % Change
7,430	9,553	11,068	28.6	15.9

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

Table 806-2: Population Projection

Growth Rate	2000	2005	2010	2015	2020	2000-10 % Change	2010-20 % Change
A – Low	11,068	12,938	14,280	15,727	17,331	29.0	21.4
B – Medium	11,068	12,980	14,407	15,959	17,684	30.2	22.7
C – High	11,068	13,521	15,310	17,212	19,276	38.3	25.9

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

806.1.3 Land Use

806.1.3.1 Hawaii County General Plan

The Hawaii County General Plan Land Use Pattern Allocation Guide Map (LUPAG) for the Southwest Mauna Loa ASEA is shown on **Figure 806-1**. The estimated land use allocation acreage for each LUPAG designation within the sector area is listed in **Table 806-3**.

Kealakekua
80603

Kaapuna
80602

Manuka
80601

Kealakekua Bay

Loa Pt.

Kau Loa Pt.

Ka Lae Pt.

Okoe Bay

Okoe Bay

Kauna Pt.

Ka Lae Pt.

PACIFIC OCEAN

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

2 1 0 2
Miles

INDEX MAP - Island of Hawaii

FIGURE 806-1

AQUIFER SECTOR
S.W. MAUNA LOA - 806

Aquifer Systems

Manuka - 80601
Kaapuna - 80602
Kealakekua - 80603

2005 Revised General Plan Land Use Pattern Allocation Guide

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

Table 806-3: LUPAG Map Estimated Land Use Allocation Acreage Southwest Mauna Loa Aquifer Sector Area

LAND USE PATTERN	ACREAGE	% of TOTAL
High Density Urban	0	0
Medium Density Urban	370	0.1
Low Density Urban	1,291	0.3
Industrial	0	0
Important Agricultural Land	36,622	9.2
Extensive Agriculture	141,946	35.6
Orchard	1,224	0.3
Rural	10,631	2.7
Resort/Resort Node	25	0.0
Open	4,362	1.1
Pond	0	0
Conservation	201,685	50.6
Urban Expansion	273	0.1
University Use	0	0
TOTAL	398,429	100.0

The water utility courses of action for South Kona and Kau in the Hawaii County General Plan relevant to the sector area are as follows:

- ***(a)*** *Continue to pursue groundwater source investigation, exploration and development in areas that would provide for anticipated growth and an efficient and economic system operation.*
- ***(b)*** *Continue to evaluate growth conditions to coordinate improvements as required to the existing water system in accordance with the South Kona Water System Master Plan.*
- ***(c)*** *Pursue groundwater source investigation, exploration and well development at Ocean View.*
- ***(d)*** *Investigate alternative means to finance the extension of water systems to subdivisions that rely on catchment.*

806.1.3.2 Hawaii County Zoning

Hawaii County Zoning for the Southwest Mauna Loa ASEA is shown on **Figure 806-2**. The estimated land use allocation acreage for each zoning class within the sector area is listed in **Table 806-4**.

Table 806-4: County Zoning Estimated Class Allocation Acreage – Southwest Mauna Loa Aquifer Sector Area

ZONING CLASS	ACREAGE	% of TOTAL
Single Family Residential	445	0.11
Multi-Family Residential (including duplex)	6	0.00
Residential-Commercial Mixed Use	0	0
Resort	15	0.00
Commercial	123	0.03
Industrial	0	0
Industrial-Commercial Mixed	0	0
Family Agriculture	13	0.00
Residential Agriculture	150	0.04
Agriculture	215,929	54.20
Open	136,581	34.28
Project District	23	0.01
Forest Reserve	42,949	10.78
(road)	2,194	0.55
TOTAL	398,429	100.00

806.2 EXISTING WATER RESOURCES

806.2.1 Ground Water

Southwest Mauna Loa ASEA has a sustainable yield of 130 mgd. According to the CWRM database, there are 16 production wells in the sector, including 5 municipal, 5 irrigation, 4 domestic, and 2 other. There are also 2 wells drilled and categorized as "unused". Refer to **Appendix B** for this database. **Figure 806-3** shows the well locations.

806.2.2 Surface Water

There are no streams classified as perennial in the sector area. The Kiilae Stream flowing into Kauhako Bay at Hookena is intermittent.

There are 4 declared stream diversions in the CRWM database listed in **Table 806-5** and shown on **Figure 806-4**. The two Kiilae Stream diversions have declared flows, the other two do not.

Hawaii County

Department of Water Supply

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Job No. 2003-818

Kealakekua
80603

Kaapuna
80602

Manuka
80601

Loa Pt.

Kau Loa Pt.

Ka Lae Pt.

Okoe Bay

PACIFIC OCEAN

Kauna Pt.

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

2 1 0 2
Miles

INDEX MAP - Island of Hawaii

FIGURE 806-2

AQUIFER SECTOR
S.W. MAUNA LOA - 806

Aquifer Systems
Manuka - 80601
Kaapuna - 80602
Kealakekua - 80603

County Zoning

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Consulting Engineers
1388 Kapiolani Boulevard, Honolulu, Hawaii 96814

Figure 806-3: Well and Tunnel Location

MAP CURRENTLY NOT AVAILABLE ON-LINE

Figure 806-4: Streams & Diversions

MAP CURRENTLY NOT AVAILABLE ON-LINE

Table 806-5: Stream Diversions – Southwest Mauna Loa Aquifer Sector Area

FILE REFERENCE	TMK	STREAM NAME	
CARLSMITH DW	8-9-010:004	Unnamed Spring	Spring diversion, pipe from Kalihi Spring.
MCCANDLESS RAN	8-5-001:002	Kiilae	Stream diversion Pipe #1 from Kiilae Stream. See also new entry for Pipe #2. Delcared Q of 4.0 MG is the total for both pipes.
MCCANDLESS RAN	8-5-001:002	Kiilae	Stream diversion, Pipe #2 from Kiilae Stream (new entry). Declared Q of 4.0 MG is the total for both pipes.
TANOAI A	8-3-011:043	Unnamed/ Unmapped	Stream diversion, pump from Wailapa Stream. Stream is noted to be located 150 ft from house, but not shown on USGS. Lat/long taken at location of structure on USGS.

806.2.3 Reclaimed Wastewater

There are no wastewater reclamation facilities in the Southwest Mauna Loa ASEA.

806.3 EXISTING WATER USE

806.3.1 General

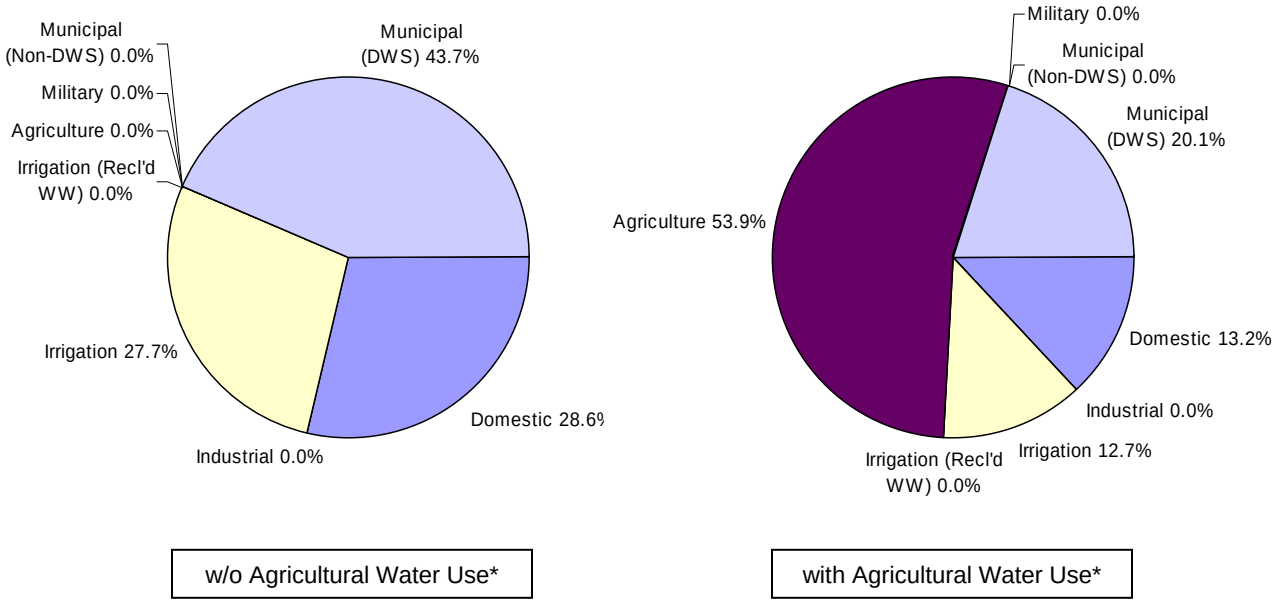
The total estimated average water use within the Southwest Mauna Loa ASEA from 2004 to 2005 (DWS meter data and CWRM pumpage data from November 2004 through October 2005 and available GIS data) is listed in **Table 806-6**. **Table 806-6** and **Figure 806-5** summarize water use in accordance with CWRM categories and indicate separately 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.

Table 806-6: Existing Water Use by Categories – Southwest Mauna Loa Aquifer Sector Area

CWRM Water Use Category	Water Use (MGD)	Percent of Total without Ag*	Percent of Total with Ag*
Domestic	0.73	28.6	13.2
Industrial	0.00	0.0	0.0
Irrigation	0.71	27.7	12.7
Reclaimed WW	0.00	0.0	0.0
Agriculture	3.01	0.0	53.9
Military	0.00	0.0	0.0
Municipal			
DWS System	1.12	43.7	20.1
Private Public WS	0.00	0.0	0.0
Total without Ag*	2.57	100.0	
Total with Ag*	5.57		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 806-5: Existing Water Use by Categories – Southwest 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.

Figure 806-6 generally shows the service area for the various water systems and indicates the extent of the DWS water system.

806.3.2 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 1,731 developed parcels serving approximately 4,700 people, which is 37 percent of the sector area population. The estimated demand is 0.73 mgd. None of the four wells classified as "Domestic" in the CWRM database report pumpage.

806.3.3 Industrial Use

There is no reported industrial usage in the CWRM well database.

806.3.4 Irrigation Use

Irrigation is based on pumpage reported for private wells categorized by CWRM as irrigation wells. **Table 806-7** indicates the average for private irrigation well pumpage reported to CWRM or listed in the 2003 SWPP.

Hawaii County

Department of Water Supply

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Job No. 2003-818

South Kona

Kealakekua
80603

Loa Pt.

Kau Loa Pt.

Kaapuna
80602

Manuka
80601

Okoe Bay

Okoe Bay

Manuka
80601

Kauna Pt.

PACIFIC OCEAN

Ka Lae Pt.

LEGEND:

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

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Miles

INDEX MAP - Island of Hawaii

FIGURE 806-6

AQUIFER SECTOR
S.W. MAUNA LOA - 806

Aquifer Systems
Manuka - 80601
Kaapuna - 80602
Kealakekua - 80603

Water System and Service Area

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Consulting Engineers
1388 Kapiolani Boulevard, Honolulu, Hawaii 96814

Table 806-7: Private Irrigation Well Pumpage

Private Irrigation	Irrigation Well Pumpage (mgd)
Mac Farms Hawaii	0.16
Kona Horizons Ltd.	0.01
1250 Oceanside Partners	0.54
TOTAL	0.71

There are no golf courses located within the Southwest Mauna Loa ASEA.

806.3.5 Agricultural Use

According to the *2003 South Kona Watershed Irrigation System Study (SKWIS)*, the agricultural water usage within the 15,000-acre study area immediately south of the Papa Bay Homesteads is supplied by catchment systems. Water trucks have provided water from the DWS South Kona Water System during drought periods, which may contribute to the 0.12 mgd drawn from the DWS water system from accounts classified as "Agricultural."

806.3.6 Military Use

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

806.3.7 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.

806.3.7.1 County Water Systems

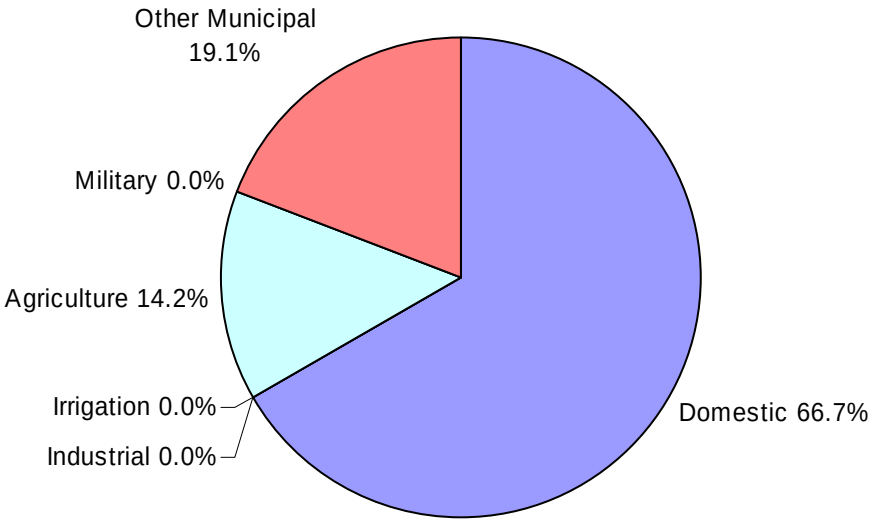
The DWS has one system in the Southwest Mauna Loa ASEA. The South Kona Water System interconnects with the North Kona Water System a short distance from the district boundary at Konawaena School. The principal source for the water system is the Keei Well field, however three of the four wells are used as backup only. In 1997, the Halekii Well at Kealakekua was brought into service. The water system extends south to Hookena, a distance of 16 miles. Eight booster pump stations, nine storage tanks and over twenty PRV's allow eleven operational zones to be serviced. A connection to the North Kona System exists along Mamalahoa Highway. The normally closed valve may be opened in case of emergencies.

DWS water use is subcategorized in **Table 806-8** to the extent possible based on available meter data and is depicted in **Figure 806-7**. "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 806-8: DWS Existing Water Use by Categories – Southwest Mauna Loa Aquifer Sector Area

CWRM Water Use Category	DWS Purveyed Water Use (MGD)	Percent of Total
Domestic	0.75	66.7
Industrial	0.00	0.0
Irrigation	0.00	0.0
Agriculture	0.16	14.2
Military	0.00	0.0
Other Municipal	0.21	19.1
Total	1.12	100.0

Figure 806-7: DWS Existing Water Use by Categories – Southwest Mauna Loa Aquifer Sector Area



806.3.7.2 State Water Systems

There are no State water systems in the Southwest Mauna Loa ASEA regulated by the DOH.

806.3.7.3 Federal Water Systems

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

806.3.7.4 Private Public Water Systems

There are no private public water systems in the Southwest Mauna Loa ASEA regulated by the DOH.

806.3.8 Water Use by Resource

806.3.8.1 Ground Water

Table 806-9 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 806-9: Sustainable Yield – Southwest 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 (%)
		2.38	**6.92**	**10.38**	**130**	**1.83**	**5.32**	**7.98**
80601	Manuka	0.16	0.79	1.18	42	0.38	1.87	2.81
80602	Kaapuna	0.01	0.40	0.60	50	0.02	0.80	1.20
80603	Kealakekua	2.17	5.73	8.60	38	5.71	15.09	22.63

806.3.8.2 Surface Water

The 15,000-acre McCandless Ranch near Kalahiki uses two diversions of the Kiilae Stream with a total declared flow of 8.0 mgd; however, the actual quantity used is not readily available.

806.3.8.3 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 previously categorized as Domestic Use in **Table 806-6** is assumed to be supplied by individual catchment systems.

As mentioned previously, the SKWIS Study indicates that catchment reservoir systems are utilized by agricultural users to supplement natural precipitation.

806.3.8.4 Reclaimed Wastewater

There is no reclaimed wastewater usage in the sector area.

806.4 FUTURE WATER NEEDS

806.4.1 General

Table 806-10 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 806-10: 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 S.W. Mauna Loa ASEA	130	18.0	1.5	2.6	2.8	3.2	3.5	3.9
80601 – Manuka ASYA	42	7.7	0.0	0.5	0.6	0.7	0.7	0.8
80602 – Kaapuna ASYA	50	0.0	0.0	0.3	0.3	0.3	0.4	0.4
80603 – Kealakekua ASYA	38	10.3	1.4	1.7	1.9	2.2	2.4	2.7
With Agricultural Demand*	**SY (mgd)**	**LUPAG (mgd)**	**Zoning (mgd)**	**Growth Rate B Demand Projections (mgd)**				
				2005	**2010**	**2015**	**2020**	**2025**
Total S.W. Mauna Loa ASEA	130	142.5	123.1	5.6	6.2	6.8	7.6	8.4
80601 – Manuka ASYA	42	33.2	25.2	1.2	1.3	1.4	1.6	1.7
80602 – Kaapuna ASYA	50	40.8	40.4	1.3	1.4	1.6	1.8	2.0
80603 – Kealakekua ASYA	38	68.5	57.5	3.1	3.4	3.8	4.3	4.7

* 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 all aquifer system areas, full build-out water demands excluding agricultural demands are considerably less than the SY, and the 2025 demand projections excluding agricultural demands are less than 10 percent of the system area 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.

806.4.2 Full Build-Out Water Demand Projections

The full build-out water demand projections based on the General Plan and County Zoning for the Southwest Mauna Loa ASEA are listed in **Tables 806-11** and **806-12**, and reflect refinement as discussed below. Each land use class is associated with the most appropriate CWRM water use category.

Table 806-11: Hawaii County General Plan Full Build-Out Water Demand Projection – Southwest Mauna Loa Aquifer Sector Area

LUPAG Class	CWRM Category	Water Demand (mgd)
Urban	Domestic/Irrigation/Municipal	9.8
Urban Expansion	Domestic/Irrigation/Municipal	1.4
Resort	Irrigation/Municipal	0.4
Industrial	Industrial	0.0
Agriculture	Agriculture	124.5
University	Irrigation/Municipal	0.0
Rural	Irrigation/Municipal	6.4
DHHL	Irrigation/Municipal	0.0
TOTAL w/o Ag*		18.0
TOTAL w/ Ag*		142.5

* 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 806-12: County Zoning Full Build-Out Water Demand Projection – Southwest Mauna Loa Aquifer Sector Area

Zoning Class	CWRM Category	Water Demand (mgd)
Residential	Domestic/Irrigation/Municipal	1.0
Resort	Irrigation/Municipal	0.0
Commercial	Municipal	0.4
Industrial	Industrial	0.0
Agriculture	Agriculture	121.6
DHHL	Irrigation/Municipal	0.0
TOTAL w/o Ag*		1.5
TOTAL w/ Ag*		123.1

* 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.

806.4.2.1 Refine Land Use Based Projection

806.4.2.1.1 State Water Projects Plan

The total projected demand to the year 2020 for 15 State Water Projects within the Southwest Mauna Loa ASEA is 0.12 mgd, using 0.02 mgd potable, and 0.10 mgd nonpotable using potable sources. These projects may account for 3 percent of the total projected water demand in the sector area. The projects that will generate the most significant demands are listed in **Table 806-13**.

Table 806-13: Future State Water Projects to Generate Significant Demands

Project Name	Primary Use	State Department	2020 Demand (mgd)
Kealakekua Bay Ship	Nonpotable using Potable	State Parks	0.08
Kona Civic Center	Nonpotable using Potable	DAGS – Planning	0.02

806.4.2.1.2 State Department of Hawaiian Home Lands

There are no tracts of land in the Southwest Mauna Loa ASEA owned by the DHHL.

806.4.2.1.3 Agricultural Water Use and Development Plan

There is no information available in the AWUDP specific to activity within the Southwest Mauna Loa ASEA to further refine projections.

806.4.3 Water Use Unit Rates

Water use unit rates are based on the *Water System Standards* as discussed in Chapter 1, and single family residential (Low Density Urban category of the General Plan and RS-7.5 and greater or Single-Family Residential categories of one lot per at least 7,500 acres of County Zoning) consumption is based on 1.5 units per lot.

806.4.4 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 Southwest Mauna Loa ASEA. The projected low, medium, and high growth rates are listed in **Table 806-14**, and are graphed in **Figure 806-8**. Potable and nonpotable water demands are also differentiated.

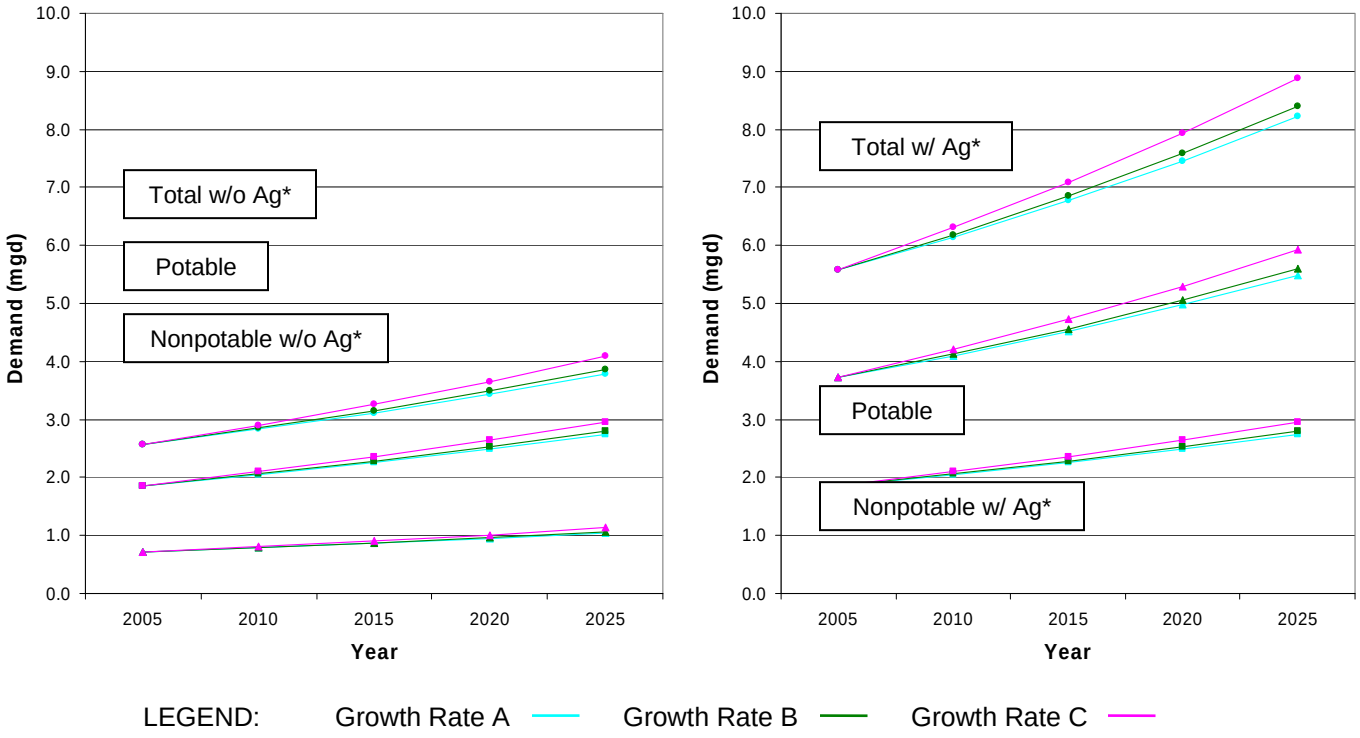
Focusing on Medium Growth Rate B, **Figure 806-9** illustrates the magnitude of the sustainable yield, both LUPAG and Zoning full build-out water use, and water use projection through the year 2025. **Figure 806-10** shows the breakdown of water demand projections by CWRM categories through the year 2025. **Table 806-15** summarizes these figures.

Table 806-14: Water Demand Projection – Southwest 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	2.6	2.8	3.1	3.4	3.8	5.6	6.1	6.8	7.5	8.2
Potable	1.9	2.0	2.3	2.5	2.7	1.9	2.0	2.3	2.5	2.7
Nonpotable	0.7	0.8	0.9	0.9	1.0	3.7	4.1	4.5	5.0	5.5
GROWTH RATE B	**2005**	**2010**	**2015**	**2020**	**2025**	**2005**	**2010**	**2015**	**2020**	**2025**
Total	2.6	2.8	3.2	3.5	3.9	5.6	6.2	6.8	7.6	8.4
Potable	1.9	2.1	2.3	2.5	2.8	1.9	2.1	2.3	2.5	2.8
Nonpotable	0.7	0.8	0.9	1.0	1.1	3.7	4.1	4.6	5.1	5.6
GROWTH RATE C	**2005**	**2010**	**2015**	**2020**	**2025**	**2005**	**2010**	**2015**	**2020**	**2025**
Total	2.6	2.9	3.3	3.7	4.1	5.6	6.3	7.1	7.9	8.9
Potable	1.9	2.1	2.4	2.6	3.0	1.9	2.1	2.4	2.6	3.0
Nonpotable	0.7	0.8	0.9	1.0	1.1	3.7	4.2	4.7	5.3	5.9

* 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 806-8: Water Demand Projection Summary – Southwest Mauna Loa Aquifer Sector Area



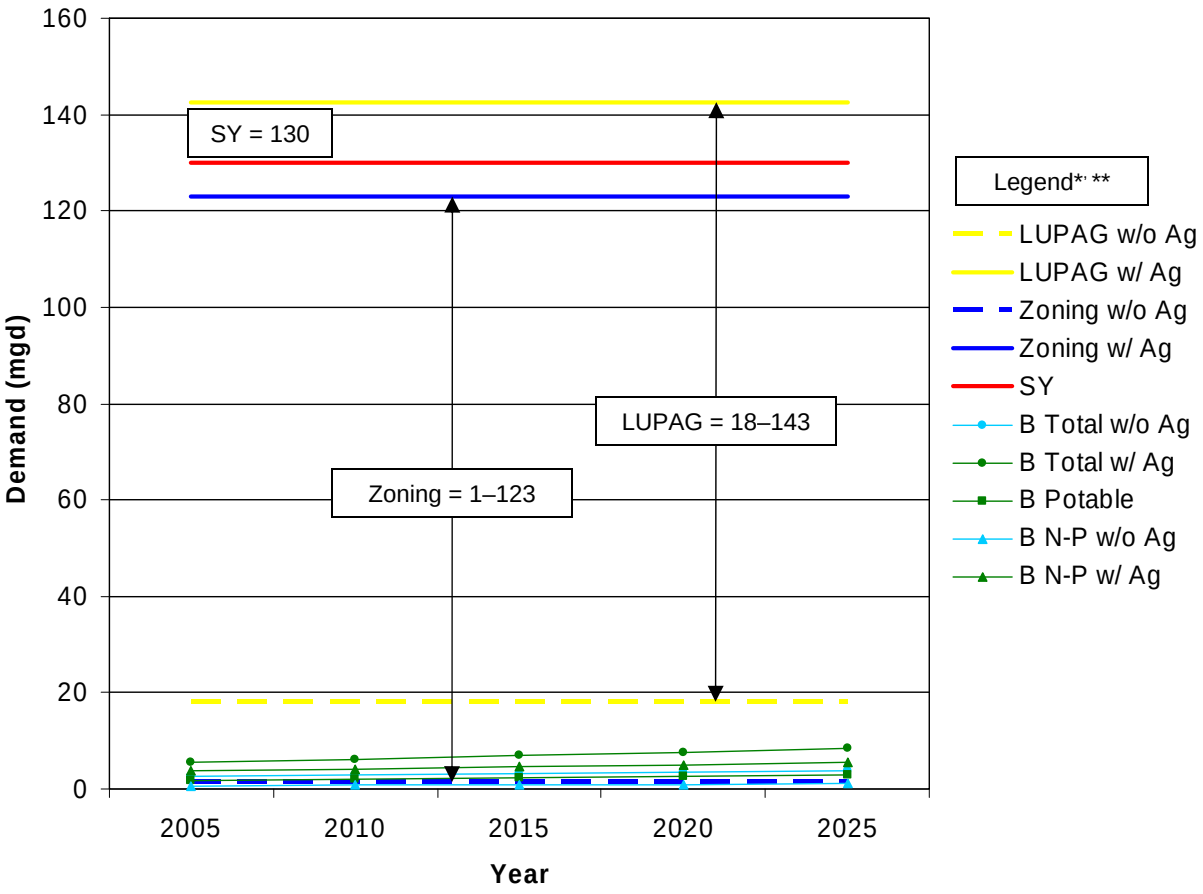
* Demand scenarios without and with agricultural demands represent the potential minimum and maximum agricultural demand, respectively, with the expectation that the actual demand will fall somewhere in between.

Table 806-15: Medium Growth Rate B Water Demand Projection by Category – Southwest Mauna Loa Aquifer Sector Area

Water Use Category	2005 (mgd)	2010 (mgd)	2015 (mgd)	2020 (mgd)	2025 (mgd)
Total without Ag*	2.6	2.8	3.2	3.5	3.9
Total with Ag*	5.6	6.2	6.8	7.6	8.4
Domestic	0.7	0.8	0.9	1.0	1.1
Industrial	0.0	0.0	0.0	0.0	0.0
Irrigation	0.7	0.8	0.9	1.0	1.1
Agriculture	3.0	3.3	3.7	4.1	4.5
Military	0.0	0.0	0.0	0.0	0.0
Municipal	1.1	1.2	1.4	1.5	1.7
Potable	1.9	2.1	2.3	2.5	2.8
Nonpotable w/o Ag*	0.7	0.8	0.9	1.0	1.1
Nonpotable w/ Ag*	3.7	4.1	4.6	5.1	5.6
DWS	1.1	1.2	1.4	1.5	1.7

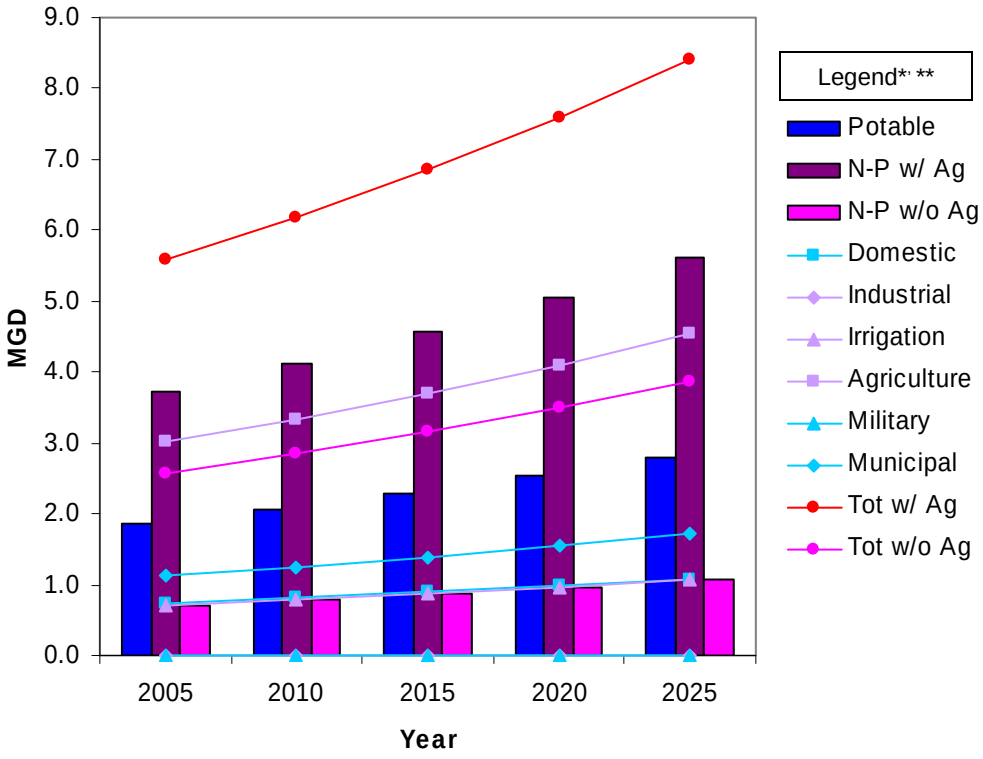
* Demand scenarios without and with agricultural demands represent the potential minimum and maximum agricultural demand, respectively, with the expectation that the actual demand will fall somewhere in between.

Figure 806-9: Medium Growth Rate B Water Demand Projections and Full Build-Out – Southwest 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 806-10: Medium Growth Rate B Water Demand Projection by Category – Southwest Mauna Loa Aquifer Sector Area

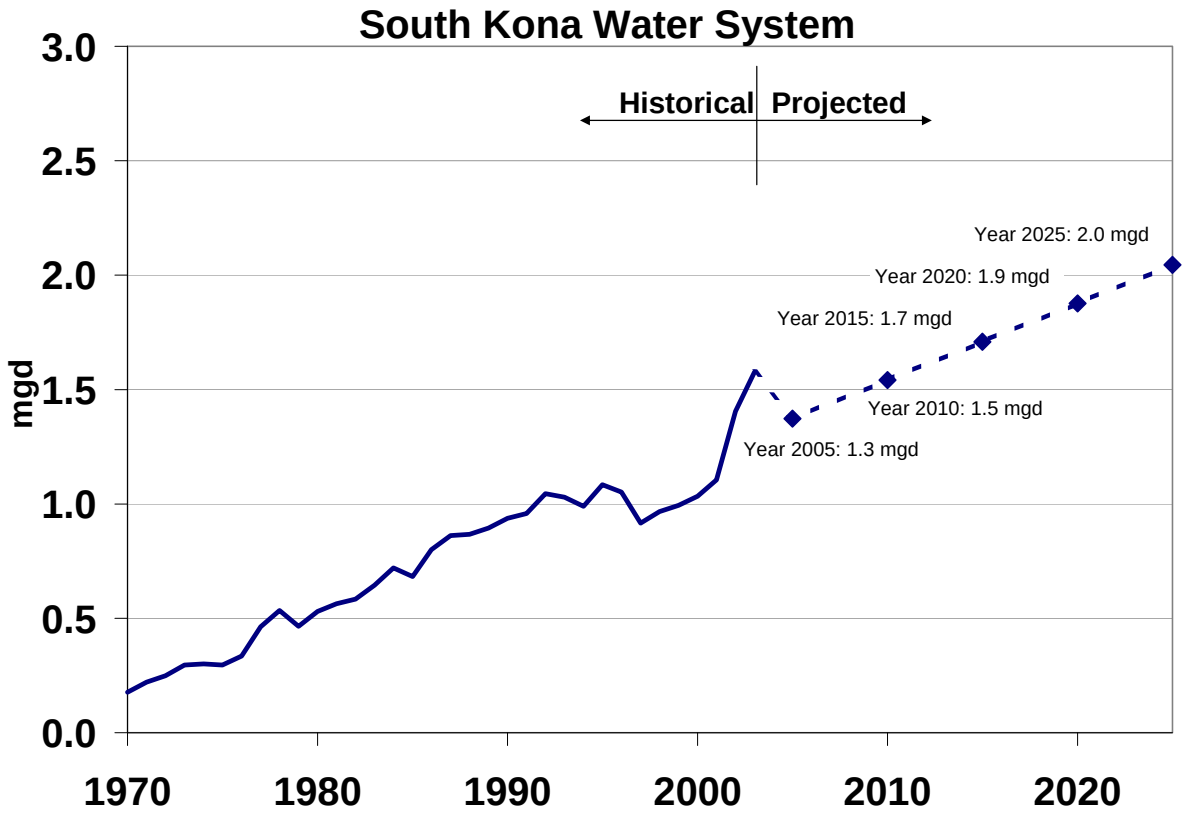


* Demand scenarios without and with agricultural demands represent the potential minimum and maximum agricultural demand, respectively, with the expectation that the actual demand will fall somewhere in between.
** "N-P" represents the nonpotable component of the demand.

806.4.5 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 806-11**.

Figure 806-11: DWS Water Demand Projection – Southwest Mauna Loa Aquifer Sector Area



Historical data and graph provided by RW Beck, Inc.

Projections based on historical DWS water consumption data are slightly lower than projections based on population growth rate, primarily because the projected demand for 2005 is lower than actual data. The growth rate; however, is consistent with the projections for the total sector area, and indicates that DWS may need to supply potable water of as much as half of the total projected water supply for the Southwest Mauna Loa ASEA.

806.5 RESOURCE AND FACILITY RECOMMENDATIONS

806.5.1 Water Source Adequacy

806.5.1.1 Full Build-Out

Full development to the maximum density of the County General Plan land use within the Southwest Mauna Loa Aquifer Sector Area (ASEA) can be sustained by conventional water resources. If agricultural demands are excluded, LUPAG water demands amount to less than 15 percent of the sustainable yield (SY) of the sector area, and the existing Zoning requires approximately 1 percent of the sector area SY. If worst case agricultural demands are included, the LUPAG demand scenario would exceed the SY, and Zoning demand scenario would require 95 percent of the SY.

806.5.1.2 Twenty-Year Projection

Existing demands range between 2 and 3 percent of the SY of the sector area, and 20-year projected demands range between 4 and 7 percent of the SY.

806.5.2 Source Development Requirements

806.5.2.1 Supply-Side Management

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

806.5.2.1.1 Conventional Water Resource Measures

806.5.2.1.1.1 Ground Water

The basal groundwater lens extends at least six miles inland, is thin, difficult to develop, and a significant portion may be brackish according to the WRPP. The existence of high-level water has been shown by the development of the DWS Halekii and Keei 4 Wells in the Kealakekua Aquifer System Area (ASYA). Further inland, high level water is present at 1,000 to 1,500 feet beneath the ground surface. High level groundwater remains the most viable resource and should continue to be developed. DWS has planned another high level well further south of the existing Halekii Well. As no wells have been drilled mauka of Mamalahoa Highway south of Keei in the sector area, the potential for high level groundwater is uncertain and needs to be investigated further.

Potable basal water is one of the many potential options to the Ocean View area. Multiple wells with smaller pumping rates spread out would be necessary to avoid drawing brackish water.

The *2003 SKWIS* study indicates that either high level potable sources or low level nonpotable sources may be developed to supply a future agricultural irrigation system in the study area,

which is split by Mamalahoa Highway and is bound by Ocean View to the south and Papa Bay Homesteads to the north. The service area may also be extended to supply the Ocean View area.

806.5.2.1.1.2 Surface Water

Surface water is not considered a viable resource as shown by the limited number of stream diversions and the lack of perennial streams in the sector area.

806.5.2.1.1.3 Water Transfer

One of the alternatives to supply potable water to the southern areas in the Manuka ASYA proposed for development is to develop sources in the Southeast Mauna Loa ASEA (805) and transfer water to the Southwest Mauna Loa ASEA. As described in the *2004 Kau to South Kona Water Master Plan*, several water transfer alternatives might be considered, including different combinations of development of wells north of South Point and extension of the DWS Waiohinu-Naalehu System, construction of a pipeline to deliver such sources to South Point, and standpipes north of the South Point area to reduce water hauler distances.

Water transfer may also be considered to supply nonpotable water for agricultural purposes. Should DWS abandon tunnel sources in the Naalehu Aquifer System, which may be under surface water influence, in favor of groundwater sources due to Federal Safe Drinking Water Act requirements, these sources may be available to transfer to areas proposed for development in the Manuka ASYA.

806.5.2.1.2 Alternative Water Resource Enhancement Measures

806.5.2.1.2.1 Rainwater Catchment Systems

Some of the area within the sector area proposed for development receives sufficient rainfall to support catchment, however most do not. Notably, the Ocean View area, which relies on individual rainwater catchment systems, receives less than 60 inches of rainfall per year, which is generally less than adequate. Evidence of this inadequacy is Ocean View's frequent dependency on hauled water.

Rainwater catchment systems may be used to supplement nonpotable sources. Runoff could be to collected from land and road areas and stored in ponds, which in turn could be used for irrigation or fire protection.

806.5.2.1.2.2 Wastewater Reclamation

Wastewater reclamation facilities can only be implemented if a sanitary collection system and a wastewater treatment facility exist. Currently, only areas in the Kealakekua ASYA have such systems in place. In future development areas, community planning may structure land uses requiring nonpotable water around the placement of a wastewater treatment and wastewater reclamation facility. Wastewater flows would need to be large enough to justify the cost of a

reclamation facility. Projections indicate the population of the sector area is expected to grow by 8,000 over the next 20 years; therefore, this alternative might become feasible.

806.5.2.1.2.3 Desalination

Although costly, desalination of brackish groundwater might be one of the more cost-effective alternatives in southern areas of the Manuka ASYA. Chloride content in the Kahuku Well was reported at 300 ppm, which is promising. Desalination of water with such low chlorides would require significantly less energy.

806.5.2.2 Demand-Side Management

806.5.2.2.1 Development Density Control

Full build-out demands associated with LUPAG maximum density are over ten times greater than that of Zoning. The Ocean View area is classified as "Rural" in the LUPAG. The area consists of over 12,000 subdivided lots, almost all of which are one acre in size; therefore, the density assumption of 1 lot per acre for LUPAG "Rural" designations is consistent.

Urban LUPAG areas only exist in the Kealakekua ASYA, where potable water sources are available. Water requirements associated with development of these areas to the maximum density area less than 10 mgd, which is less than 5 percent of the SY; therefore, development density control in these locations is not necessary.

806.5.2.2.2 Water Conservation

The average water consumption per connection to the DWS system in the Southwest Mauna Loa ASEA is over 500 gpd per connection, which is higher than the island average; however, the average potable water consumption per capita from all sources is estimated at 145 gpd, which is exactly the island average. Water conservation should continue; however, strict demand-side conservation practices do not need to be implemented. Some measures include voluntary water conservation during dry periods, education programs, and requirement for more efficient landscaping practices.

806.5.3 Recommended Alternatives

Exploration and development of high-level groundwater sources should continue as the primary source to meet potable water requirements in the Kealakekua ASYA, and for potential transfer to the Hualalai ASEA (809).

DWS should strive to reduce the average consumption per connection closer to the island average. Although sources are readily available, conservation efforts would make available more source water to transfer to the Hualalai ASEA (809).

Alternatives to supply potable and nonpotable water to the area in the Manuka ASYA proposed for development should be considered in conjunction with public input to determine near term and far term water supply strategies.