ES EXECUTIVE SUMMARY

ES.1 INTRODUCTION

In 1987, the State Legislature passed the State Water Code (Hawaii Revised Statutes, Chapter 174C) to protect Hawaii's surface and ground water resources, which called for the establishment of a Commission on Water Resource Management (CWRM) and the formulation of a *Hawaii Water Plan* that would serve as a dynamic, long-range planning guide for the Commission. The *Hawaii Water Plan* consists of five parts: (1) the *Water Resource Protection Plan*, (2) the *Water Quality Plan*, (3) the *State Water Projects Plan*, (4) the *Agricultural Water Use and Development Plan* (AWUDP), and (5) the County Water Use and Development Plans (WUDP). A separate WUDP is to be prepared by each of the four Counties.

In compliance with the State Water Code, the County of Hawaii Department of Water Supply (DWS) was tasked with the responsibility to prepare the *County of Hawaii Water Use and Development Plan* in 1988. The WUDP serves as a continuing long-range guide for the water resource development in the County. Its objective is "to set forth the allocation of water to land use through the development of policies and strategies which shall guide the County in its planning, management, and development of water resources to meet projected demands." Section 13-170-31, Hawaii Administrative Rules states that the WUDP shall include but not be limited to:

> *(1) Status of water and related land development including an inventory of existing water uses for domestic, municipal, and industrial users, agriculture, aquaculture, hydropower development, drainage, reuse, reclamation, recharge, and resulting problems and constraints;*
> *(2) Future land uses and related water needs; and*
> *(3) Regional plans for water developments including recommended and alternative plans, costs, adequacy of plans, and relationship to the water resource protection and water quality plans.*

The original County of Hawaii WUDP was adopted by the County Council by ordinance on May 10, 1990, and was conditionally accepted by the CWRM for incorporation into the *Hawaii Water Plan* on June 27, 1990, with the provisions that the WUDP be reviewed and revised as necessary by the County to coincide with the review process of the *Hawaii Water Plan*.

The *Statewide Framework for Updating the Hawaii Water Plan* (Framework) dated February 2000 was created by the CWRM to facilitate coordination, integration, and consistency of the components of the *Hawaii Water Plan*. In addition, the framework is a guide for preparation of the WUDP to insure effective implementation by the County and utilization by the CWRM for resource management purposes.

The Framework requires data and analyses to be based on ground water and surface water hydrologic units designated by the CWRM. However, the surface water hydrologic units were only recently established and adopted in June 2005; and additional information on the surface

water hydrologic units is extremely limited. Therefore, the Hawaii WUDP update is based on the ground water hydrologic units, and references the surface water hydrologic units as applicable. There are nine Aquifer Sector Areas on the island of Hawaii, which are further subdivided into Aquifer System Areas. **Figure ES-1** shows the aquifer areas and indicates the Sustainable Yield, or safe source capacity, established by the *Water Resource Protection Plan* (WRPP).

Sustainable Yield (SY) is defined and described in the *Water Resource Protection Plan* (WRPP) as follows:

> *Sustainable yield refers to the forced withdrawal rate of groundwater that could be sustained indefinitely without affecting either the quality of the pumped water or the volume rate of pumping. It depends upon the head selected as the minimum allowable during continuous pumping. Head is the elevation* [or height] *of the unconfined water table above sea level. There is not a unique value for sustainable yield; the value depends on the head that will preserve the integrity of the groundwater resource at the level decided upon by the manager.*
>
> *Sustainable yield is equal to a fraction of the recharge. In a basal lens the fraction is usually more than half and sometimes greater than three fourths where initial heads are high. In high level aquifers about three fourths of the recharge can be taken as sustainable yield.*
> [Groundwater recharge is the process of adding water to the aquifer through the infiltration of precipitation on the land surface.]
>
> *The estimates of sustainable yield are not meant to be an exact number which could be used in final planning documents. The estimates are constrained not only by the scanty data base but also by the fact that they do not consider the feasibility of developing the groundwater. The estimates should not be equated to developable groundwater. In many regions, taking advantage of a high estimate would not be economically feasible.*

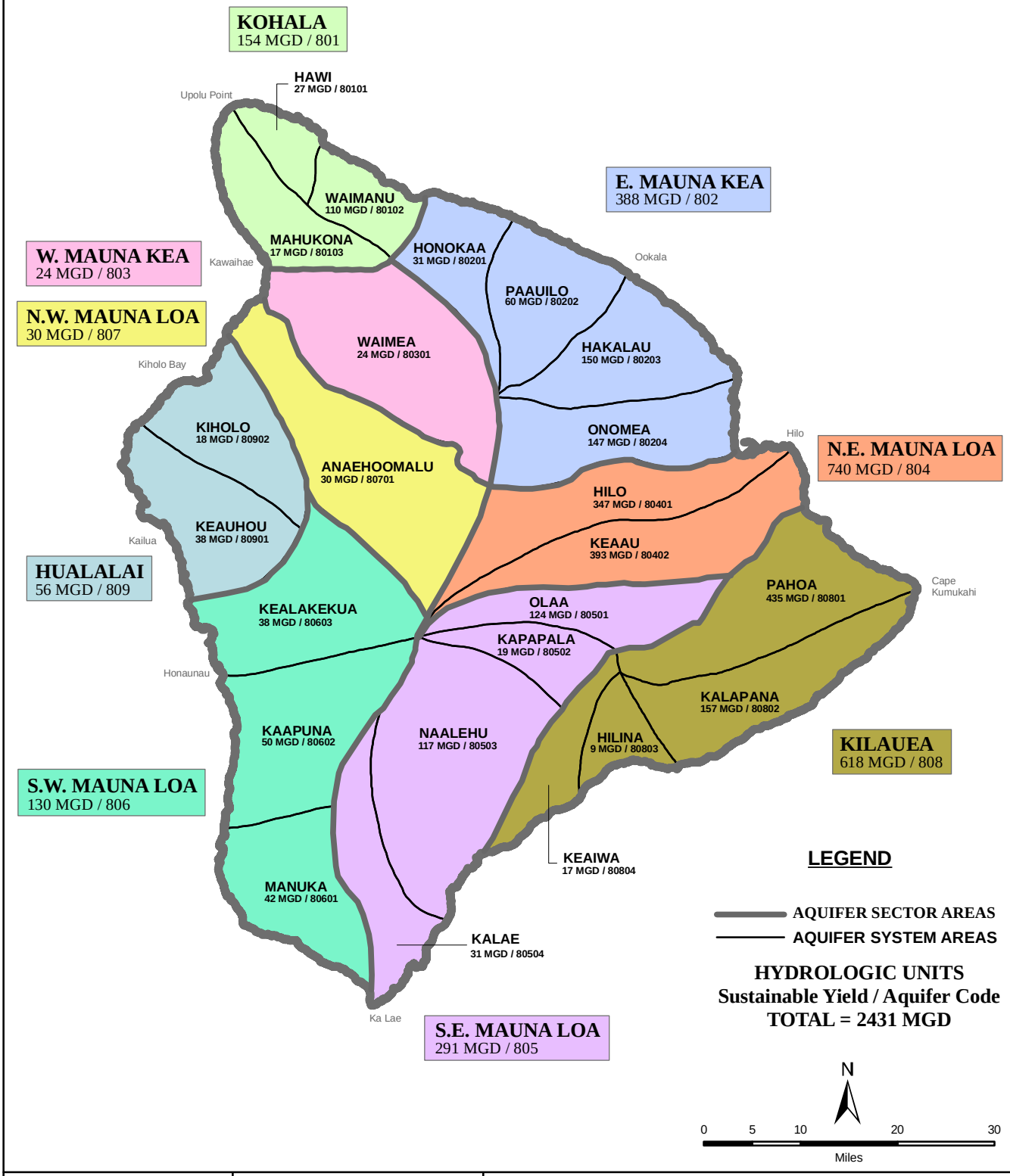
ES.2 METHODOLOGY

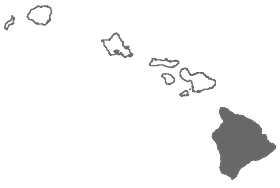
Each Aquifer Sector Area is evaluated with the following methodology.

ES.2.1 Existing Water Resources

Water resources that currently are utilized on the island are examined within each sector area. These resources include the following:

- Groundwater
- Surface water
- Rainwater catchment
- Reclaimed wastewater





Island of Hawaii

FIGURE ES-1

AQUIFER BOUNDARIES

Hawaii County
Department of Water Supply

DWS UPDATE TO THE WATER USE AND DEVELOPMENT PLAN

Job No. 2003-818

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

ES.2.2 Existing Water Use

Existing water use is calculated based on available data, including well pumpage reported to the CWRM, water purveyor records, Department of Health records, and available GIS data.

ES.2.2.1 Existing Water Use by CWRM Categories

Existing water use is categorized to the extent possible according to preliminary water use categories recently established by CWRM staff. Future WUDP Updates should conform to the finalized water use categories to the extent possible. Water use is assigned to a single category to avoid overlap and confusion.

- Domestic (Individual Household)
- Industrial (Fire Protection, Mining, Thermoelectric Cooling, Geothermal)
- Irrigation (Golf Course, Hotel, Landscape, Parks, School, Dust Control)
- Agriculture (Aquatic Plants & Animals, Crops/Processing, Livestock & Pasture, Ornamental/Nursery)
- Military
- Municipal (County, State, Private Public Water Systems [as defined by DOH])

ES.2.2.2 Existing Water Use by Resource

Existing water use is also categorized according to the four water resources listed previously.

ES.2.3 Future Water Needs

Water resource planning for the Hawaii WUDP update considers both land use based water demand projections and rate of population growth to plan for future water needs. A distinct difference between the scenarios is that the land use based projections are based on planning level standards, while the 20-year projections are based on actual consumption.

ES.2.3.1 Full Build-Out Water Demand Projections

The full build-out water demand projections are land use based. The County General Plan Land Use Pattern Allocation Guide (LUPAG) and County Zoning Land Use classifications are assessed to estimate the projected development densities for each designation at full-build out. The results are used to project the ultimate water demand based on the General Plan, and potential water demand based on land use zoning, which is legally developable, to determine if there are adequate water resources to sustain the land uses.

As required by the Framework, the WUDP considers the most recent *State Water Projects Plan*, and *Agricultural Water Use and Development Plan* forecasts if water requirements are available; and recognizes the current and future development needs of the Department of Hawaiian Home Lands.

ES.2.3.2 5-Year Incremental Water Demand Projections to the Year 2025

Existing population and water use were calculated as the basis of the water demand projections to the year 2025 to assess the adequacy of current and near-term water sources (20 years). Population and growth rate projections were applied in 5-year increments for the next 20 years; and have high-growth, medium-growth (base case) and low-growth (the most conservative) scenarios. The demands are further differentiated into potable and nonpotable demands.

ES.2.4 Water Use Unit Rates

Water use unit rates were based on the *Water System Standards* as listed in **Table ES-1** and actual consumption data. Potable and non-potable water requirements were differentiated where appropriate.

Table ES-1: Water System Standards, Domestic Consumption Guidelines

Zoning Designation	Average Daily Demand
RESIDENTIAL:	
Single Family or Duplex	400 gals/unit
Multi-Family Low Rise	400 gals/unit
Multi-Family High Rise	400 gals/unit
COMMERCIAL:	
Commercial Only	3000 gals/acre
RESORT:	400 gals/unit or 17,000 gal/acre*
LIGHT INDUSTRY:	4000 gals/acre
SCHOOLS, PARKS:	4000 gals/acre or 60 gals/student
AGRICULTURE:	3400 gals/acre**

* Resort ADD of 17,000 gal/acre based on ADD for Maui.
** Agriculture ADD based on AWUDP.

Water use unit rates based on actual consumption data for specific geographic regions were developed by the Hawaii County Department of Water Supply for single family residential units, as listed below:

- South Kohala and North Kona – 2.5 units/lot
- South Kona – 1.5 units/lot
- Elsewhere – 400 gals/unit

These unit rates result in higher water demand projections as compared to the *Water System Standard* unit rates, but are viewed as more realistic based on historic consumption data.

ES.2.5 Agricultural Water Use

Agricultural water use is extremely difficult to determine due to the lack of available data. The proposed methodology to determine agricultural water use was met with strong objection at

public meetings. Overwhelmingly, public input suggested that the need for irrigation water was not predicated on the classification of Agricultural lands. Public input further suggested that agricultural users would grow what is feasible according to the climate, and that irrigation from groundwater sources would be minimal. For example, crops requiring large amounts of moisture would be grown in areas that have a higher ambient rainfall. For these reasons, and because it is expected that the next update to the AWUDP will investigate these issues in greater detail, two agricultural water use scenarios are presented for each of the full build-out scenarios (Hawaii County General Plan and Hawaii County Zoning) and the 5-year incremental water demand projection scenario. This identifies a range of agricultural water use, which considers the best and worst case scenarios on an interim basis, until the next phase of the AWUDP is complete.

ES.2.6 Resource and Facility Recommendations

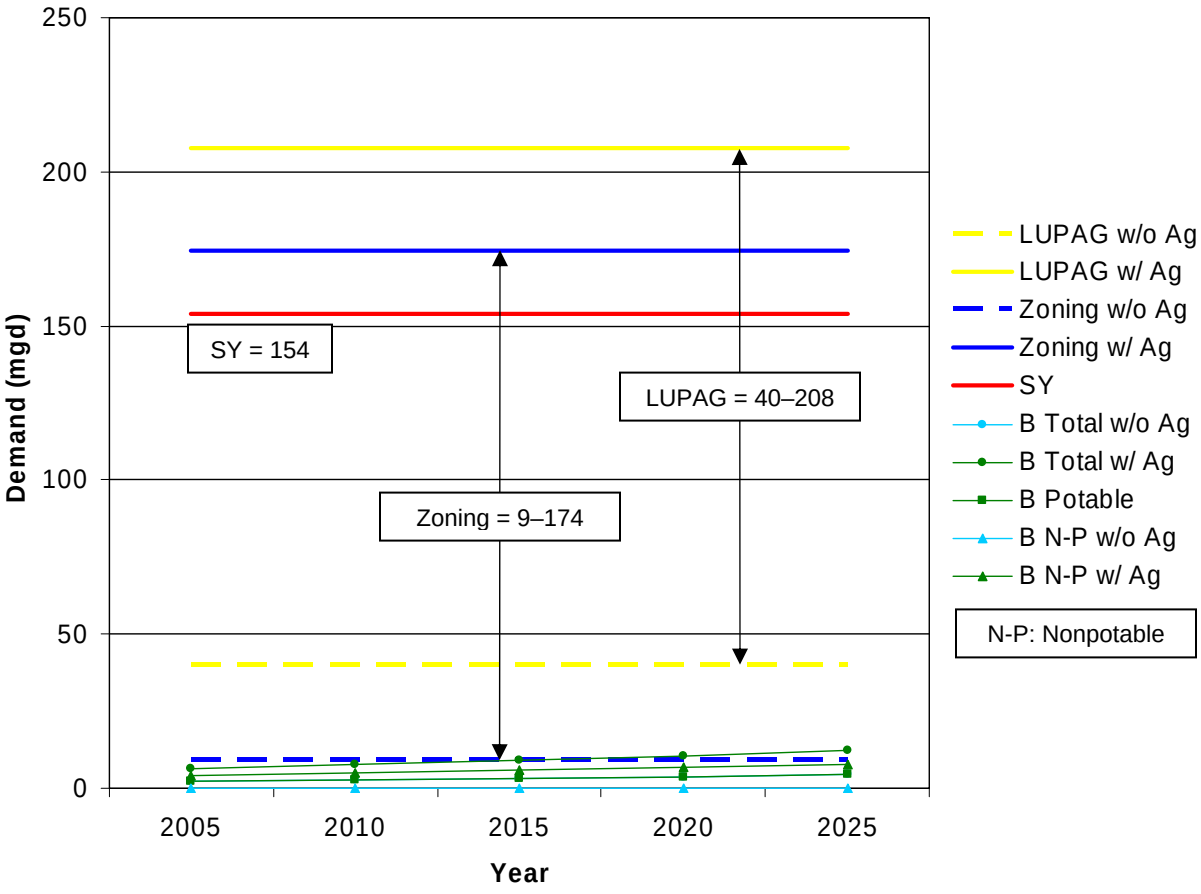
Several water resource enhancement measures were examined to meet the projected water demands. These include conventional supply-side measures such as groundwater and surface water development, alternative supply-side measures such as development of rainwater catchment systems, reclaimed wastewater, and desalination; and demand-side management such as development density control and water conservation measures. The feasibility of these water resource enhancement options was compared to provide a recommended combination of measures.

ES.2.7 Aquifer Sector Area Synopses

A brief synopsis of each Aquifer Sector Area follows.

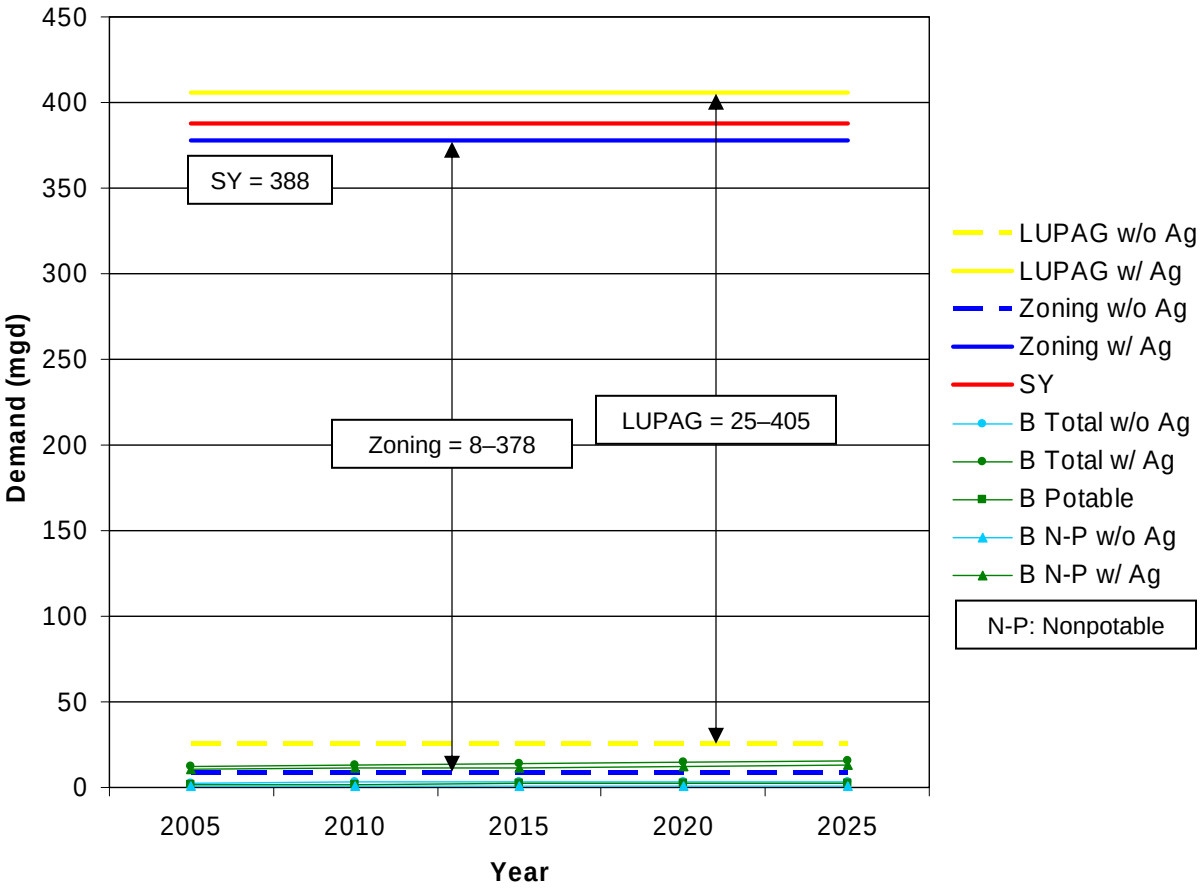
801 – Kohala Aquifer Sector Area

Ground water and surface water are plentiful in the Kohala Aquifer Sector Area, and these may continue as the primary sources of water. Specifically, high-level groundwater could be developed for potable water sources, and the island's four major ditch systems could be restored to satisfy non-potable needs. Including worst-case agricultural demands, full development to the maximum densities of LUPAG and County Zoning are not sustainable within the Kohala Aquifer Sector Area and the Hawi and Mahukona Aquifer System Areas. Without agricultural water demands, the LUPAG and County Zoning scenarios are sustainable within the Kohala Aquifer Sector Area; however, LUPAG maximum density build-out cannot be sustained within the Mahukona Aquifer System Area. This can be mitigated by transfer of water between aquifer system areas, although the projected 20-year demands indicate that this will not be necessary in the near future. Potential shortages of water in adjacent aquifer sector areas can also be addressed through transfer of water from the Kohala Aquifer Sector Area, which will likely necessitate infrastructure upgrades.



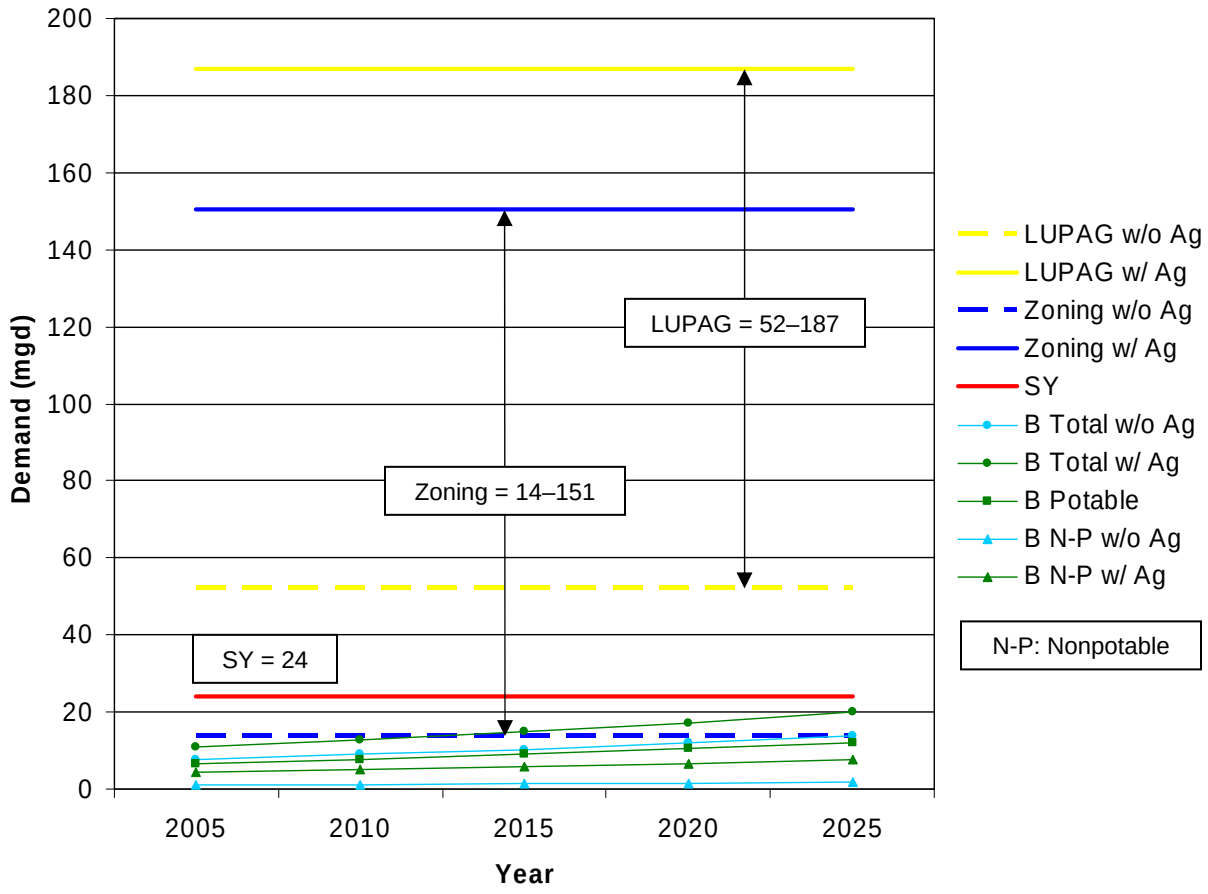
802 – East Mauna Kea Aquifer Sector Area

Ground water and surface water are present in great abundance in the sector area. However, if worst-case agricultural demands are included, the land use full build-out scenarios are close to the sustainable yield. Excluding agricultural demands, the current, 20-year projected, and land use full build-out demands are well below the sustainable yield; therefore, groundwater may be developed as the primary source of potable water. Spring sources used to provide potable water may be replaced by groundwater sources if it is more beneficial and economical than to comply with Federal Safe Drinking Water Act requirements.



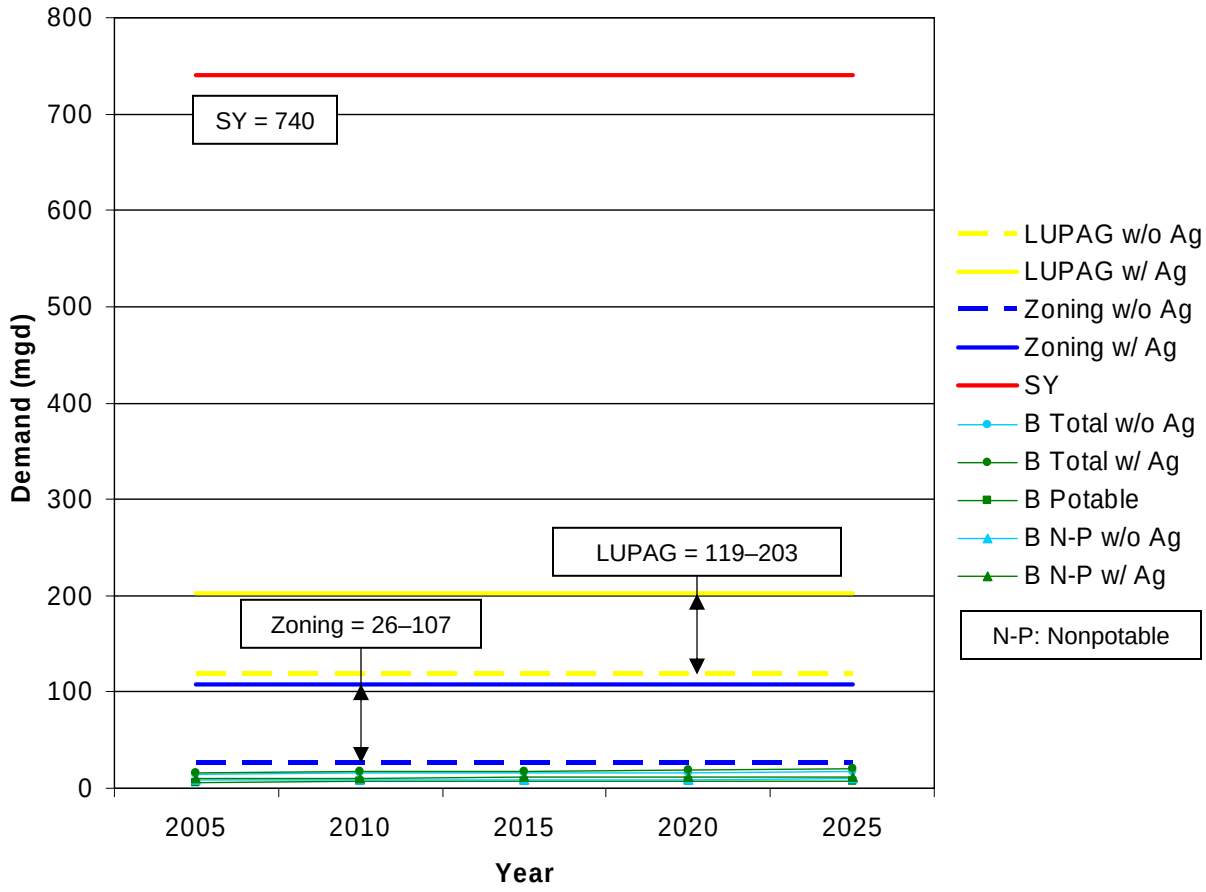
803 – West Mauna Kea Aquifer Sector Area

The sector area encompasses part of the Kohala Coast, including one of the island's three luxury resort complexes (Mauna Kea Resort). Not surprisingly, current water usage is high, nearly one-third of the sector area's sustainable yield. Full build-out to LUPAG maximum density is not sustainable. Full development to the maximum density of County Zoning is sustainable if agricultural demands are excluded, and is not sustainable if worst-case agricultural demands are included. Twenty-year projected demands range between 60 and 80 percent of the sustainable yield. For these reasons, water resource planning for the sector area is important. Development of basal potable water resources should proceed with caution, and the feasibility for water transfer from the adjoining Kohala Aquifer Sector Area should be examined. Water conservation should be a primary focus in the sector area, and utilizing the highest quality water for the highest end use should be promoted. It would be prudent to irrigate primarily with non-potable sources, and take measures to encourage reduction of potable water usage by residential customers closer to average island water usage.



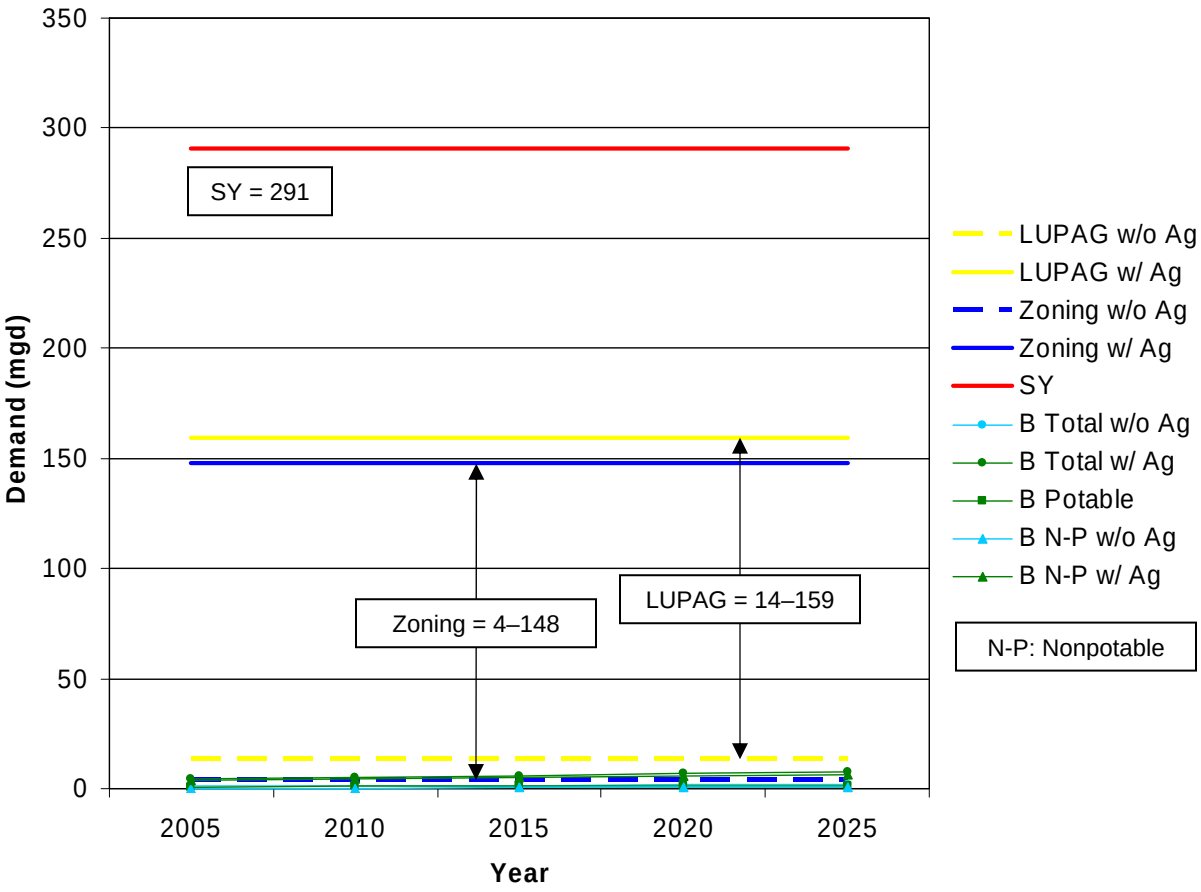
804 – Northeast Mauna Loa Aquifer Sector Area

Encompassing the Urban Hilo area, this sector area has the highest current water usage on the island. Due to the high annual rainfall, it also has the island's highest sustainable yield, which can easily sustain the LUPAG and Zoning maximum density full build-out demands, even if worst-case agricultural demands are included. Development of groundwater sources may continue as land development demands dictate. The recommendation for this sector area is to improve the efficiency of the DWS Hilo Water System; loss of source water through leakage is suspected. The detriment is the excess cost of production, not loss of a limited supply of sources.



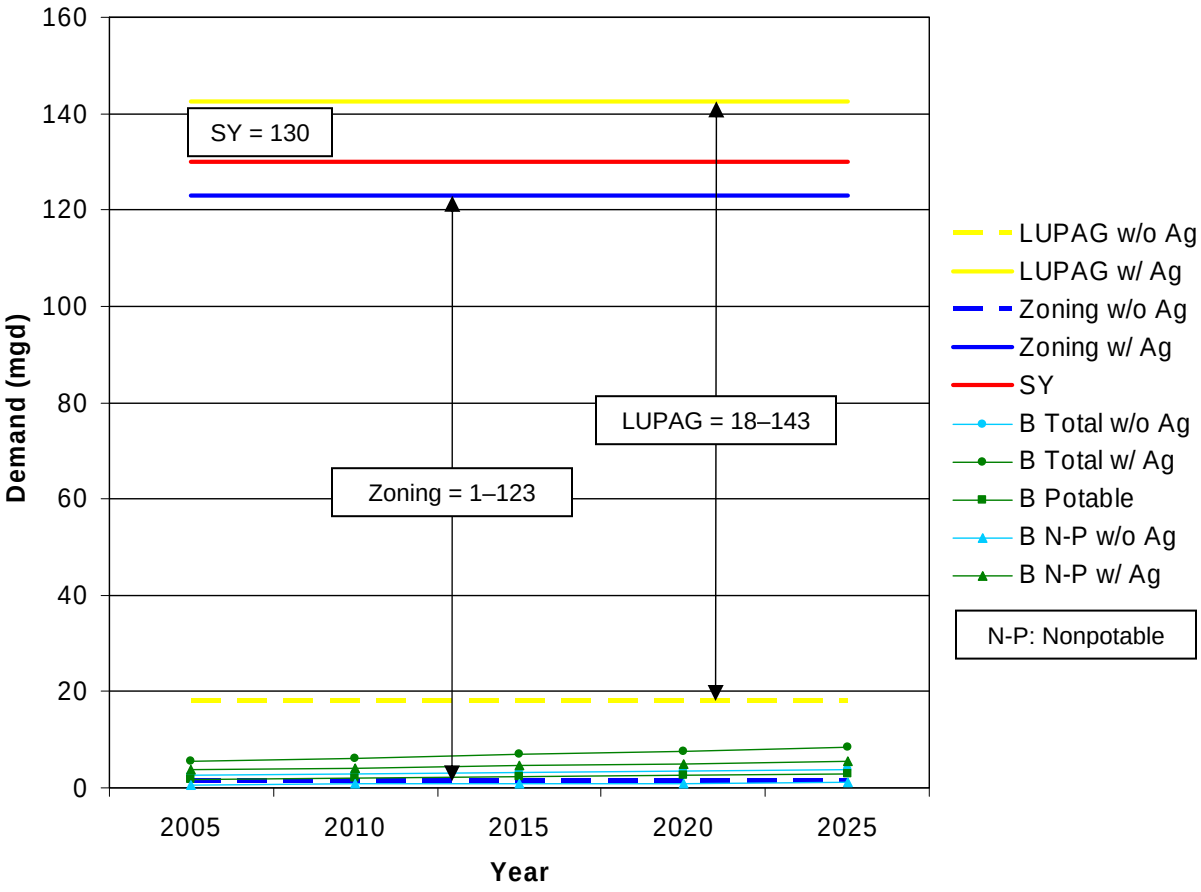
805 – Southeast Mauna Loa Aquifer Sector Area

This sector area is sparsely populated. If agricultural demands are excluded, it has the lowest current water usage, the lowest 20-year projected usage, and the lowest full build-out projected demands of all sector areas on the island; all of these are a small fraction of the sector area's sustainable yield. If worst case agricultural demands are included, the land use full build-out scenarios require approximately half of the sustainable yield. Deep groundwater wells may be developed to suit anticipated development that would require potable water. Groundwater sources may also replace existing tunnel and spring sources, which are influenced by surface water, if costs to comply with DOH regulations are excessive. Formerly used by the sugar plantation, tunnel and spring sources are numerous, and should be examined as a potential resource to supply non-potable demands, both in the Southeast Mauna Loa Aquifer Sector Area and the adjacent Southwest Mauna Loa Aquifer Sector Area.



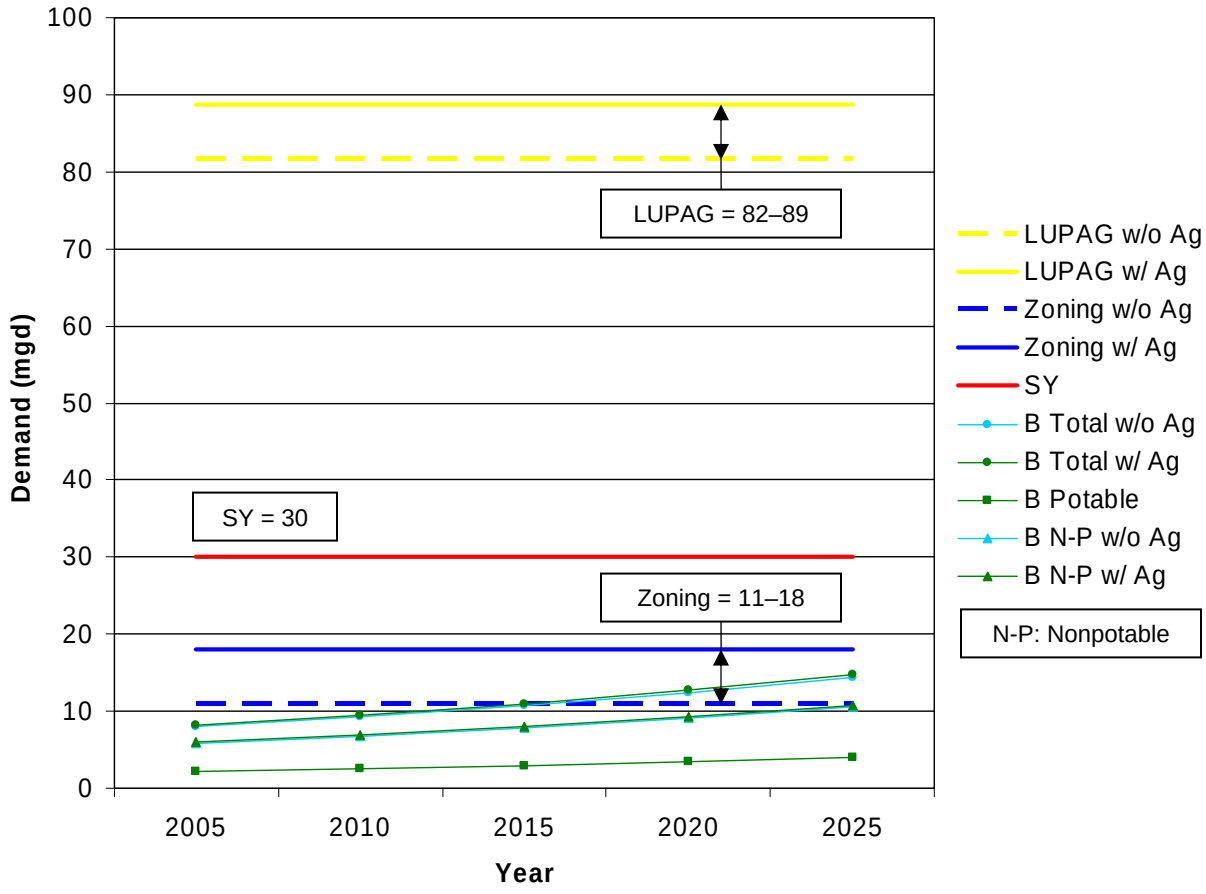
806 – Southwest Mauna Loa Aquifer Sector Area

Current water usage, 20-year projected usage, and full build-out LUPAG and County Zoning maximum density demands within the sector area are a small fraction of its sustainable yield if agricultural demands are not included. If worst-case agricultural demands are included, the LUPAG full build-out demand exceeds the sustainable yield, and the Zoning demand is nearly 95 percent of the sustainable yield. Surface water sources are extremely limited, and due to the limited availability of basal groundwater, high level groundwater is expected to be the primary water resource. The challenge in this sector area is transmission, particularly to areas which are currently supplied by individual rainwater catchments and water hauling. Previous studies have proposed several alternative measures to supply both potable and non-potable water. These alternatives should be further evaluated and compared.



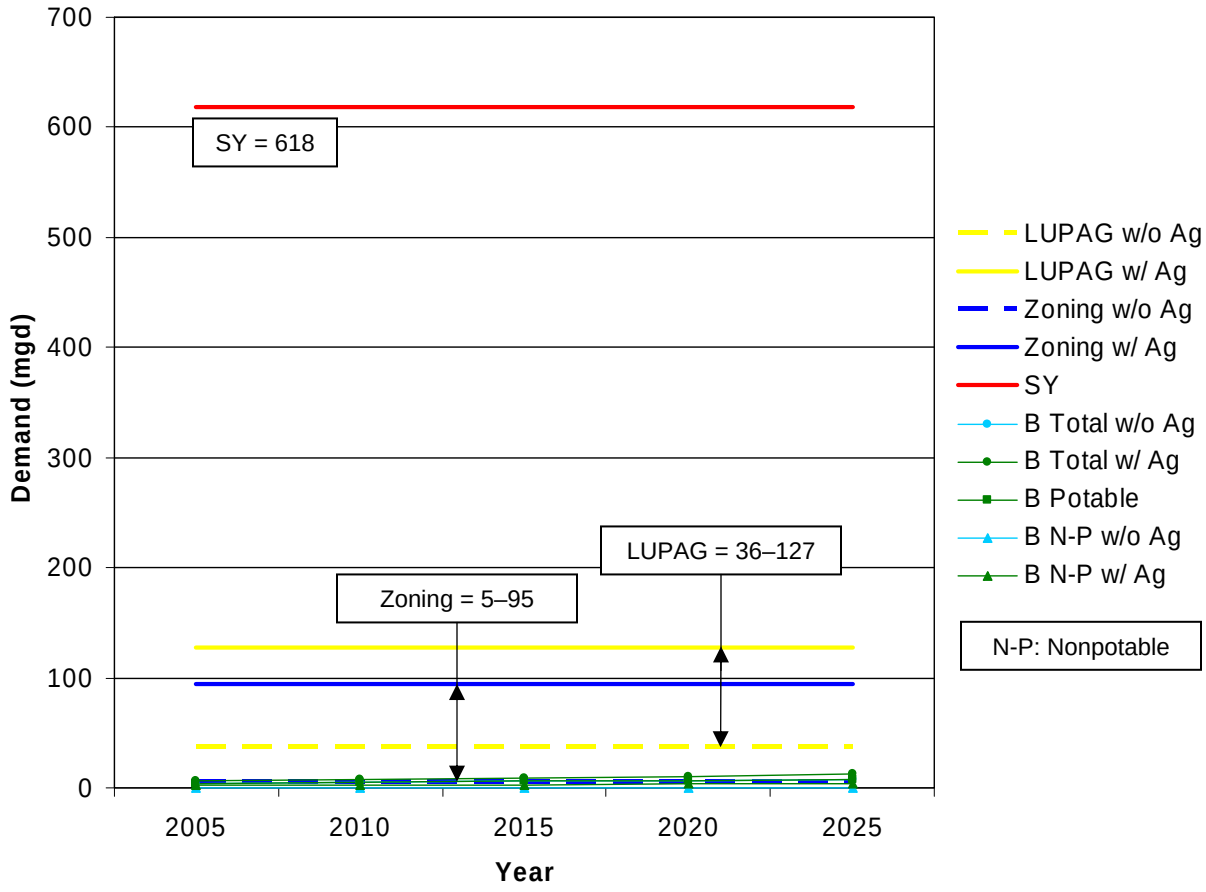
807 – Northwest Mauna Loa Aquifer Sector Area

Two of the island's three luxury resort complexes along the Kohala Coast (Mauna Lani Resort and Waikaloa Resort) are located within the sector area. Existing development demands are over one-quarter of the sustainable yield, and 20-year projected demands will amount to nearly half of the sustainable yield. Full build-out to the maximum density of LUPAG is not sustainable, with and without worst-case agricultural demands. Full build-out to the Zoning maximum density requires 30 to 60 percent of the sustainable yield. Because there are no potable water sources in the sector area, and minimal potential for significant future development of potable sources, a proper balance of water transfer from other aquifer sector areas and water conservation must be achieved. The relative compactness of the two major resort developments increases the possibility of combining non-potable sources into a water system to satisfy the non-potable needs. Wastewater reclamation should be continued. Demand-side conservation programs should be implemented by the potable water purveyors to reduce the average water usage closer to island averages.



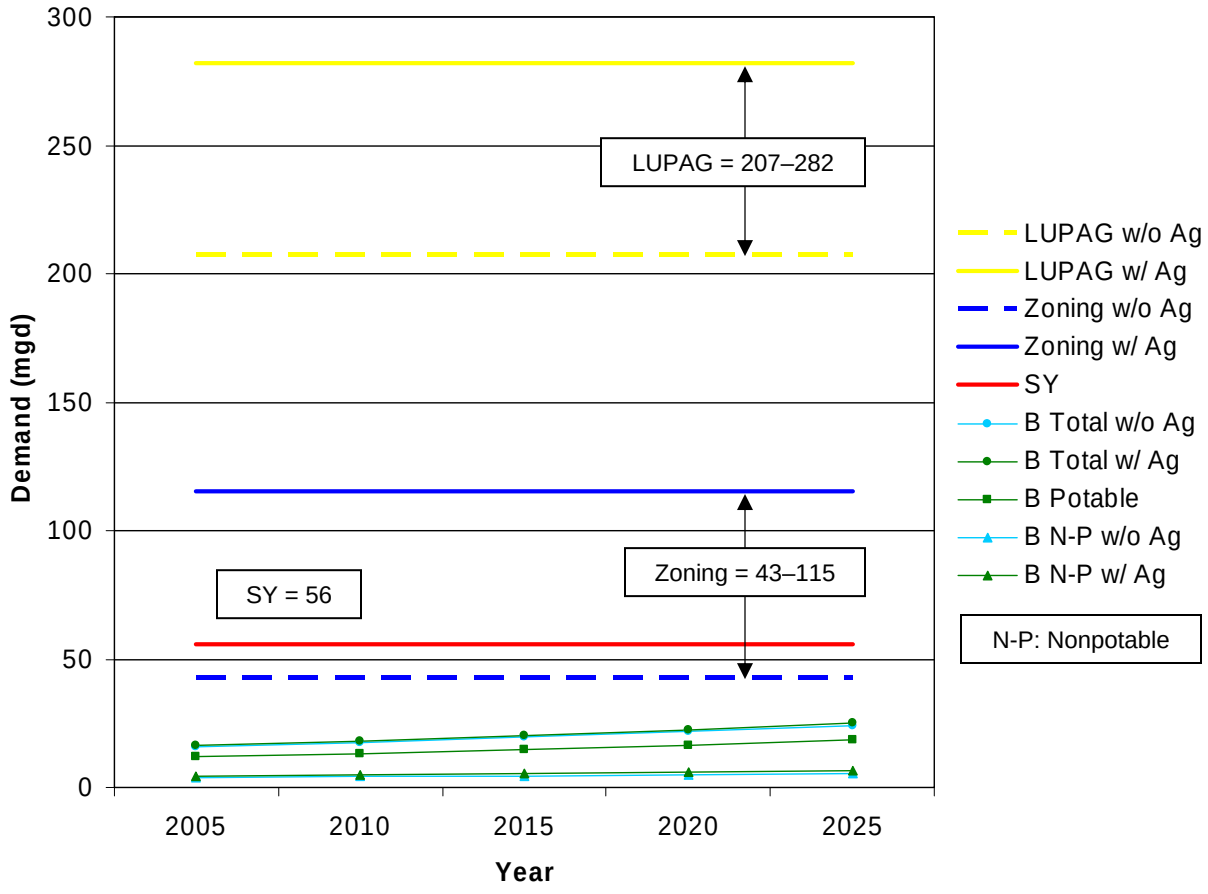
808 – Kilauea Aquifer Sector Area

The sustainable yield of this sector area is the second highest of all sector areas on the island. Water demands associated with the full build-out to the maximum density of LUPAG and County Zoning, and 20-year projections are sustainable with and without agricultural demands. The WRPP indicates that a large quantity of high-level groundwater is developable; therefore, these sources may continue to be the primary source of potable water. The key issue in this sector area is whether to develop a municipal water system in the Central Puna area. Currently, users rely on individual rainwater catchment systems, and the high volume of ambient rainfall suggests that this is adequate. Undoubtedly, development of groundwater sources for such a system is feasible; however, other factors, such as cost and public opinion, need to be considered.



809 – Hualalai Aquifer Sector Area

This sector area includes Kona and the surrounding area, which has expanded significantly in the last 20 years. Water demands in the sector area are the highest on the island due to the increases in population and tourism. Development of high-level groundwater sources, primarily in the Keauhou Aquifer System Area, has relieved some of the stress to the basal aquifer. However, there should be concern with the on-going land development, as demands associated with the full build-out to LUPAG maximum density exceed the sustainable yield by four to five times. County Zoning full build-out demands are close to the sustainable yield if agricultural demands are excluded, and exceed the sustainable yield if worst-case agricultural demands are included. Although the 20-year projections indicate that demands will not approach the sustainable yield for some time, measures should be considered to control future water demands. Demand-side water conservation measures should be implemented by the potable water purveyors. It would be prudent for County Planning officials to re-examine land use policies; controlling the development density may be considered. Most importantly, the concept of using the highest quality water for the highest end use should be followed. Efforts should be initiated to utilize reclaimed wastewater and brackish basal groundwater for non-potable uses, thereby reserving potable water for potable domestic use. Water transfer from the adjacent Southwest Mauna Loa Aquifer Sector, which has a surplus of potable water sources, should also be explored.



ES.2.8 Summary of Conclusions and General Recommendations

The Hawaii Water Use and Development Plan Update promotes several common themes which are applicable island-wide. The themes are as follows:

- Reserve the highest quality of water for the most valuable end use
- Promote water conservation
- Initiate more monitoring and studies

Potable water is considered the highest quality water, and the sustenance of life is considered the most valuable end use. Reclaimed wastewater, brackish groundwater, surface water and other such lower quality water sources should be used for landscaping and agriculture, thereby reserving potable water for human consumption.

Potable water usage above the County standard of 400 gpd per household is considered excessive, and is therefore discouraged. End users, water purveyors and government agencies should work together to conserve potable water.

The Department of Water Supply, as the largest purveyor of potable water on the island, plays a key role in the use and protection of water resources. The goals and policies of DWS are described in detail in Appendix C.

Additional studies and monitoring to determine the "safe" sustainable yields, on which the data and analyses presented in the WUDP are base, are recommended. The next update of the Water Resources Protection Plan should provide updated sustainable yields. Because of the interdependencies between neighboring aquifer system and sector areas, regional studies should be initiated. This is of special concern in West Hawaii. The WUDP proposes to create overall resource management practices, and future updates should promote a policy of well-planned source development.