807 NORTHWEST MAUNA LOA AQUIFER SECTOR AREA

807.1 SECTOR AREA PROFILE

807.1.1 General

The Northwest Mauna Loa Aquifer Sector Area (ASEA) includes the Anaehoomalu [80701] Aquifer System Area (ASYA). It extends from the summit of Mauna Loa, northwest to the western shores of Anaehoomalu; and spans three districts, capturing the southern coastal portion of the South Kohala District, the northeastern portion of the North Kona District and the southern portion of the Hamakua District.

Average rainfall ranges from 10 inches along the coast to 45 inches in the low-lying areas between Mauna Kea and Mauna Loa. The sustainable yield is 30 mgd.

807.1.2 Economy and Population

807.1.2.1 Economy

Tourism has become the leading economic industry in South Kohala. Two of South Kohala's three luxury resorts lie within the Northwest Mauna Loa ASEA. The Mauna Lani Resort includes a hotel and several condominium resorts and villas. The Waikoloa Resort includes two hotels and six condominium resorts on 1,150 acres. Both resorts sport two golf courses and other amenities.

The Pohakuloa Military Training Area (PTA) is also located in the saddle area between Mauna Kea and Mauna Loa within the southern portion of the sector area. The PTA consists of 108,863 acres, however much of this is designated as a conservation district. As the largest training area in Hawaii, Pohakuloa can be used to accomplish nearly all of the varying types of training required by the military forces. A support area of 600 acres containing logistic and administrative facilities plus quarters for approximately 2,000 troops is located to the north at the base of Mauna Kea.

807.1.2.2 Population

Nearly all of the population contributing to the demands from the sector area is within the South Kohala District. The growth in tourism has followed the dramatic increase in the population of South Kohala over the past 30 years; and as a result, South Kohala enjoyed the lowest unemployment rate and the highest median income on the island in 1997.

Table 807-1: Historical Population

1980	1990	2000	1980-90 % Change	1990-2000 % Change
173	344	494	98.8	43.6

Data Source: 2000 U.S. Census
Data redistributed and evaluated for Northwest Mauna Loa ASEA

Table 807-2: Population Projection

Growth Rate	2000	2005	2010	2015	2020	2000-10 % Change	2010-20 % Change
A – Low	494	587	678	781	901	37.2	32.9
B – Medium	494	589	684	793	919	38.5	34.4
C – High	494	614	727	855	1,002	47.2	37.8

Data Source: County General Plan, February 2005
Data redistributed and evaluated for Northwest Mauna Loa ASEA

807.1.3 Land Use

807.1.3.1 Hawaii County General Plan

The Hawaii County General Plan Land Use Pattern Allocation Guide Map (LUPAG) for the sector area is shown on **Figure 807-1**. The estimated land use allocation acreage for each LUPAG designation within the Sector is listed in **Table 807-3**.

Table 807-3: LUPAG Map Estimated Land Use Allocation Acreage – Northwest Mauna Loa Aquifer Sector Area

LAND USE PATTERN	ACREAGE	% of TOTAL
High Density Urban	0	0
Medium Density Urban	99	0.05
Low Density Urban	343	0.17
Industrial	155	0.08
Important Agricultural Land	2,079	1.02
Extensive Agriculture	23,100	11.31
Orchard	0	0
Rural	44	0.02
Resort/Resort Node	2,551	1.25
Open	5,472	2.68
Conservation	163,573	80.08
Urban Expansion	6,842	3.35
University Use	0	0
TOTAL	204,257	100.00

PACIFIC OCEAN

Puako Bay

Kiholo Bay

Mahaiula Bay

Kailua Bay

Kailua Kona

Kealakekua Bay

Anaehoomalu
80701

Hawaii County
Department of Water Supply

DWS UPDATE TO THE WATER USE AND DEVELOPMENT PLAN

Job No. 2003-818

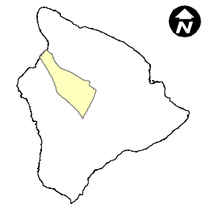
LEGEND:

- 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 807-1

AQUIFER SECTOR
N.W. MAUNA LOA - 807

Aquifer System
Anaehoomalu - 80701

2005 Revised General Plan Land Use Pattern Allocation Guide Map

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

The water utility courses of action for South Kohala in the Hawaii County General Plan relevant to the Northwest Mauna Loa ASEA are as follows:

(a) *Seek alternative sources of water for the Lalamilo system.*

(b) *Improve and replace inadequate distribution mains and steel tanks.*

807.1.3.2 Hawaii County Zoning

Hawaii County Zoning for the sector area is shown on **Figure 807-2**. The estimated land use allocation acreage for each zoning class within the sector area is listed in **Table 807-4**.

Table 807-4: County Zoning Estimated Class Allocation Acreage – Northwest Mauna Loa Aquifer Sector Area

ZONING CLASS	ACREAGE	% of TOTAL
Single Family Residential	349	0.17
Multi-Family Residential (including duplex)	1,222	0.60
Residential-Commercial Mixed Use	0	0
Resort	234	0.11
Commercial	127	0.06
Industrial	2	0.00
Industrial-Commercial Mixed	0	0
Family Agriculture	0	0
Residential Agriculture	868	0.42
Agriculture	32,869	16.09
Open	60,274	29.51
Project District	0	0
Forest Reserve	107,774	52.76
(road)	537	0.26
TOTAL	204,254	100.00

807.2 AVAILABLE WATER RESOURCES

807.2.1 Ground Water

The Northwest Mauna Loa ASEA has a sustainable yield of 30 mgd. According to the CWRM database, there are 19 production wells in the sector, including 11 irrigation, 1 industrial, and 7 other. Refer to **Appendix B** for this database. **Figure 807-3** shows the well locations.

807.2.2 Surface Water

There are no declared stream diversions in the sector area in CRWM database.

807.2.3 Reclaimed Wastewater

There are 2 wastewater reclamation facilities (WWRF) in the study area. **Table 807-5** lists the WWRF, reclaimed water classification, facility treatment capacity, current reuse amount, and current application.

Table 807-5: Wastewater Reclamation Facilities – Northwest Mauna Loa Aquifer Sector Area

Wastewater Reclamation Facility	Reclaimed Water Classification	WWRF Capacity (MGD)	Current Reuse Amount (MGD)	Irrigation Application
Waikoloa Beach Resort WRF	R-2	1.3	0.5	Beach Resort/Golf Course
Mauna Lani WWRF	R-2	0.75	0.25	Nursery/Sod Farm/Composting

807.3 EXISTING WATER USE

807.3.1 General

The total estimated average water use within the Northwest Mauna Loa ASEA from November 2004 through October 2005 based on DWS meter data, CWRM pumpage data, available GIS data, SWPP estimates, and estimated reclaimed wastewater usage is listed in **Table 807-6** and summarized in **Figure 807-5** 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.

Table 807-6: Existing Water Use by Categories – Northwest Mauna Loa Aquifer Sector Area

CWRM Water Use Category	Water Use (MGD)	Percent of Total without Ag*	Percent of Total with Ag*
Domestic	0.00	0.0	0.0
Industrial	0.00	0.0	0.0
Irrigation	5.05	63.3	62.0
Reclaimed WW	0.75	9.4	9.2
Agriculture	0.18	0.0	2.2
Military	0.03	0.4	0.4
Municipal			
DWS System	2.14	26.9	26.3
Private Public WS	0.00	0.0	0.0
Total without Ag*	7.97	100.0	
Total with Ag*	8.15		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.

PACIFIC OCEAN

Puako Bay

Kiholo Bay

Mahaiula Bay

Anaehoomalu
80701

Kailua Bay

Kailua Kona

Kealakekua Bay

Hawaii County

Department of Water Supply

DWS UPDATE TO THE WATER USE AND DEVELOPMENT PLAN

Job No. 2003-818

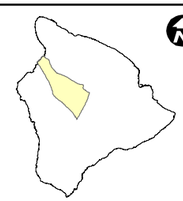
LEGEND:

- 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 Reserse
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 807-2

AQUIFER SECTOR
N.W. MAUNA LOA - 807

Aquifer System

Anaehoomalu - 80701

County Zoning

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

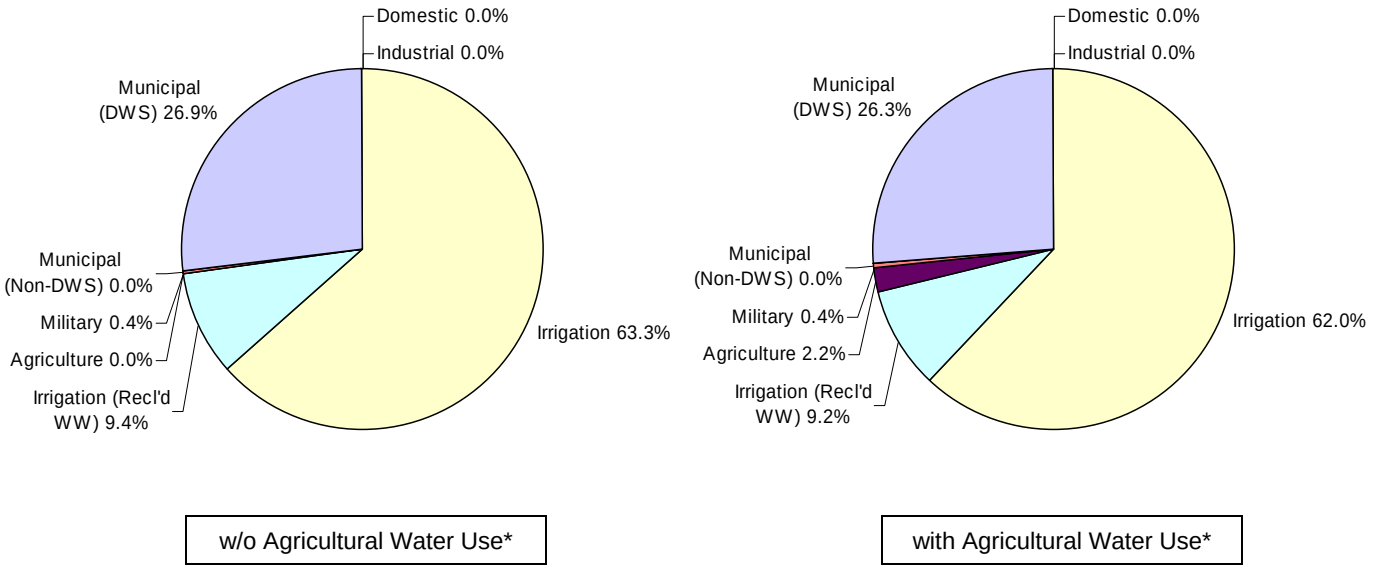
Figure 807-3: Well and Tunnel Location

MAP CURRENTLY NOT AVAILABLE ON-LINE

Figure 807-4: Streams & Diversions

MAP CURRENTLY NOT AVAILABLE ON-LINE

Figure 807-5: Existing Water Use by Categories – Northwest 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 807-6 generally shows the service area for the various water systems and indicates the extent of the DWS water system.

807.3.2 Domestic Use

Domestic use or water use by individual households is assumed to be supplied by private individual rainwater catchment systems. However, there is no evidence of such usage within the sector.

807.3.3 Industrial Use

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

807.3.4 Irrigation Use

Irrigation accounts for nearly two-thirds of the water used in the sector area, and is based on pumpage reported for private wells categorized by CWRM as irrigation wells and reclaimed water use as indicated in previously **Table 807-6**. **Table 807-7** indicates the average for private irrigation well pumpage reported to CWRM.

Table 807-7: Private Irrigation Well Pumpage

Private Irrigation	Irrigation Well Pumpage (mgd)
Mauna Lani Resort	1.56
Waikoloa	2.56
Parker Ranch	0.83
TOTAL	5.05

The Mauna Lani Resort maintains seven brackish water wells for golf course irrigation, four of which are located in the Northwest Mauna Loa ASEA.

The Waikoloa Resort lands were purchased in 1968 from Parker Ranch by Boise Cascade. The lands are split between the Northwest Mauna Loa ASEA and the West Mauna Kea ASEA (803), with the higher elevation lands above the beach resort used for residential development within the former and the oceanfront lands used for resort hotel development within the latter. Six wells located within the Northwest Mauna Loa ASEA provide brackish water for golf course irrigation.

807.3.5 Agricultural Use

There is no agricultural usage from known sources in the sector area.

807.3.6 Military Use

One of the county's two military water systems is located at the Pohakuloa Training Area (PTA) in the saddle region between Mauna Kea and Mauna Loa. Not including the small permanent staff, the population of this military training camp fluctuates with the number of troops involved in the training being held at a specific time and water demand fluctuates accordingly. For example, the population can increase up to 5,000 troops for major exercises, usually held during May to October. The average day demand estimated in the Hawaii SWPP is 30,000 gpd with a peak during training periods of 80,000 gpd. The system obtains its water from the Mauna Kea State Park Water System, which is supplied by five springs in the West Mauna Kea ASEA. During periods of high consumption, additional water is hauled by private and military tankers from municipal systems either in Hilo or Kamuela.

807.3.7 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.

807.3.7.1 County Water Systems

The Lalamilo Water System described in Chapter 803 services the Mauna Lani Resort. DWS records indicate that the Mauna Lani Bay Hotel is one of the largest single water users served by DWS.

PACIFIC OCEAN

Puako Bay

Lalamilo

Waikoloa

Kiholo Bay

Mahaiula Bay

Kailua Bay

Kailua Kona

Kealakekua Bay

Anaehoomalu
80701

DWS UPDATE TO THE WATER USE AND DEVELOPMENT PLAN

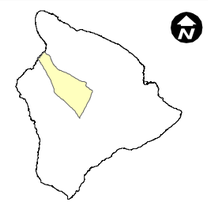
Job No. 2003-818

Hawaii County
Department of Water Supply

LEGEND:

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

2 1 0 2
Miles



INDEX MAP - Island of Hawaii

FIGURE 807-6

AQUIFER SECTOR
N.W. MAUNA LOA - 807

Aquifer System

Anaehoomalu - 80701

Water System and Service Area

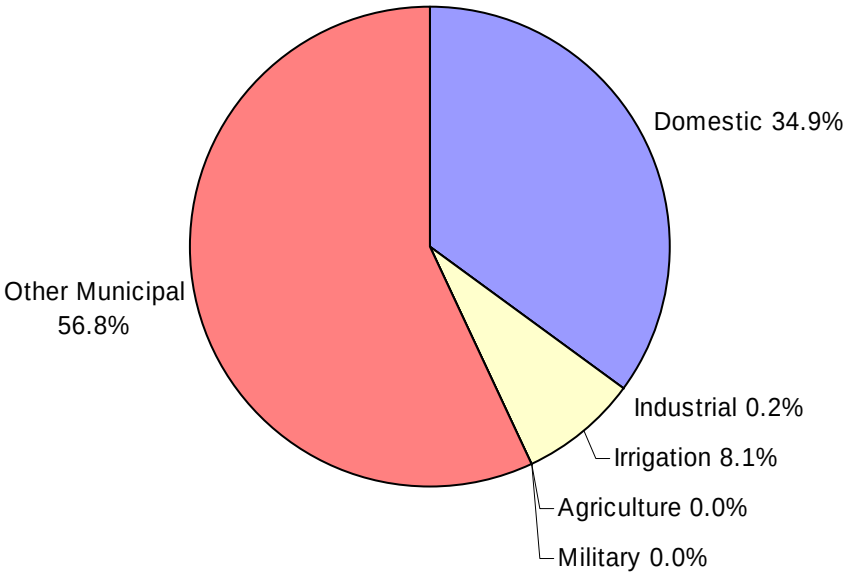
FUKUNAGA & ASSOCIATES, INC.
Consulting Engineers
1388 Kapiolani Boulevard, Honolulu, Hawaii 96814

DWS water use is subcategorized in **Table 807-8** to the extent possible based on available meter data and is depicted in **Figure 807-7**. "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 807-8: DWS Existing Water Use by Categories – Northwest Mauna Loa Aquifer Sector Area

CWRM Water Use Category	DWS Purveyed Water Use (MGD)	Percent of Total
Domestic	0.75	34.9
Industrial	0.00	0.2
Irrigation	0.17	8.1
Agriculture	0.00	0.0
Military	0.00	0.0
Other Municipal	1.22	56.8
Total	2.14	100.0

Figure 807-7: DWS Existing Water Use by Categories – Northwest Mauna Loa Aquifer Sector Area



807.3.7.2 State Water Systems

There are no State water systems in the Northwest Mauna Loa ASEA.

807.3.7.3 Federal Water Systems

The PTA Water System described in Section 807.3.6 is the only Federal water system in the Northwest Mauna Loa ASEA.

807.3.7.4 Private Public Water Systems

Potable water wells supplying the Waikoloa Water System described in Chapter 803 are located in the West Mauna Kea ASEA (803); however, the water system service area extends into the Northwest Mauna Loa ASEA to the Waikoloa Resort.

807.3.8 Water Use by Resource

807.3.8.1 Ground Water

Table 807-9 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.

Talbe 807-9: Sustainable Yield – Northwest 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 (%)
		4.13	**10.61**	**15.91**	**30**	**13.77**	**35.36**	**53.03**
80701	Anaehoomalu	4.13	10.61	15.91	30	13.77	35.36	53.03

807.3.8.2 Surface Water

There are no known surface water uses in the Northwest Mauna Loa ASEA.

807.3.8.3 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. According to available GIS information, no such parcels exist within the sector area.

807.3.8.4 Reclaimed Wastewater

Reclaimed wastewater from the two wastewater treatment plants within the Northwest Mauna Loa ASEA is used for golf course, landscaping, nursery, sod farm and compost irrigation. Refer to **Table 807-5** presented earlier.

807.4 FUTURE WATER NEEDS

807.4.1 General

Table 807-10 summarizes the LUPAG, Zoning and 5-year incremental water demand projection scenarios for the total aquifer sector area and the individual aquifer system area. The sustainable yield (SY) is presented to draw comparisons.

Table 807-10: 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 N.W. Mauna Loa ASEA	30	81.7	11.0	8.0	9.3	10.7	12.4	14.4
80701 – Anaehoomalu ASYA	30	81.7	11.0	8.0	9.3	10.7	12.4	14.4
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	30	88.7	18.1	8.2	9.5	11.0	12.7	14.7
80701 – Anaehoomalu ASYA	30	88.7	18.1	8.2	9.5	11.0	12.7	14.7

* 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.

There is only one aquifer system area within the Northwest Mauna Loa ASEA; therefore, demands presented by aquifer sector area and by aquifer system area are one in the same.

807.4.2 Full Build-Out Water Demand Projections

The full build-out water demand projections based on the General Plan and County Zoning for the Northwest Mauna Loa ASEA are listed in **Tables 807-11** and **807-12**, and reflect refinement as discussed below. Each land use class is associated with the most appropriate CWRM water use category.

Table 807-11: Hawaii County General Plan Full Build-Out Water Demand Projection – Northwest Mauna Loa Aquifer Sector Area

LUPAG Class	CWRM Category	Water Demand (mgd)
Urban	Domestic/Irrigation/Municipal	3.4
Urban Expansion	Domestic/Irrigation/Municipal	34.2
Resort	Irrigation/Municipal	43.4
Industrial	Industrial	0.6
Agriculture	Agriculture	7.1
University	Irrigation/Municipal	0.0
Rural	Irrigation/Municipal	0.0
DHHL	Irrigation/Municipal	0.0
TOTAL w/o Ag*		81.7
TOTAL w/ Ag*		88.7

* 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.

Table 807-12: County Zoning Full Build-Out Water Demand Projection – Northwest Mauna Loa Aquifer Sector Area

Zoning Class	CWRM Category	Water Demand (mgd)
Residential	Domestic/Irrigation/Municipal	7.3
Resort	Irrigation/Municipal	3.3
Commercial	Municipal	0.4
Industrial	Industrial	0.1
Agriculture	Agriculture	7.1
DHHL	Irrigation/Municipal	0.0
TOTAL w/o Ag*		11.0
TOTAL w/ Ag*		18.1

* 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.

807.4.2.1 Refine Land Use Based Projection

807.4.2.1.1 State Water Projects Plan

There is only one State Water Project within the Northwest Mauna Loa ASEA. The projected demand required by the Puako Boat Ramp in the year 2020 is 0.005 mgd of potable water.

807.4.2.1.2 State Department of Hawaiian Home Lands

There are no tracts of land owned by the DHHL within the Northwest Mauna Loa ASEA.

807.4.2.1.3 Agricultural Water Use and Development Plan

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

807.4.3 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 square foot of County Zoning) consumption is 2.5 units per lot based on historical consumption data.

807.4.4 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 Northwest Mauna Loa ASEA. The projected low, medium, and high growth rates are listed in **Table 807-13**, and are graphed in **Figure 807-8**. Potable and nonpotable water demands are also differentiated.

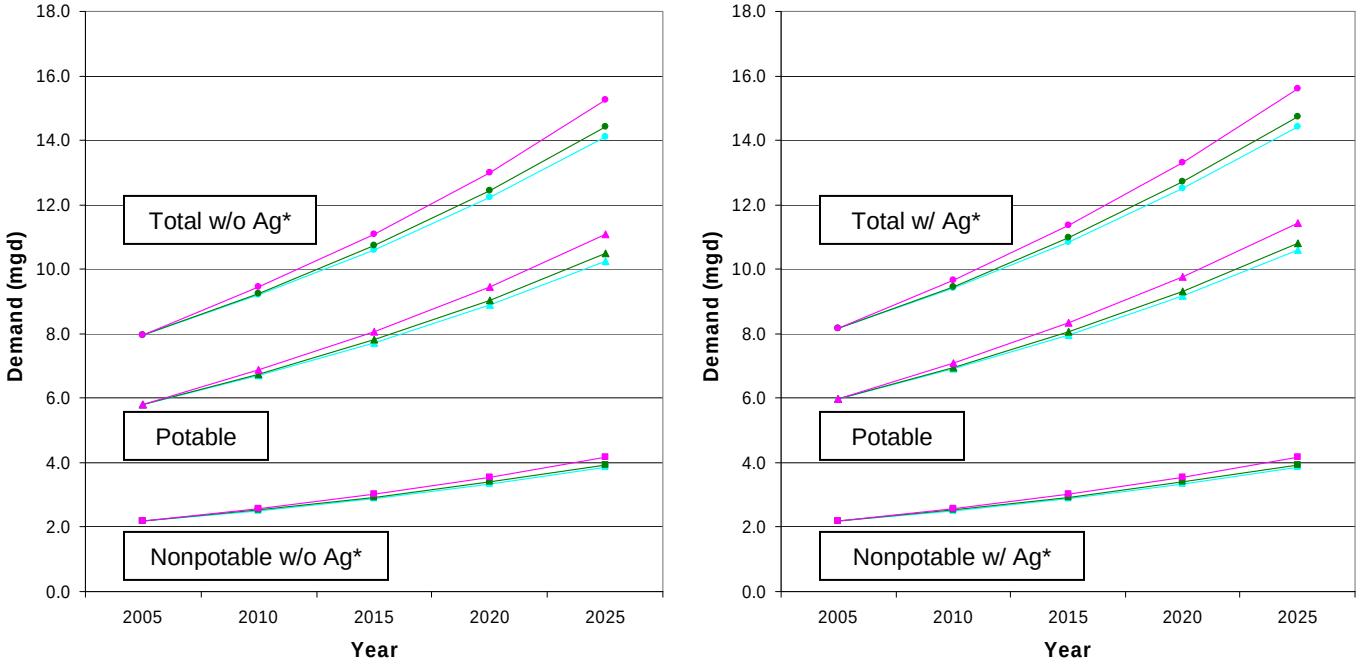
Figure 807-9 illustrates the magnitude of the sustainable yield, both LUPAG and Zoning full build-out water use, and water use projection through the year 2025 focusing on Medium Growth Rate B. **Figure 807-10** shows the breakdown of water demand projections by CWRM categories through the year 2025. **Table 807-14** summarizes these figures.

Table 807-13: Water Demand Projection – Northwest 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	8.0	9.2	10.6	12.2	14.1	8.2	9.4	10.8	12.5	14.4
Potable	2.2	2.5	2.9	3.3	3.8	2.2	2.5	2.9	3.3	3.8
Nonpotable	5.8	6.7	7.7	8.9	10.3	6.0	6.9	8.0	9.2	10.6
GROWTH RATE B	**2005**	**2010**	**2015**	**2020**	**2025**	**2005**	**2010**	**2015**	**2020**	**2025**
Total	8.0	9.3	10.7	12.4	14.4	8.2	9.5	11.0	12.7	14.7
Potable	2.2	2.5	2.9	3.4	3.9	2.2	2.5	2.9	3.4	3.9
Nonpotable	5.8	6.7	7.8	9.0	10.5	6.0	6.9	8.1	9.3	10.8
GROWTH RATE C	**2005**	**2010**	**2015**	**2020**	**2025**	**2005**	**2010**	**2015**	**2020**	**2025**
Total	8.0	9.4	11.1	13.0	15.2	8.2	9.7	11.4	13.3	15.6
Potable	2.2	2.6	3.0	3.5	4.2	2.2	2.6	3.0	3.5	4.2
Nonpotable	5.8	6.9	8.1	9.5	11.1	6.0	7.1	8.3	9.8	11.4

* 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.

Figure 807-8: Water Demand Projection Summary – Northwest Mauna Loa Aquifer Sector Area



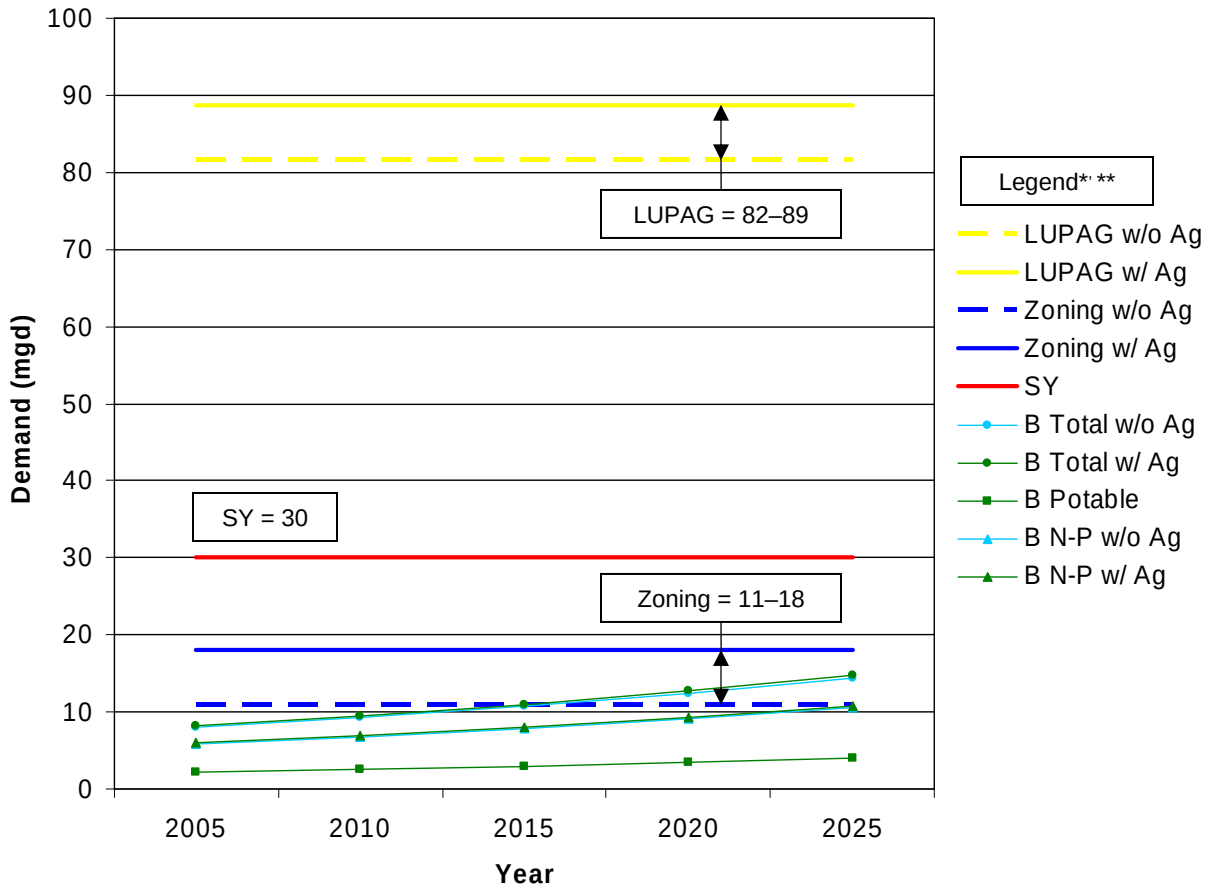
* Demand scenarios without and with agricultural demands represent the potential minimum and maximum agricultural demand, respectively, with the expectation that the actual demand will fall somewhere in between.

Table 807-14: Medium Growth Rate B Water Demand Projection by Category – Northwest Mauna Loa Aquifer Sector Area

Water Use Category	2005 (mgd)	2010 (mgd)	2015 (mgd)	2020 (mgd)	2025 (mgd)
Total without Ag*	8.0	9.3	10.7	12.4	14.4
Total with Ag*	8.2	9.5	11.0	12.7	14.7
Domestic	0.0	0.0	0.0	0.0	0.0
Industrial	0.0	0.0	0.0	0.0	0.0
Irrigation	5.8	6.7	7.8	9.0	10.5
Agriculture	0.2	0.2	0.2	0.3	0.3
Military	0.0	0.0	0.0	0.0	0.1
Municipal	2.1	2.5	2.9	3.3	3.9
Potable	2.2	2.5	2.9	3.4	3.9
Nonpotable w/o Ag*	5.8	6.7	7.8	9.0	10.5
Nonpotable w/ Ag*	6.0	6.9	8.1	9.3	10.8
DWS	2.1	2.5	2.9	3.3	3.9

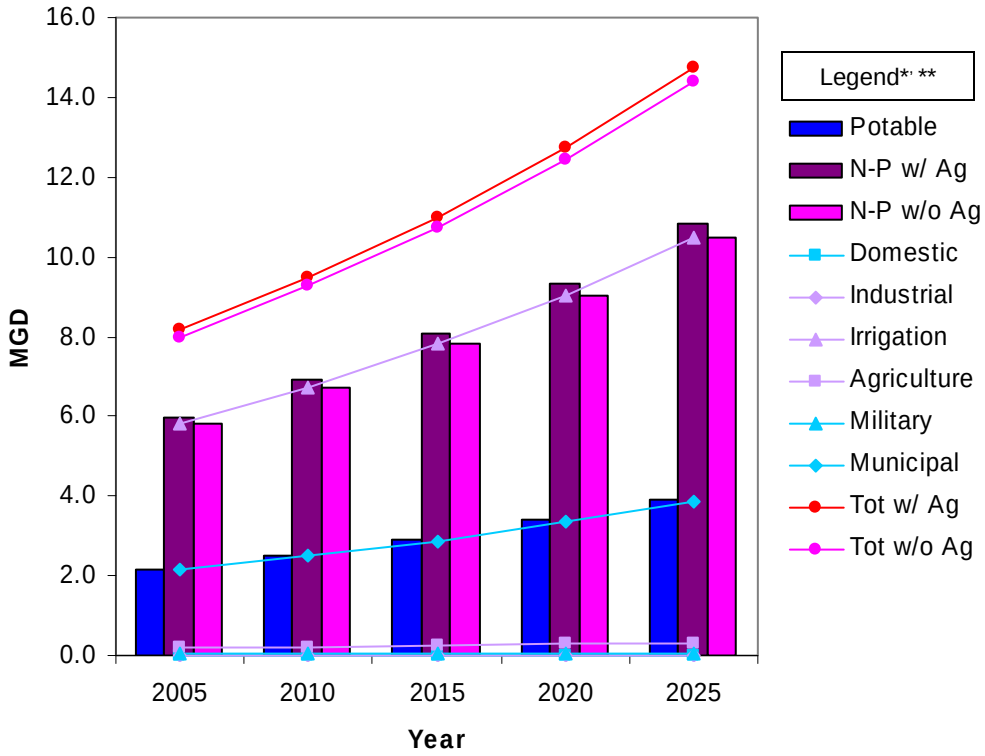
* Demand scenarios without and with agricultural demands represent the potential minimum and maximum agricultural demand, respectively, with the expectation that the actual demand will fall somewhere in between.

Figure 807-9: Medium Growth Rate B Water Demand Projections and Full Build-Out – Northwest 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 807-10: Medium Growth Rate B Water Demand Projection by Category – Northwest Mauna Loa Aquifer Sector Area

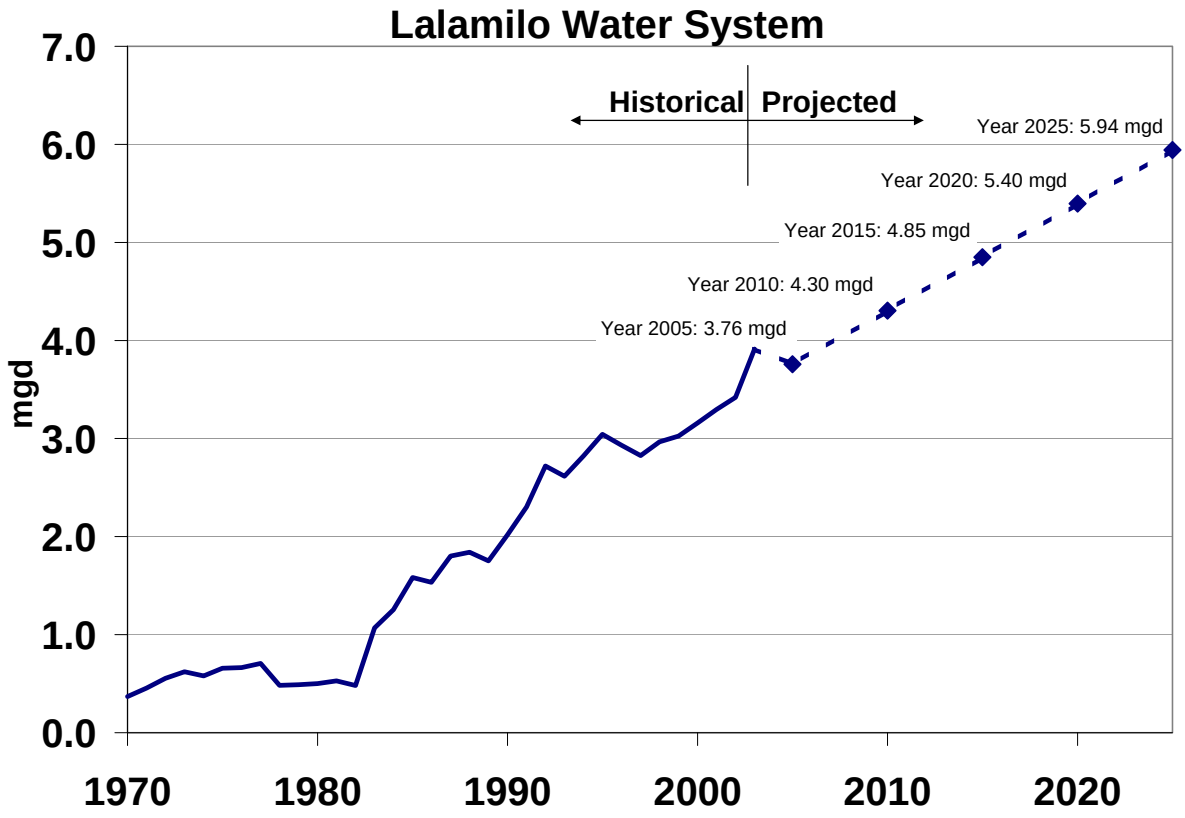


* Demand scenarios without and with agricultural demands represent the potential minimum and maximum agricultural demand, respectively, with the expectation that the actual demand will fall somewhere in between.
** "N-P" represents the nonpotable component of the demand.

807.4.5 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 807-11**.

Figure 807-11: DWS Water Demand Projection – Northwest 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 Lalamilo Water System spans the Northwest Mauna Loa and West Mauna Kea (803) ASEAs. The projected rate of growth of the future population is slightly higher than the rate of increase based on historical consumption.

807.5 RESOURCE AND FACILITY RECOMMENDATIONS

807.5.1 Water Source Adequacy

807.5.1.1 Full Build-Out

The full development to the maximum density of the County General Plan land use within the Northwest Mauna Loa ASEA cannot be sustained by water sources in the sector area if agricultural demands are not included. Full build-out water demands based on LUPAG are nearly three times the sustainable yield of sector area. The existing Zoning requires approximately one third of the existing sustainable yield. If worst case agricultural demands are included, the LUPAG demand is three times the SY, and the Zoning demand is 60 percent of the SY.

807.5.1.2 Twenty-Year Projection

Existing demands are less than 30 percent of the SY, and 20-year projected demands are close to 50 percent of the SY.

807.5.2 Source Development Requirements

807.5.2.1 Supply-Side Management

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

807.5.2.1.1 Conventional Water Resource Measures

807.5.2.1.1.1 Ground Water

According to the *1990 Water Resources Protection Plan*, the basal lens extends at least five miles inland, and approximately 10 miles from the coast high level water may occur at great depth. Due to the remoteness and high cost of developing the high level aquifer, exploitation of this resource to supply existing developed areas and adjacent expansion areas is not likely. High level water may be utilized should localized development occur in areas over the high-level aquifer.

The basal aquifer is thin in most accessible areas which would prevent development of potable water. However, additional brackish water may be developed to some extent as evidenced by the irrigation wells located along Queen Kaahumanu Highway. Care should be exercised to avoid overdrawing which may lead to intrusion of saltwater in the wells. Chloride levels should be continuously monitored.

807.5.2.1.1.2 Surface Water

There are no perennial streams nor are there any registered stream diversions in the Northwest Mauna Loa ASEA, therefore surface water is not a viable water resource enhancement measure.

807.5.2.1.1.3 Water Transfer

Currently, all potable water is obtained from the West Mauna Kea ASEA (803) by water transfer via the DWS Lalamilo Water System, which supplies the Mauna Lani Resort, and the private Waikoloa System, which supplies the Waikoloa Resort. An undetermined quantity of water is also transferred into ASEA 803 from the Kohala ASEA (801) through the Waimea SystemDue to the difficulty in developing potable sources in the Northwest Mauna Loa ASEA, additional water transfer from the ASEA 803 will continue ; however, the feasibility of developing additional sources in the ASEA 803 for transfer needs to be examined further.

807.5.2.1.2 Alternative Water Resource Enhancement Measures

807.5.2.1.2.1 Rainwater Catchment Systems

The Northwest Mauna Loa ASEA is the driest on the island. Most of the sector area receives between 10 and 30 inches of rainfall per year, which is not sufficient to support rainwater catchment systems. This is not considered a viable alternative.

807.5.2.1.2.2 Wastewater Reclamation

The two existing wastewater reclamation facilities currently reuse 0.75 mgd but are expandable to 2.05 mgd. Reuse of the up to 75% of the capacity of a WWRF is generally the maximum percentage achievable. The facilities use wastewater from the two major resort developments, Mauna Lani and Waikoloa, which together account for nearly all of the potable water used in the sector area. Increase in reclaimed wastewater production is therefore limited by the amount of water used by and hence growth of the two resorts. However, reclaimed wastewater is currently used for irrigation purposes within the resort complexes, and since increased irrigation uses are expected to follow additional development of the resorts, expansion of the existing facilities is a logical choice.

807.5.2.1.2.3 Desalination

Desalination of groundwater from brackish wells in the lower lying areas may be considered. The chloride content of the existing irrigation wells is generally less than 1,000 ppm, indicating that the brackish water from the aquifer is suitable for desalination. However, there are limits to the amount of water that can be drawn without degrading the water table. As in the West Mauna Kea ASEA (803), the service area would be limited to the coastal regions, such as in the vicinity of the Mauna Lani and the Waikoloa Resorts.

807.5.2.2 Demand-Side Management

807.5.2.2.1 Development Density Control

The water requirements of full-build out under maximum density LUPAG are over eight times greater than those of legally developable land under Zoning, largely due to the difference in areas of land classified as "Resort" and "Urban/Residential." Proposed land uses according to the General Plan should therefore be examined in greater detail. In particular, there is nearly 7,000 acres designated as "Urban Expansion." Control of the density of these future expansion areas could conserve a significant quantity of water.

807.5.2.2.2 Water Conservation

Water use unit rates for users on the DWS Water System in the sector area are the highest on the island. Accounts classified as "Residential" use an average of over 2,700 gpd per connection, and the average usage for all accounts is over 6,300 gpd per connection, although this average is likely greatly skewed by the large hotel and resort users. The per capita potable water consumption unit rate is not a reliable indicator of average water usage since nearly all of the potable water demand is from the transient population. Nonetheless, existing residential usage is over six times the island average. Both resort complexes include private villa and mansion style homes that possibly use potable water for landscaping.

Water purveyors could easier justify implementing conservation measures in the Northwest Mauna Loa ASEA than any other sector area, because it is the driest sector area on the island. Financial conservation measures, such as a rate structure incorporating higher unit costs for increased usage, may not be effective, because many of the end users are in a higher income bracket and are not likely to be deterred by cost. Water conservation measures such as water restrictions during drier and/or warmer periods, and implementation of requirements for more efficient irrigation practices would be most effective.

807.5.3 Recommended Alternatives

The lack of conventional water sources places the emphasis on water conservation. Average usage in the Northwest Mauna Loa ASEA is the highest on the island; the demand can be reduced considerably by lowering per unit usage rates closer to the island average.

Transfer of potable water from the West Mauna Kea ASEA (803) to the Northwest Mauna Loa ASEA must continue, and may be increased in the near term to supply the projected demands. However, existing sources in the ASEA 803 will not be adequate past 2010.

Brackish groundwater should be developed to satisfy nonpotable needs, but should be preceded by studies evaluating the potential of brackish water sources.

Wastewater reclamation should be emphasized due to the limited availability of groundwater and non-existence of surface water sources. It may be prudent for County Planning to consider linking additional development in the vicinity of the resort complexes that require irrigation to increase in wastewater reclamation capacity to ensure that nonpotable water demands are met by nonpotable sources. Because of the compactness of the two major resort developments, studies should be undertaken to investigate the possibility of combining reclaimed wastewater and

brackish groundwater sources into a nonpotable water system to satisfy the nonpotable needs. This, along with other alternatives consistent with the concept of using the highest quality water for the highest intended use, should be considered.

In light of the fact that the sustainable yield is not fully developable, and maximum density LUPAG full build-out demands cannot be sustained by existing sources, it is important that a long-range water plan for the Northwest Mauna Loa ASEA be developed, in which all of the recommended alternatives are evaluated.