# 802 EAST MAUNA KEA AQUIFER SECTOR AREA

## 802.1 SECTOR AREA PROFILE

### 802.1.1 General

The East Mauna Kea Aquifer Sector Area (ASEA) includes the Honokaa, [80201] Paauilo [80202], Hakalau [80203], and the Onomea [80204] Aquifer System Areas (ASYA), and spans three districts, capturing most of the northern section of the Hamakua district, and the northern sections of the North Hilo and South Hilo districts. The sector includes the northern and eastern slopes of Mauna Kea and most of the northeastern coast of the island from Waipio Bay to Hilo Bay.

Rainfall is extremely variable throughout the sector area. Rainfall in the coastal areas average less than 100 inches and up to 150 inches per year, which increases to 300 inches per year in a lateral band in the 2,000 to 4,000 foot elevation range 5 miles inland of Hilo. The summits of Mauna Kea experience less than 20 inches per year. The Hakalau ASYA has the highest sustainable yield of the four system areas at 150 mgd, followed by the Onomea ASYA at 147 mgd, the Paauilo ASYA at 60 mgd, and the Honokaa ASYA at 31 mgd. The total sustainable yield of the East Mauna Kea ASYA is 388 mgd.

### 802.1.2 Economy and Population

#### 802.1.2.1 Economy

Agriculture continues to be the primary source of income and employment within the sector area. The demise of the sugar industry has made lands available for various other crops, including macadamia nuts, eucalyptus trees, flowers, fruits and vegetables. Large tracts of land are also used for cattle grazing and logging of native and planted forests. A new 15,000-acre eucalyptus plantation has created 100 full-time jobs in the sector. State DLNR has partnered with Hawaii Forestry and Communities Initiative to cultivate 40 acres of State land in Ookala with high value hardwoods. The project will be managed by several local groups with assistance from State and Federal agencies.

Visitor accommodations are limited to scattered private bed-and-breakfast operations, with the exception of a 19-unit hotel in Honokaa.

The Hamakua Energy Partners' new 60-MW co-generation power plant in Haina is the largest generating facility on the island, and is anticipated to attract other manufacturing operations that use thermal energy.

### 802.1.2.2 Population

Over half of the population contributing to the demands from the East Mauna Kea ASEA is within the South Hilo District, and over one third is within the Hamakua District. Population centers are scattered and are generally tied to former plantation areas, and the marginal growth over the past 20 years can be attributed to the activities in other sector areas. Scattered homesteads and ranches are located at higher elevations.

**Table 802-1: Historical Population**

| 1980 | 1990 | 2000 | 1980-90 % Change | 1990-2000 % Change |
|---|---|---|---|---|
| 13,680 | 14,997 | 16,745 | 9.6 | 11.7 |

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

**Table 802-2: Population Projection**

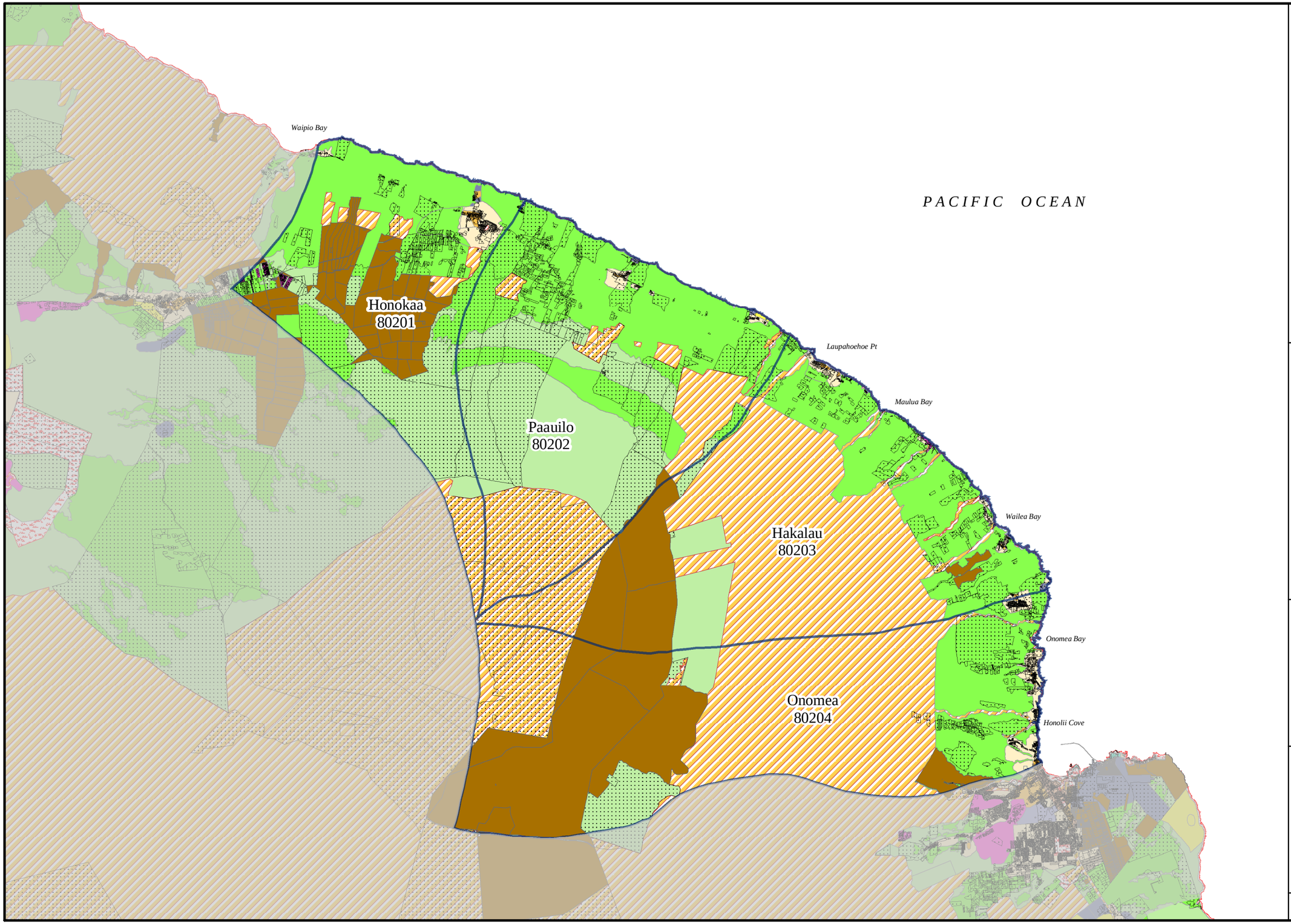
| Growth Rate | 2000 | 2005 | 2010 | 2015 | 2020 | 2000-10 % Change | 2010-20 % Change |
|---|---|---|---|---|---|---|---|
| A – Low | 16,745 | 16,920 | 17,814 | 18,745 | 19,779 | 6.4 | 11.0 |
| B – Medium | 16,745 | 16,974 | 17,971 | 19,022 | 20,175 | 7.3 | 12.3 |
| C – High | 16,745 | 17,682 | 19,098 | 20,515 | 21,991 | 14.1 | 15.1 |

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

### 802.1.3 Land Use

### 802.1.3.1 Hawaii County General Plan

The Hawaii County General Plan Land Use Pattern Allocation Guide Map for the East Mauna Kea ASEA is shown on **Figure 802-1**. The estimated land use allocation acreage for each LUPAG designation within the sector area is listed in **Table 802-3**.




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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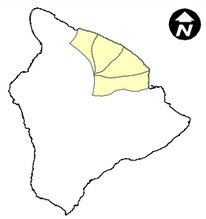
Miles



**INDEX MAP - Island of Hawaii**

## FIGURE 802-1

AQUIFER SECTOR
E. MAUA KEA - 802

Aquifer Systems

Honokaa - 80201
Paauilo - 80202
Hakalau - 80203
Onomea - 80204

**2005 Revised General Plan Land Use Pattern Allocation Guide**

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

Table 802-3: LUPAG Map Estimated Land Use Allocation Acreage East Mauna Kea Aquifer Sector Area

| LAND USE PATTERN | ACREAGE | % of TOTAL |
|---|---|---|
| High Density Urban | 0 | 0 |
| Medium Density Urban | 507 | 0.1 |
| Low Density Urban | 5,634 | 1.5 |
| Industrial | 241 | 0.1 |
| Important Agricultural Land | 121,310 | 31.4 |
| Extensive Agriculture | 103,668 | 26.8 |
| Orchard | 0 | 0 |
| Rural | 380 | 0.1 |
| Resort/Resort Node | 6 | 0.0 |
| Open | 1,738 | 0.5 |
| Conservation | 152,856 | 39.6 |
| Urban Expansion | 65 | 0.0 |
| University Use | 0 | 0 |
| TOTAL | 386,405 | 100.0 |

The water utility courses of action for Hamakua, and North Hilo, and South Hilo in the Hawaii County General Plan relevant to the East Mauna Kea ASEA are as follows:

- ***(a)*** *Continue to co-ordinate programs with State and Federal Agencies to develop a well at Kukuihaele and Honakaa Hospital to the standards of the DWS.*
- ***(b)*** *Investigate groundwater sources in the Honokaa and Kukuihaele areas.*
- ***(c)*** *Develop a stand-by well for the Ookala system.*
- ***(d)*** *Replace old, sub-standard, or deteriorating lines and storage facilities.*
- ***(e)*** *Investigate groundwater sources at Kaieie Mauka, Kulaimano, Saddle Road and Honomu areas.*
- ***(f)*** *Further investigate future ground water resources.*

### 802.1.3.2 Hawaii County Zoning

Hawaii County Zoning for the East Mauna Kea ASEA is shown on **Figure 802-2**. The estimated land use allocation acreage for each zoning class within the sector area is listed in **Table 802-4**.

**Table 802-4: County Zoning Estimated Class Allocation Acreage – East Mauna Kea Aquifer Sector Area**

| ZONING CLASS | ACREAGE | % of TOTAL |
|---|---|---|
| Single Family Residential | 1,926 | 0.5 |
| Multi-Family Residential (including duplex) | 41 | 0.0 |
| Residential-Commercial Mixed Use | 0 | 0 |
| Resort | 40 | 0.0 |
| Commercial | 71 | 0.0 |
| Industrial | 132 | 0.1 |
| Industrial-Commercial Mixed | 0 | 0 |
| Family Agriculture | 6 | 0.0 |
| Residential Agriculture | 92 | 0.0 |
| Agriculture | 239,937 | 62.1 |
| Open | 1,270 | 0.3 |
| Project District | 0 | 0 |
| Forest Reserve | 140,305 | 36.3 |
| (road) | 2,584 | 0.7 |
| TOTAL | 386,404 | 100.0 |

## 802.2 EXISTING WATER RESOURCES

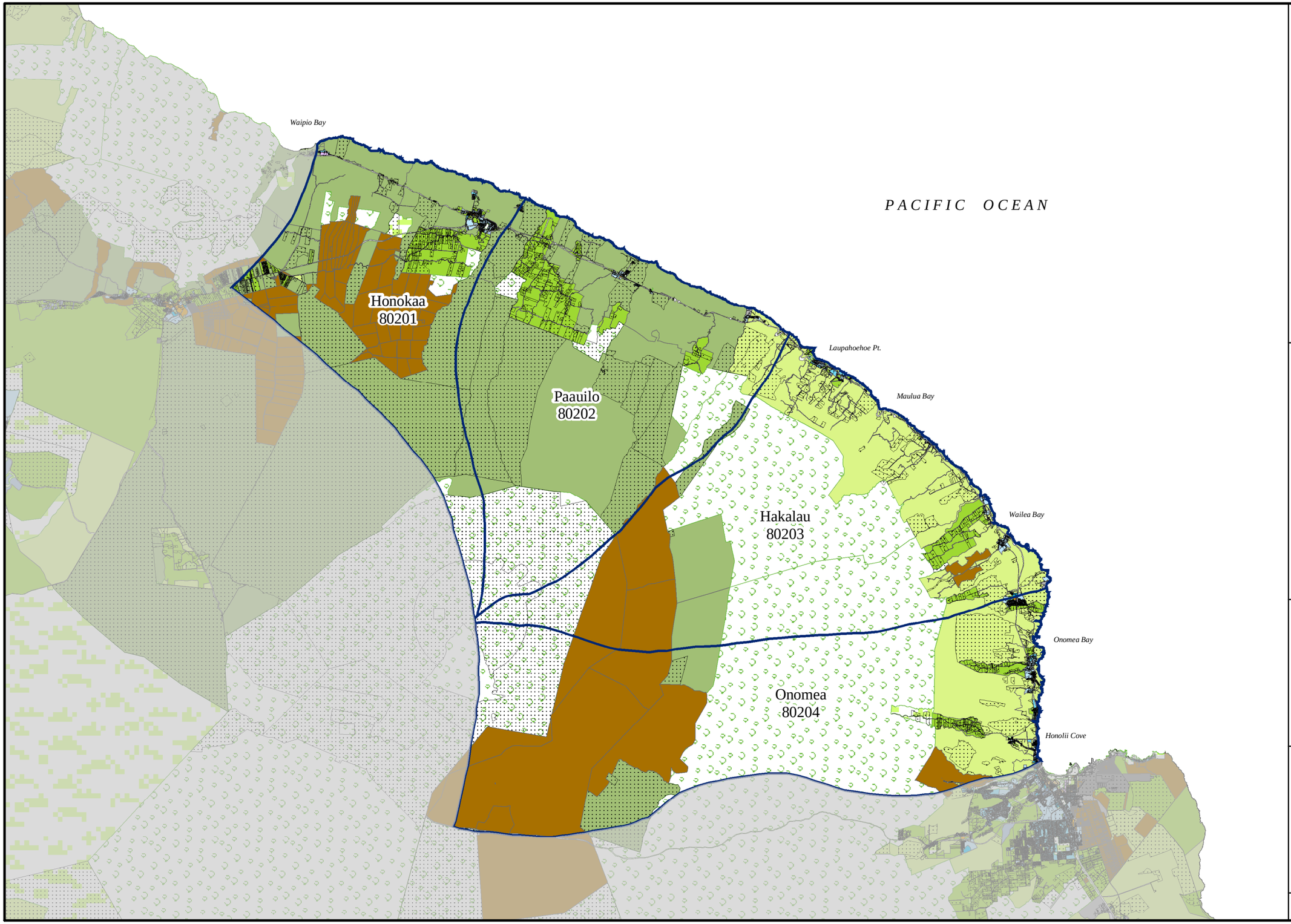
### 802.2.1 Ground Water

East Mauna Kea ASEA has a sustainable yield of 388 mgd. According to the CWRM database, there are 26 production wells in the sector, including 9 municipal, 5 domestic, 4 irrigation, 7 industrial, and 1 other. There are also 33 wells drilled and categorized as "unused". Refer to **Appendix B** for this database. **Figure 802-3** shows the well locations.

### 802.2.2 Surface Water

More perennial streams are located in the East Mauna Kea ASEA than on the rest of the island. Of the 85 perennial streams classified in the HSA, 60 are continuous, and the other 25 are intermittent. One gage operated by the USGS is located on the Honolii Stream near Papaikou. Records from the gage were listed previously in **Table 1-8**.

There are 62 declared stream diversions in CRWM database shown on **Figure 802-4**, which accounts for 30 percent of the 202 declared stream diversions on the island. The stream diversions with declared flows are listed in **Table 802-5**.




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 |

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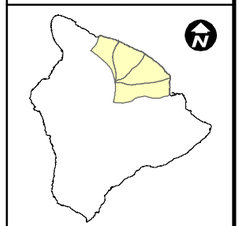
Miles



**INDEX MAP - Island of Hawaii**

## FIGURE 802-2

AQUIFER SECTOR
E. MAUNA KEA - 802

Aquifer Systems
Honokaa - 80201
Paauilo - 80202
Hakalau - 80203
Onomea - 80204

**County Zoning**

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

**Figure 802-3: Well and Tunnel Location**

**MAP CURRENTLY NOT AVAILABLE ON-LINE**

**Figure 802-4: Streams & Diversions**

**MAP CURRENTLY NOT AVAILABLE ON-LINE**

**Table 802-5: Stream Diversions – East Mauna Kea Aquifer Sector Area**

| FILE REFERENCE | TMK | STREAM NAME | |
|---|---|---|---|
| HAWAII DWS | 2-8-003:002 | Unnamed Spring | Spring diversion, pipe from Maukaloa (Makea). Declared Q = 0.190 MGD. |
| HAWAII DWS | 2-8-010:033 | Unnamed/ Unmapped Spring | Spring diversion, pipe from Akaka Falls Spring. Declared Q = 0.09 MGD. |
| | 2-8-011:005 | Honomu | Stream diversion, intake from Malamalama Iki Stream (new entry). SCAP-HA-317 After-the-Fact Permit approved for intake. Water used to wash down farm equipment. Maximum Q = 100 gpd. |
| | 3-1-003:002 | Peleau | Stream diversion, intake from Peleau. (new entry). SCAP-HA-314 After-the-Fact Permit approved for intake with maximum Q = 8 gpm. |
| HAWAII DWS | 3-2-002:041 | Unnamed/ Unmapped Spring | Spring diversion, 2 pumps from Chaves Spring. Declared Q = 0.02 MGD. |
| GILLMAR JNS | 3-3-001:005 | Nanue | Stream diversion, dam on Nanaue Stream. Declared Q of 1 cubic foot per second; estimated from flow rate. |
| HAWAII DWS | 3-5-004:035 | Unnamed/ Unmapped Spring | Spring diversion, pipe from Kihalani Spring. Declared Q = 0.01 MGD. |
| HAWAII DWS | 3-5-004:050 | Unnamed/ Unmapped Spring | Spring diversion, pipe from Manowaiopae Spring. Declared Q = 0.05 MGD. |
| | 3-6-006:018 | Manowaiopae | Stream diversion, upper dam and pipe on Manowaiopae Stream. Declared Q = 100 gpm; Verified Q = 48 gpm. SCAP-HA-195 for After-the-Fact permit approved for this diversion. |
| | 3-6-006:018 | Manowaiopae | Stream diversion, lower dam and pipe on Manowaiopae Stream (new entry). Declared Q = 100 gpm; Verified Q = 66 gpm. Application for After-the-Fact Permit was denied for this diversion in SCAP-HA-195. |
| HAWAII DWS | 2-7-005:030 | Unnamed/ Unmapped Spring | Spring diversion, pipe from Kaieie Spring. Declared Q = 0.030 MGD. |

### 802.2.3 Reclaimed Wastewater

There are no wastewater reclamation facilities within the sector area.

## 802.3 EXISTING WATER USE

### 802.3.1 General

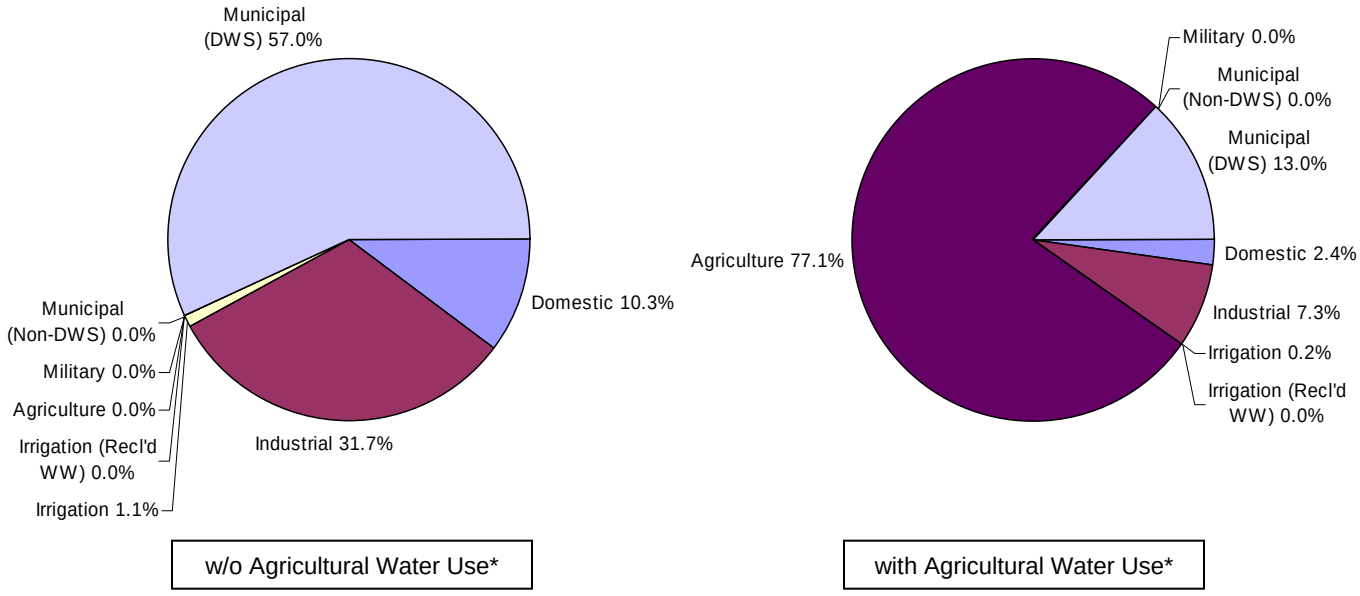
The total estimated average water use within the East Mauna Kea ASEA from November 2004 through October 2005 based on DWS meter data and CWRM pumpage data and available GIS data is listed in **Table 802-6** and summarized in **Figure 802-5,** in accordance with CWRM categories; and indicate the quantities 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 802-6: Existing Water Use by Categories – East Mauna Kea Aquifer Sector Area**

| CWRM Water Use Category | Water Use (MGD) | Percent of Total without Ag* | Percent of Total with Ag* |
|---|---|---|---|
| Domestic | 0.29 | 10.3 | 2.4 |
| Industrial | 0.90 | 31.7 | 7.3 |
| Irrigation | 0.03 | 1.1 | 0.2 |
| Reclaimed WW | 0.00 | 0.0 | 0.0 |
| Agriculture | 9.56 | 0.0 | 77.1 |
| Military | 0.00 | 0.0 | 0.0 |
| Municipal | | | |
| DWS System | 1.62 | 57.0 | 13.0 |
| Private Public WS | 0.00 | 0.0 | 0.0 |
| Total without Ag | 2.84 | 100.0 | |
| Total with Ag | 12.40 | | 100.0 |

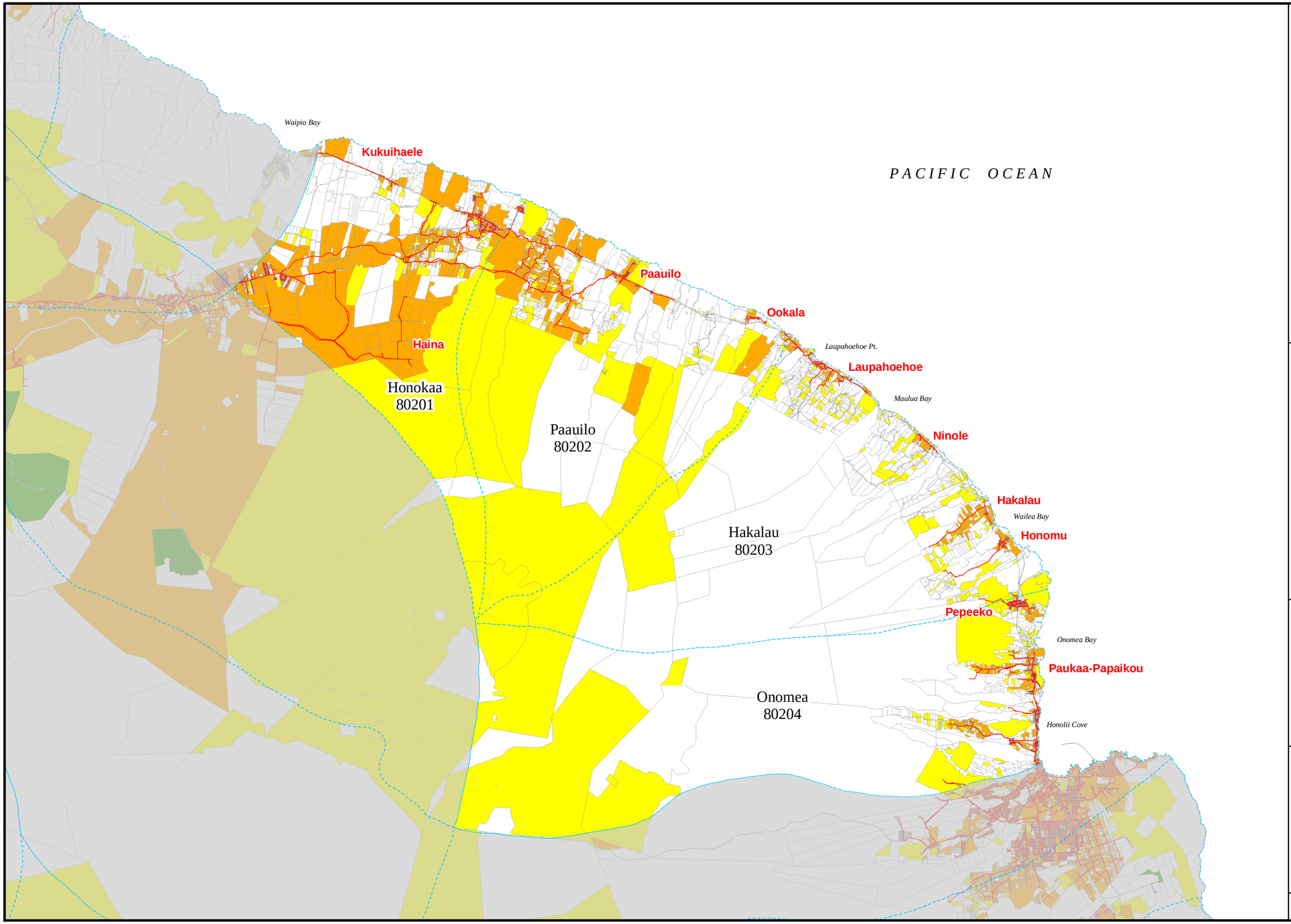
* Demand scenarios without and with agricultural demands represent the potential minimum and maximum agricultural demand, respectively, with the expectation that the actual demand will fall somewhere in between.

**Figure 802-5: Existing Water Use by Categories – East Mauna Kea 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 802-6** generally shows the service areas 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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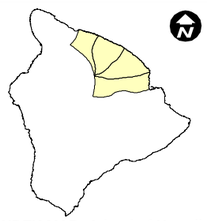
Miles



**INDEX MAP - Island of Hawaii**

## FIGURE 802-6

AQUIFER SECTOR
E. MAUNA KEA - 802

Aquifer Systems
Honokaa - 80201
Paauilo - 80202
Hakalau - 80203
Onomea - 80204

**Water System and Service Area**

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

### 802.3.2 Domestic Use

Domestic use or water use by individual households is assumed to be supplied by private individual rainwater catchment systems. Based on available GIS data, there are 730 such units or approximately 2,000 people, which is 12 percent of the sector's population. The estimated demand is 0.29 mgd. The 5 wells in the CWRM database classified as "Domestic" have not reported pumpage.

### 802.3.3 Industrial Use

Hamakua Energy owns two wells for use at the Haina power plant, with a reported pumpage of 0.9 mgd.

### 802.3.4 Irrigation Use

There are two golf courses within the East Mauna Kea ASEA. The Waimea Country Club is located west of Waimea Village along Mamahaloa Highway. One well classified as "Irrigation" located in the vicinity is owned by Otaka Inc. The reported pumpage is 0.03 mgd. It is not known if the Hamakua Country Club located outside of Honokaa uses irrigation. There is no reported irrigation usage dedicated to other landscaping activities.

### 802.3.5 Agricultural Use

The Lower Hamakua Ditch originally was built to service the Hamakua Sugar Company's plantation, but was taken over by the HDOA after the closure of the company in 1993. The system consists of five scattered reservoirs and 14 miles of ditch generally parallel to Hawaii Belt Road from the Kukuihaele Weir to the Paauilo Reservoir. According to the AWUDP, the plantation installed service laterals along the length of the ditch, most of which consist entirely of buried pipelines, and are in the process of being located by the HDOA. The system is not fully metered, although a USGS gage located 500 feet upstream of the Kukuihaele Weir recorded an average flow of 6.5 mgd in 2003. Since the closure of the sugar company, only limited farming has taken place along the ditch system.

### 802.3.6 Military Use

There is no military use in the East Mauna Kea ASEA.

### 802.3.7 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.

### 802.3.7.1 County Water Systems

The DWS has 10 systems in the East Mauna Kea ASEA.

The Haina Water System uses a combination of surface and groundwater sources for its supply. The surface water supply comes from the Waimea Water Treatment Plant via the Waimea Water System which crosses into Hamakua from South Kohala via two unmetered connections. Groundwater is supplied from the Haina Deep Well near Honokaa Town. The system is widespread, serving the towns of Honokaa and Haina and extending to the scattered mauka communities, which necessitates 24 storage tanks and 10 booster pump stations.

The Paauilo Water System is a small system serving two zones in the Paauilo area. A single well and two storage tanks serve the system; however, a one-way, normally closed connection is available to receive supply from the Haina Water System if necessary.

The Kukuihaele Water System serves the communities of Kukuihaele and Kapulena and relies on Kukuihaele (Waiulili) Spring for its supply. Two operational zones are served by two booster pump stations and two storage tanks.

The Ookala Water System is a small former plantation system that provides domestic water service to Ookala Village. The supply was once purchased from the Hamakua Sugar Co., but is now obtained from Ookala Well. Storage is achieved through a single concrete tank.

The Laupahoehoe Water System serves the Laupahoehoe community and surrounding areas, extending west to Waipunalei and east to Kapehu. Like many systems along the Hamakua Coast, supply was once obtained from high level springs, namely, the Manowaiopae Spring and the Kihalani Spring (Kuwaikahi Gulch). These springs were not dependable during dry weather periods; therefore, with the installation of two deep wells in Laupahoehoe, the spring sources were eventually phased out of service. A single booster pump station, three storage tanks and a series of pressure reducing valves (PRV) provide service to the six operational zones.

The Ninole Water System is a small system completed in 1977, some of whose services were formerly plantation housing. The system obtains its supply from Chaves Spring. One booster pump station pumps treated water from the spring to the distribution system and storage tank.

The Hakalau Water System serves a former plantation community with water from a combination of the Hakalau Well and the Hakalau Iki Spring. Storage is provided by two tanks in series downstream of the spring source.

The Honomu Water System has a relatively reliable supply from the Akaka Falls Spring. The system has one storage tank.

The Pepeeko Water System obtains its water from the Maukaloa Spring, which is a relatively reliable source, and the Kulaimano Deep Well to supplement the spring when needed. Two tanks provide storage for the system.

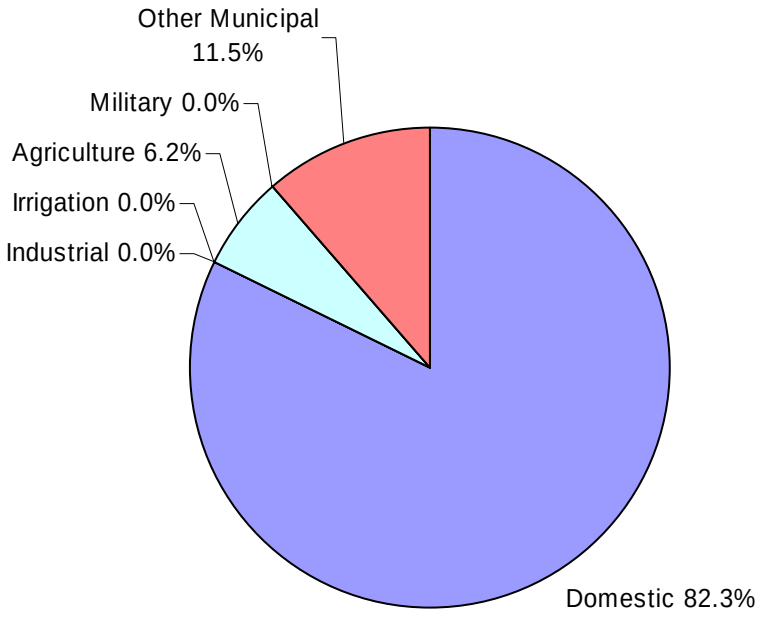
The Paukaa-Papaikou Water System serves the Papaikou and surrounding communities north to Kalaoa Camp and south to Paukaa. The system is supplied by two spring sources, the Kaieie Mauka (Papaikou) and Kaieie Medeiros Springs, and one well source. DWS is currently developing a well source to replace the unreliable Kaieie Mauka Spring, which often runs dry. Four storage tanks and two booster pump stations provide service to eight operational zones. There is also a 6-inch main connecting the Paukaa-Papaikou Water System to the adjacent Hilo Water System. A normally closed valve allows water to flow in both directions if needed.

DWS water use is subcategorized in **Table 802-7,** to the extent possible, based on available meter data, and is depicted in **Figure 802-7**. "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 802-7: DWS Existing Water Use by Categories – East Mauna Kea Aquifer Sector Area**

| CWRM Water Use Category | DWS Purveyed Water Use (MGD) | Percent of Total |
|---|---|---|
| Domestic | 1.33 | 82.3 |
| Industrial | 0.00 | 0.0 |
| Irrigation | 0.00 | 0.0 |
| Agriculture | 0.10 | 6.2 |
| Military | 0.00 | 0.0 |
| Other Municipal | 0.19 | 11.5 |
| Total | 1.62 | 100.0 |

**Figure 802-7: DWS Existing Water Use by Categories – East Mauna Kea Aquifer Sector Area**




### 802.3.7.2 State Water Systems

There are no State water systems in the East Mauna Kea ASEA regulated by the DOH.

### 802.3.7.3 Federal Water Systems

There are no Federal water systems in the East Mauna Kea ASEA regulated by the DOH.

### 802.3.7.4 Private Public Water Systems

There are no private public water systems within the East Mauna Kea ASEA regulated by the Department of Health.

## 802.3.8 Water Use by Resource

### 802.3.8.1 Ground Water

**Table 802-8** 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 802-8: Sustainable Yield – East Mauna Kea 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 (%) |
|---|---|---|---|---|---|---|---|---|
| | | **2.06** | **23.86** | **35.79** | **388** | **0.53** | **6.15** | **9.22** |
| 80201 | Honokaa | 1.41 | 2.31 | 3.46 | 31 | 4.55 | 7.44 | 11.16 |
| 80202 | Paauilo | 0.14 | 4.51 | 6.77 | 60 | 0.23 | 7.52 | 11.28 |
| 80203 | Hakalau | 0.13 | 16.17 | 24.25 | 150 | 0.09 | 10.78 | 16.17 |
| 80204 | Onomea | 0.38 | 0.87 | 1.31 | 147 | 0.26 | 0.59 | 0.89 |

Seven spring sources are utilized in six of DWS's water systems in the East Mauna Kea ASEA. Two additional spring sources currently are not in use. Spring sources are not included in the CWRM well database; therefore, are not reflected in **Table 802-8**. **Table 802-9** lists the quantity of water obtained from each source between November 2004 and October 2005, and the estimated capacities according to the *2006 DWS 20-Year Water Master Plan*.

**Table 802-9: Spring Sources – East Mauna Kea Aquifer Sector Area**

| Source Name | DWS Water System | Estimated Capacity (mgd) | Water Use (mgd) |
|---|---|---|---|
| Kukuihaele Spring | Kukuihaele | 0.144 | 0.03 |
| Chaves Spring | Ninole | 0.06 | 0.02 |
| Hakalau Iki Spring | Hakalau | 0.046 | 0.08 |
| Akaka Falls Spring | Honomu | 0.14 | 0.05 |
| Maukaloa Spring | Pepeeko | 0.4 | 0.00 |
| Kaieie Mauka (Papaikou) Spring | Paukaa-Papaikou | 0.03 | 0.01 |
| Kaieie Medeiros Spring | Paukaa-Papaikou | 0.02 | 0.06 |
| Kihalani Spring | Laupahoehoe | 0.1 | N/A |
| Manowaiopae | Laupahoehoe | 0.02 | N/A |

### 802.3.8.2 Surface Water

Surface water consumption within the sector area includes agricultural users of the Lower Hamakua Ditch. Actual consumption is not readily available.

### 802.3.8.3 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 802-6** is assumed to be supplied by individual catchment systems. As stated earlier, there is no reported pumpage for domestic wells.

### 802.3.8.4 Reclaimed Wastewater

There are no wastewater reclamation facilities in the East Mauna Kea ASEA.

## 802.4 FUTURE WATER NEEDS

### 802.4.1 General

**Table 802-10** 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 802-10: 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 E. Mauna Kea ASEA | 388 | 25.4 | 8.2 | 2.8 | 3.0 | 3.3 | 3.5 | 3.8 |
| 80201 – Honokaa ASYA | 31 | 9.5 | 2.1 | 1.6 | 1.8 | 2.0 | 2.2 | 2.4 |
| 80202 – Paauilo ASYA | 60 | 2.5 | 0.5 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 |
| 80203 – Hakalau ASYA | 150 | 5.2 | 2.5 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| 80204 – Onomea ASYA | 147 | 8.3 | 3.0 | 0.6 | 0.6 | 0.6 | 0.6 | 0.7 |
| **With Agricultural Demand*** | **SY (mgd)** | **LUPAG (mgd)** | **Zoning (mgd)** | **Growth Rate B Demand Projections (mgd)** | | | | |
| | | | | **2005** | **2010** | **2015** | **2020** | **2025** |
| Total E. Mauna Kea ASEA | 388 | 405.5 | 378.1 | 12.4 | 13.2 | 14.0 | 14.8 | 15.8 |
| 80201 – Honokaa ASYA | 31 | 105.2 | 92.6 | 4.0 | 4.4 | 4.9 | 5.3 | 5.9 |
| 80202 – Paauilo ASYA | 60 | 135.6 | 131.8 | 3.7 | 3.9 | 4.1 | 4.4 | 4.6 |
| 80203 – Hakalau ASYA | 150 | 98.0 | 93.1 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 |
| 80204 – Onomea ASYA | 147 | 66.6 | 60.7 | 2.1 | 2.1 | 2.2 | 2.2 | 2.3 |

* 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 projection excluding agricultural demand is less than one-tenth 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.

### 802.4.2 Full Build-Out Water Demand Projections

The full build-out water demand projections based on the General Plan and County Zoning for the East Mauna Kea ASEA are listed in **Tables 802-11** and **802-12**, and reflect refinement as discussed below. Each land use class is associated with the most appropriate CWRM water use category.

**Table 802-11 Hawaii County General Plan Full Build-Out Water Demand Projection – East Mauna Kea Aquifer Sector Area**

| LUPAG Class | CWRM Category | Water Demand (mgd) |
|---|---|---|
| Urban | Domestic/Irrigation/Municipal | 20.6 |
| Urban Expansion | Domestic/Irrigation/Municipal | 0.2 |
| Resort | Irrigation/Municipal | 0.1 |
| Industrial | Industrial | 1.0 |
| Agriculture | Agriculture | 380.1 |
| University | Irrigation/Municipal | 0.0 |
| Rural | Irrigation/Municipal | 0.2 |
| DHHL | Irrigation/Municipal | 3.4 |
| TOTAL w/o Ag* | | 25.4 |
| TOTAL w/ Ag* | | 405.5 |

* 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 802-12: Zoning Full Build-Out Water Demand Projection – East Mauna Kea Aquifer Sector Area**

| Zoning Class | CWRM Category | Water Demand (mgd) |
|---|---|---|
| Residential | Domestic/Irrigation/Municipal | 3.9 |
| Resort | Irrigation/Municipal | 0.2 |
| Commercial | Municipal | 0.2 |
| Industrial | Industrial | 0.5 |
| Agriculture | Agriculture | 370.0 |
| DHHL | Irrigation/Municipal | 3.4 |
| TOTAL w/o Ag* | | 8.2 |
| TOTAL w/ Ag* | | 378.1 |

* 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.

#### 802.4.2.1 Refine Land Use Based Projection

##### 802.4.2.1.1 State Water Projects Plan

The total projected demand to the year 2020 for 11 State Water Projects within the East Mauna Kea ASEA is 0.02 mgd, all requiring potable sources. The project requiring the largest portion of the total demand is the Honokaa Elementary New 4 Classroom project, by the Department of Education, at 0.0072 mgd.

#### 802.4.2.1.2 State Department of Hawaiian Home Lands

Seven tracts of land are controlled by the DHHL within the East Mauna Kea ASEA, the most on the island.

The Kamoku-Kapulena tract is a u-shaped 3,529-acre tract located northeast of Waimea Village cut by Hawaii Belt and Mamalahoa Highways. The Waikoloa-Waialeale tract lies within the u-part of the Kamoku-Kapulena tract and is 1,206 acres in area. The Nienie tract is further east of the Kamoku-Kapulena tract mauka of Mamalahoa Highway and is 7,135 acres in area. Average rainfall values range between 30 and 75 inches per year. Currently, DHHL has not proposed water demand for the three tracts.

The Honokaia tract lies in on the west side of the Nienie tract. Ground elevations vary between 2,220 feet at the makai end to 3,440 feet at the mauka end. The 3,243 acres of land are proposed primarily for agricultural use, but also for residential and commercial use. Water demand is estimated to be 1.16 mgd.

The Lower Piiohuna tract is bordered by forest reserve northwest of Hilo. The 1,842 acres were formerly used for sugar cane, but are currently uncultivated. Numerous streams traverse the tract, and there is plenty of rainfall, averaging between 170 and 250 inches per year. Potential water supplies are the DWS Hilo Water System, and Wailuku River or other streams and springs for irrigation water. The proposed land uses of the tract are agricultural and residential with an estimated demand of 0.89 mgd.

The Honomu and Kuhua tracts combined are 766 acres of former sugar cane land located above Honomu Village on the coast above Hilo. Average annual rainfall ranges between 150 and 250 inches. The tracts may be serviced by the DWS Honomu Water System; however, the estimated demand of 1.14 mgd far exceeds the capacity of the water system. There are several spring sources in the vicinity; however, their potential as sources of irrigation water has not yet been determined.

The Humuula tract is a 49,100-acre tract of land along the eastern slope of Mauna Kea. Average rainfall varies with elevation in the tract, ranging from 40 inches along the upper boundary to 112 inches along the lower boundary. The Upper Piiohuna tract is a 7,078-acre tract on the east side of the Humuula tract. Because there is no potable water system or perennial stream in feasible proximity, the *DHHL Special Report #2* has recommended that individual roof catchment and storage systems be installed for each unit as developed. The proposed demand is 0.16 mgd.

#### 802.4.2.1.3 Agricultural Water Use and Development Plan

The AWUDP estimates the potential service area of the Lower Hamakua Ditch System to be 4,765 acres, with a 20-year service area of between 1,070 and 6,240 acres. The AWUDP estimates that the average agricultural irrigation water unit rate is 3,400 gallons per acre per day, which translates to a 20-year water requirement of between 3.64 and 21.22 mgd. Because of the uncertainty of the projected service area, the associated water demands were not used to refine the full build-out projections.

### 802.4.3 Water Use Unit Rates

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

### 802.4.4 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 East Mauna Kea ASEA. The projected low, medium, and high growth rates are listed in **Table 802-13**, and are graphed in **Figure 802-8**. Potable and nonpotable water demands are also differentiated.

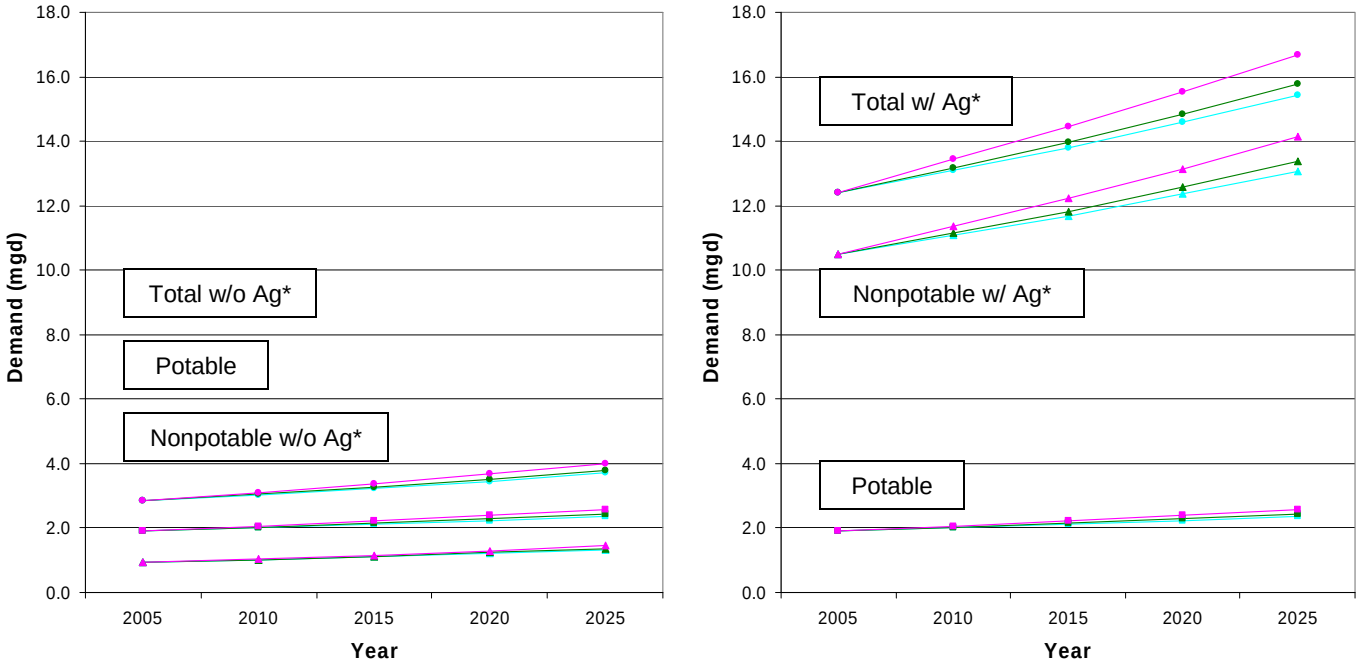
**Figure 802-9** illustrates the magnitude of the sustainable yield, both LUPAG and Zoning full build-out water use, and water use projection through the year 2025 focusing on Medium Growth Rate B. **Figure 802-10** shows the breakdown of water demand projections by CWRM categories through the year 2025. **Table 802-14** summarizes these figures.

**Table 802-13: Water Demand Projection – East Mauna Kea 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 | 2.8 | 3.0 | 3.2 | 3.5 | 3.7 | 12.4 | 13.1 | 13.8 | 14.6 | 15.4 |
| Potable | 1.9 | 2.0 | 2.1 | 2.2 | 2.4 | 1.9 | 2.0 | 2.1 | 2.2 | 2.4 |
| Nonpotable | 0.9 | 1.0 | 1.1 | 1.2 | 1.3 | 10.5 | 11.1 | 11.7 | 12.4 | 13.1 |
| **GROWTH RATE B** | **2005** | **2010** | **2015** | **2020** | **2025** | **2005** | **2010** | **2015** | **2020** | **2025** |
| Total | 2.8 | 3.0 | 3.3 | 3.5 | 3.8 | 12.4 | 13.2 | 14.0 | 14.8 | 15.8 |
| Potable | 1.9 | 2.0 | 2.1 | 2.3 | 2.4 | 1.9 | 2.0 | 2.1 | 2.3 | 2.4 |
| Nonpotable | 0.9 | 1.0 | 1.1 | 1.2 | 1.4 | 10.5 | 11.1 | 11.8 | 12.6 | 13.4 |
| **GROWTH RATE C** | **2005** | **2010** | **2015** | **2020** | **2025** | **2005** | **2010** | **2015** | **2020** | **2025** |
| Total | 2.8 | 3.1 | 3.4 | 3.7 | 4.0 | 12.4 | 13.4 | 14.5 | 15.5 | 16.7 |
| Potable | 1.9 | 2.1 | 2.2 | 2.4 | 2.6 | 1.9 | 2.1 | 2.2 | 2.4 | 2.6 |
| Nonpotable | 0.9 | 1.0 | 1.2 | 1.3 | 1.4 | 10.5 | 11.4 | 12.2 | 13.1 | 14.1 |

* 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 802-8: Water Demand Projection Summary – East Mauna Kea Aquifer Sector Area



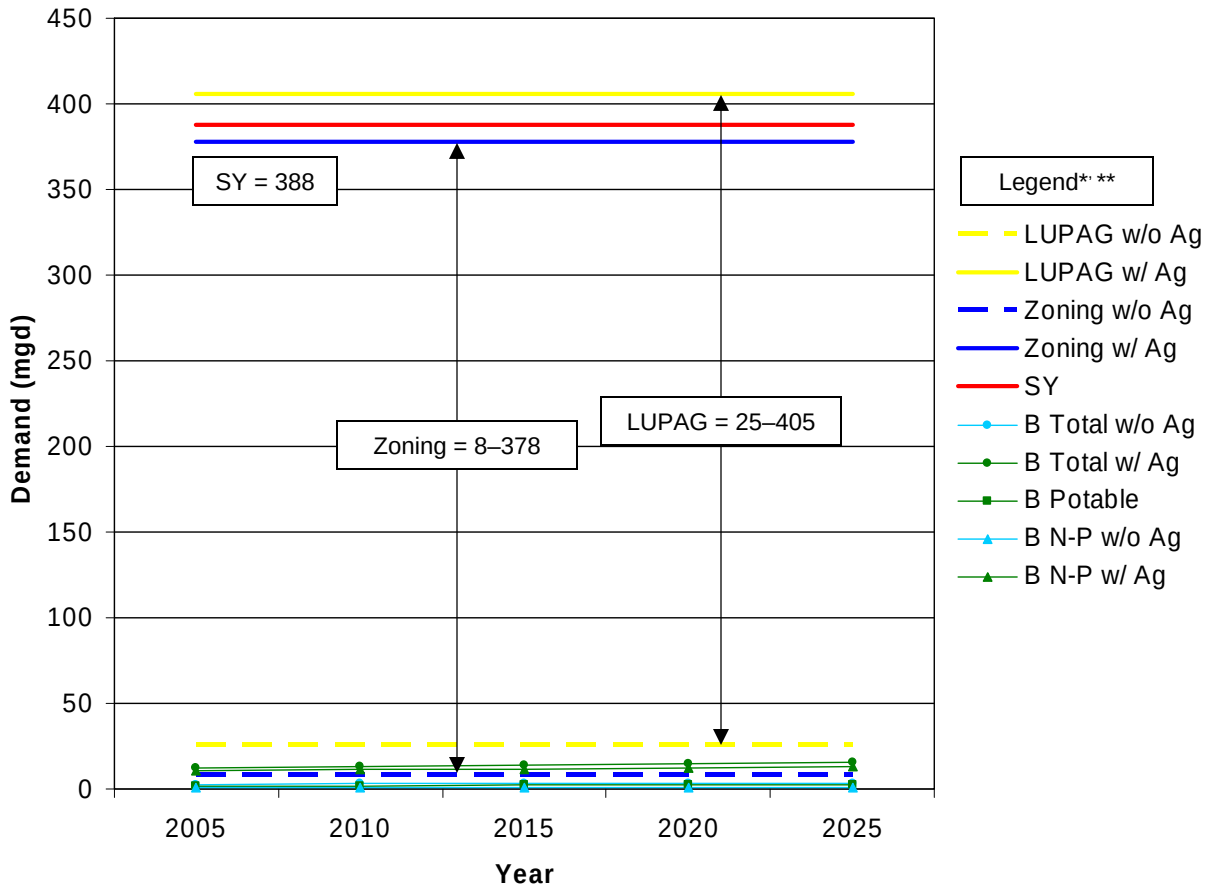

* Demand scenarios without and with agricultural demands represent the potential minimum and maximum agricultural demand, respectively, with the expectation that the actual demand will fall somewhere in between.

## Table 802-14: Medium Growth Rate B Water Demand Projection by Category – East Mauna Kea Aquifer Sector Area

| Water Use Category | 2005 (mgd) | 2010 (mgd) | 2015 (mgd) | 2020 (mgd) | 2025 (mgd) |
|---|---|---|---|---|---|
| Total without Ag* | 2.8 | 3.0 | 3.3 | 3.5 | 3.8 |
| Total with Ag* | 12.4 | 13.2 | 14.0 | 14.8 | 15.8 |
| Domestic | 0.3 | 0.3 | 0.3 | 0.3 | 0.4 |
| Industrial | 0.9 | 1.0 | 1.1 | 1.2 | 1.3 |
| Irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Agriculture | 9.6 | 10.1 | 10.7 | 11.3 | 12.0 |
| Military | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Municipal | 1.6 | 1.7 | 1.8 | 1.9 | 2.1 |
| Potable | 1.9 | 2.0 | 2.1 | 2.3 | 2.4 |
| Nonpotable w/o Ag* | 0.9 | 1.0 | 1.1 | 1.2 | 1.4 |
| Nonpotable w/ Ag* | 10.5 | 11.1 | 11.8 | 12.6 | 13.4 |
| DWS | 1.6 | 1.7 | 1.8 | 1.9 | 2.1 |

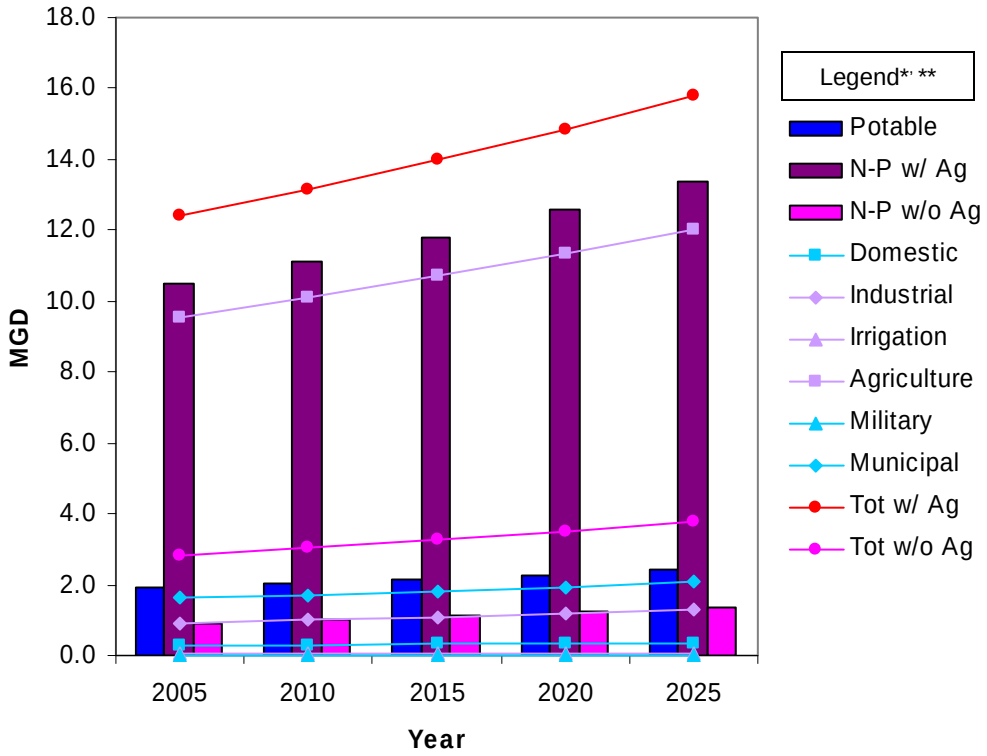
* Demand scenarios without and with agricultural demands represent the potential minimum and maximum agricultural demand, respectively, with the expectation that the actual demand will fall somewhere in between.

**Figure 802-9: Medium Growth Rate B Water Demand Projections and Full Build-Out – East Mauna Kea 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 802-10: Medium Growth Rate B Water Demand Projection by Category – East Mauna Kea Aquifer Sector Area**

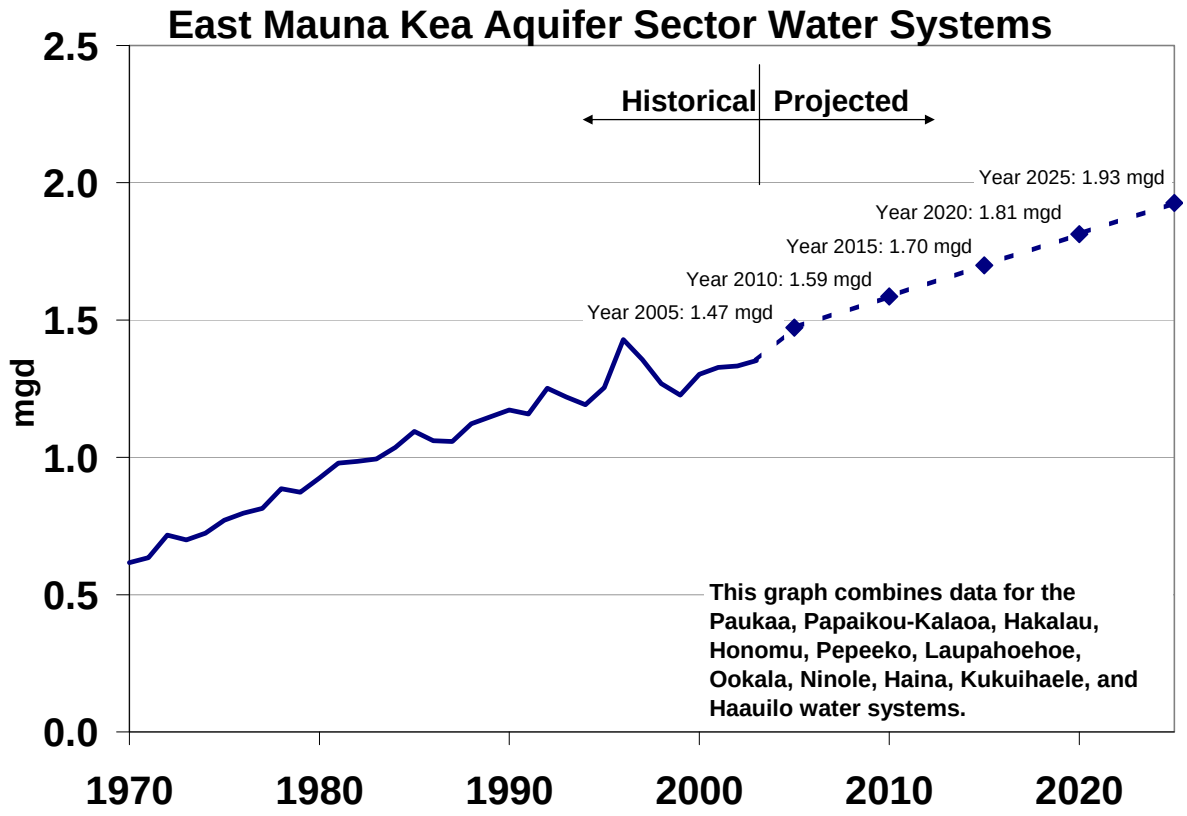



* Demand scenarios without and with agricultural demands represent the potential minimum and maximum agricultural demand, respectively, with the expectation that the actual demand will fall somewhere in between.
** "N-P" represents the nonpotable component of the demand.

### 802.4.5 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 802-11**.

**Figure 802-11: DWS Water Demand Projection – East Mauna Kea Aquifer Sector Area**




*Historical data provided by RW Beck, Inc.*

Projections based on historical DWS water consumption data are slightly lower than projections based on population growth rate. Part of the Waimea System is within the East Mauna Kea ASEA, which is not represented on the graph.

## 802.5 RESOURCE AND FACILITY RECOMMENDATIONS

### 802.5.1 Water Source Adequacy

#### 802.5.1.1 Full Build-Out

Full build-out water demands associated with the maximum density of LUPAG and Zoning land uses are both sustainable if agricultural demands are not included. The LUPAG full build-out requires approximately 6 percent sustainable yield of the East Mauna Kea ASEA. The existing zoning is legally developable, and requires approximately 2 percent of the existing sustainable yield. If worst case agricultural demands are included, the LUPAG demand exceeds the SY, and the Zoning demand is 97 percent of the SY.

#### 802.5.1.2 Twenty-Year Projection

Present and 20-year projected water demands are miniscule compared to the SY, even including worst case agricultural demands.

### 802.5.2 Source Development Requirements

#### 802.5.2.1 Supply-Side Management

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

#### 802.5.2.1.1 Conventional Water Resource Measures

##### 802.5.2.1.1.1 Ground Water

The East Mauna Kea ASEA has the third highest sustainable yield of the sectors on the island. High level dike water exists in the rift zone section of Mauna Kea, and perched water is common in the Laupahoehoe series (Refer to **Figure 1.4**). However, these locations are difficult to access and at great distances from end users. Basal water is generally found up to 5 miles inland. Existing potable water wells in the sector are in the vicinity of Hawaii Belt Road up to a few miles from the coast. The 1990 WRPP indicates that a good deal of basal water is developable, and specifically in the Paauilo Aquifer System Area the 60 mgd sustainable yield refers to potable basal groundwater. DWS has several wells planned, including two new sources at Ahualoa and Paauhau in the Haina Water System, one new source in the Ninole Water System, one new source and one backup well in the Honomu-Hakalau Water System, one new source in the Pepeeko Water System, one new source at Kaieie Mauka in the Papaikou Water System, and a backup source well in each of the Paauilo and Ookala Water Systems.

Spring water is a plentiful resource in the sector area. Due to costs associated with infrastructure improvements, treatment and monitoring, which is required to meet the rules and regulations of

the Federal Safe Drinking Water Act (SDWA), the usage of these sources has been reduced. Implementing new sources may still be more expensive than developing basal groundwater wells. However, spring sources are available to develop as a secondary potable water resource.

Spring sources that are owned by DWS but currently not in use due to the development of groundwater sources may also be considered for non-potable use.

#### 802.5.2.1.1.2 Surface Water

Most of the surface water used for non-potable requirements originates in the Kohala ASEA (ASEA 801) and is transferred through the Upper and Lower Hamakua Ditch Systems. Surface water can and should be used for localized non-potable uses. The number of stream diversions registered with the CWRM indicates that this is already taking place.

#### 802.5.2.1.1.3 Water Transfer

As mentioned in the previous section, transfer of non-potable source water into the East Mauna Kea ASEA from ASEA 801 is already taking place. This is not viewed as a problem considering the abundance of surface water in the ASEA 801.

Currently, an undetermined quantity of potable water is being transferred into the DWS Haina System from the DWS Waimea Water System, the sources of which are streams and one high-level groundwater well in the ASEA 801. Transfer of potable water into the East Mauna Kea ASEA may continue due to the abundance of potable sources in both sector areas.

### 802.5.2.1.2 Alternative Water Resource Enhancement Measures

#### 802.5.2.1.2.1 Rainwater Catchment Systems

Most of the developed area within the sector area receives over 60 inches of rainfall per year, which should be adequate to support rainwater catchment systems. This is confirmed by the quantity of domestic usage, which currently is 15 percent of all potable water used in the sector area. Population densities in remote areas where catchment is typically used are not expected to grow significantly and may continue to be served by catchment.

#### 802.5.2.1.2.2 Wastewater Reclamation

Except for the Haina Water System, most of the public water systems service small populations; therefore, the amount of reclaimed wastewater generated at each treatment plant would be minimal. Due to the abundance of other non-potable water from other sources, reclaimed wastewater is not viewed with large scale development potential.

#### 802.5.2.1.2.3 Desalination

Desalination plants would be restricted to coastal areas where brackish groundwater can be drawn. As potable water is readily available in these areas, desalination is not considered a feasible alternative due to the high cost.

### 802.5.2.2 Demand-Side Management

#### 802.5.2.2.1 Development Density Control

Full build-out water demand associated with LUPAG is three times that of Zoning; however, most of the LUPAG Urban area is already classified as "Low Density". Furthermore, water demands are miniscule compared to the sustainable yield even with full build-out to maximum density. Development density control is possible, but not considered necessary in the near future.

#### 802.5.2.2.2 Water Conservation

The average usage per connection on the DWS water systems is less than 300 gpd per connection, which is less than the island average. Potable water consumption from all sources per capita is estimated at 110 gpd, which is considered acceptable. Water usage rates should be monitored, and water conservation should continue; but currently, additional water conservation measures are not necessary.

### 802.5.3 Recommended Alternatives

Basal groundwater source development should continue; and consistent with the General Plan, sources should be investigated in the Kukuihaele, Honakaa, Kaieie Mauka, Kulaimano, and Honomu areas with the intention of replacing existing surface water sources. Specifically, additional groundwater sources should be developed for the Haina Water System so that potable water transfer from the Waimea Water System is not necessary, as sources in the ASEA 801 supplying the Waimea Water System should be conserved for transfer to the aquifer sector areas on the leeward coast that could experience deficiencies in water supply in the future. In the interim, a meter should be installed at the junctions of the Waimea and Haina Water Systems in order to monitor the quantity of water being transferred. Usage of the existing spring sources for potable use may continue, provided that necessary infrastructure improvements and treatment and monitoring required to comply with Federal SDWA regulations are not cost-prohibitive.

Surface water should continue to be the primary source of non-potable water.

The AWUDP has recommended significant improvements to the Lower Hamakua Ditch system which will properly service future diversified agricultural activities. These recommendations may change in light of the damage sustained by the ditch systems during the recent earthquake.