

APPENDIX **H**

Existing and Future Demands

Water Resource Protection Plan 2019 Update

H Existing and Future Demands

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H Existing and Future Demands

This section of the WRPP focuses on existing and future water demands statewide, as well as the issues that are associated with quantifying water use and projecting water demand. Available data on existing ground water use and surface water use are presented, followed by a summary of water demand projections through 2035 as prepared by each county. The section concludes with a discussion of county-level water planning, the status of each county's planning efforts, and the potential impacts on water resources based on coordinated land and water use planning at the county level.

H.1 CWRM Goals for Assessing Water Demands

The following Commission on Water Resource Management (CWRM) goals and objectives are intended to guide the assessment of existing and future water demands:

- Identify “hot spots” where actual and/or future water demands approach or will exceed available supply.
- Facilitate integrated water and land use planning to inform future decision-making on land use policies and plans.
- Provide State guidance, advice, and oversight in the preparation of the County Water Use and Development Plans (WUDP).
- Ensure equitable water allocation for all users in accordance with the State Water Code and the public trust doctrine.
- Utilize the best available information on water resources to make wise decisions about reasonable and beneficial use and protection of the resource.
- Provide the regulatory and internal framework, including the best use of information technology, for efficient ground and surface water management.
- Support community-based management of water resources and develop short- and long-range plans to avoid judicial and quasi-judicial disputes.
- Develop, implement, and update comprehensive short- and long-range plans protecting, conserving, and managing water resources.
- Foster comprehensive resource planning for the development, use, protection, and conservation of water.

- Promote sustainable resource management.
- Encourage and assist with the development and execution of drought planning and mitigation projects.
- Promote coordination and collaboration among agencies and private entities.

H.2 CWRM Water Use Categories

Different entities categorize and classify water use in different ways. CWRM classifies water use information based on seven broad categories of water use (see **Table H-1**). Within each category, sub-categories identify more specific applications. CWRM water use categories reflect common water uses occurring in the State of Hawai'i and are based on the types of uses identified in the State Water Code and in the County Water System Standards.

Table H-1 Water Use Categories and Sub-Categories

	Use Category	Use Sub-Category
Individual Well Operators	Agriculture	<ul style="list-style-type: none"> • Aquatic plants and animals • Crop irrigation and processing • Livestock water, pasture irrigation, and processing • Ornamental and nursery plants • Taro • Other agricultural applications
	Domestic Residential Domestic, includes potable and non-potable water needs Non-residential Domestic, includes potable (and non-potable) water needs	<ul style="list-style-type: none"> • Single- and multi-family households, including non-commercial gardening • Commercial businesses • Office buildings • Hospitals • Religious Institutions • Hotels • Schools • Other
	Industrial	<ul style="list-style-type: none"> • Fire protection • Mining, dust control • Geothermal, thermoelectric cooling, power development, hydroelectric power • Other industrial applications

Table H-1 Water Use Categories and Sub-Categories (Continued)

	Use Category	Use Sub-Category
Individual Well Operators	Irrigation	<ul style="list-style-type: none"> • Golf course • Hotel • Landscape and water features • Parks • Schools • Habitat maintenance • Other
	Military*	<ul style="list-style-type: none"> • All military use
	Municipal*	<ul style="list-style-type: none"> • State • County • Private

*May also include agriculture, domestic, industrial, and irrigation uses

Figure H-1 to Figure H-4 show the locations of production wells on each of the major Hawaiian Islands. Each well is coded according to CWRM water use categories. The primary use of each well was determined based upon available records. CWRM staff continues to verify well uses as resources allow.

Figure H-1 Island of Kauaʻi Production Wells (2018)

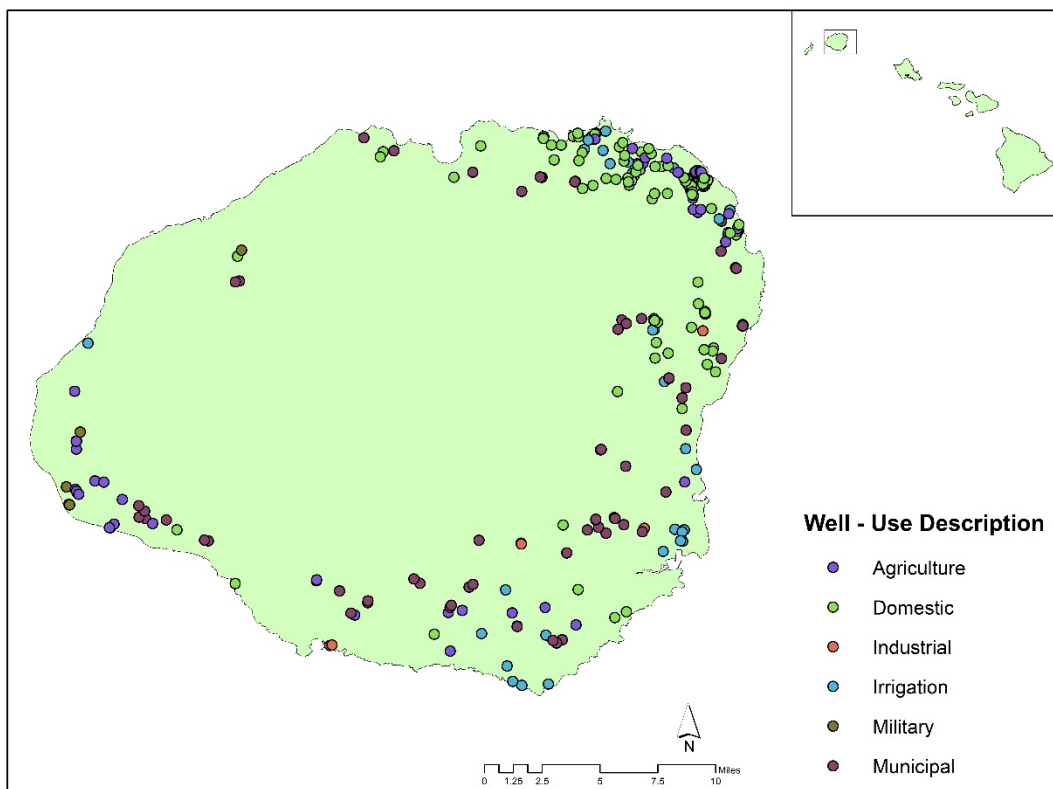


Figure H-2 Island of O’ahu Production Wells (2018)

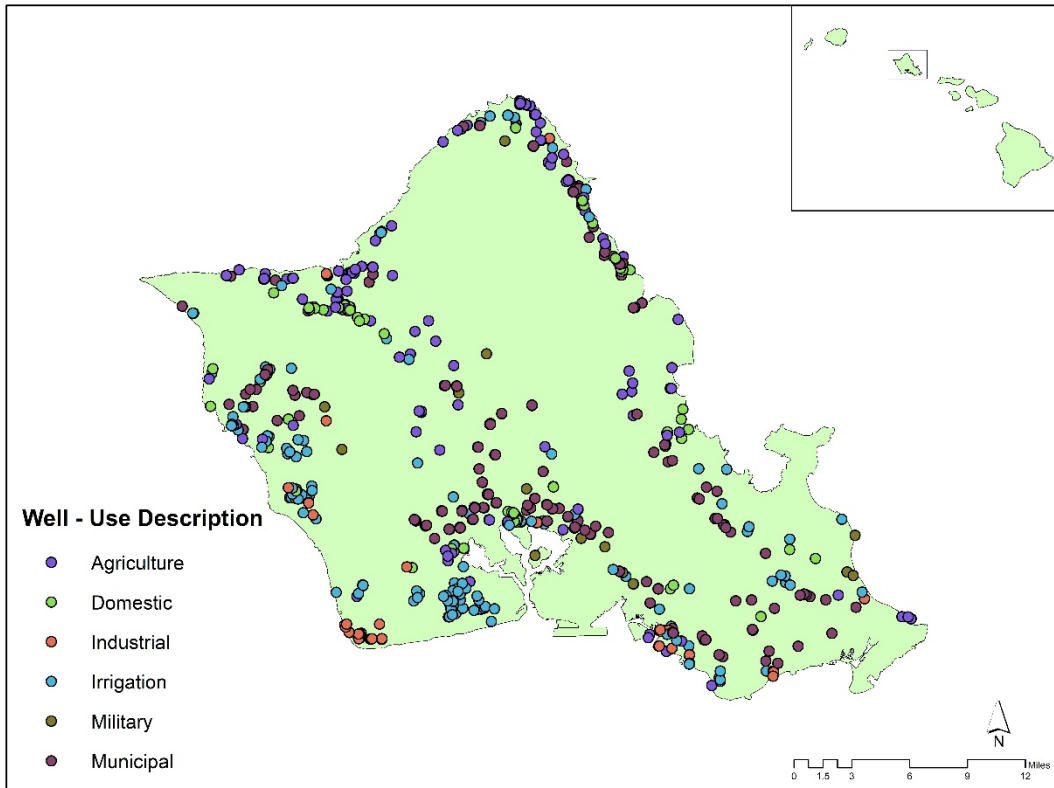


Figure H-3 County of Maui Production Wells (2018)

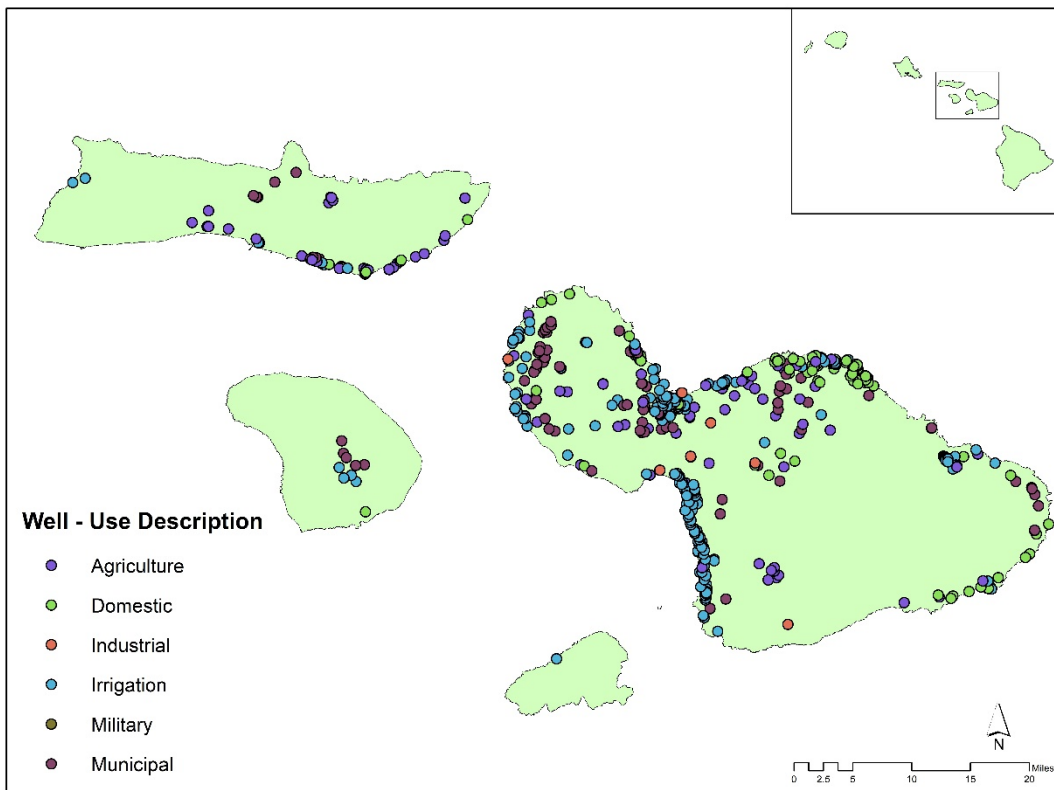
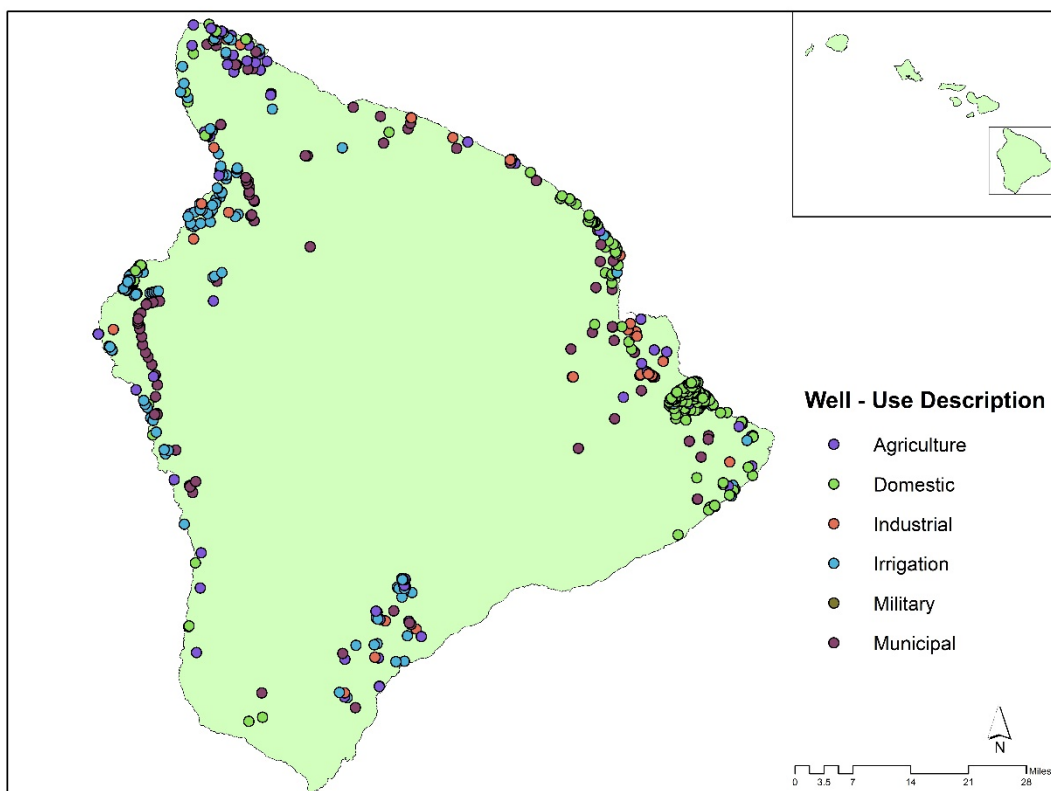


Figure H-4 Island of Hawai'i Production Wells (2018)



H.3 CWRM Water Use Reporting Requirements

The collection and analysis of water use information is essential to understand the behavior and response of water resources to stresses from water withdrawals. Such information also ensures that demand is managed effectively within the sustainable limits of supply. Water use information can also be used to: evaluate the effectiveness of alternative water management policies, regulations, and conservation activities; assess the impacts of population growth and corresponding increases in water demands; develop trends in water use; and make projections of future demands.

In 1987, the State Water Code was enacted and HRS §174C-26 required water users to file a declaration of water use with CWRM, in compliance with the rules subsequently adopted for that chapter. The Hawai'i Administrative Rules (HAR), §13-168-5(c), specify that declarations of water use shall at a minimum include information on the following:

“[T]he location of the water sources and all usage-related facts, or information within his knowledge or possession...the manner, purposes, and time in which the water source is being used and operated, the rate and volume of water being withdrawn or diverted therefrom, and the method or means of measuring and controlling the water taken or used.”

In 1989, CWRM began the process of registering existing water sources and declarations of water use in accordance with the State Water Code and administrative rules. By 1990, the declaration of water use program identified approximately 1,550 users statewide who were using water from wells, stream diversions, and water systems. Approximately 250 declarants were identified by CWRM as having “medium-to-large” uses. The remaining 1,300 water use declarations were for small uses, identified by CWRM to include individual domestic supplies, water systems involving small water capacities (pump motors less than five horsepower, or gravity-fed pipes less than two inches in diameter), and agricultural irrigation of fewer than three acres.

The Hawai'i Administrative Rules of the State Water Code require owners or operators of wells and stream diversion works to measure their water use and submit regular monthly reports of the use. In particular, HAR §13-168-7(a) and (c) provide that:

(a) The owner or operator of any well or stream diversion works from which water is being used shall provide and maintain an approved meter or other appropriate device or means for measuring and reporting total water usage on a monthly (calendar or work schedule) basis. If a well or stream diversion works is one of a battery of interconnected water sources, a centralized measuring device or facility may be approved by the commission.

(c) At the discretion of the commission, requirements for measuring and reporting monthly water usage may be lessened, modified, or exempted for owners or operators of small individual wells or stream diversion works. The lessening, modification, or exemption of such requirements shall be approved, disapproved, or otherwise decided by the commission on a case-by-case basis.

The monthly water use reporting requirement was difficult to implement and enforce. Enforcement of the water-use reporting requirements began in 1988, with the monthly collection of water use reports from major users, including county departments of water supply and large plantations. Water purveyors and large plantations already had monitoring equipment in place to measure and record water usage. However, the monthly reporting requirement specified in HAR §13-168-7(a) proved burdensome on other users, as evidenced by the requests for reporting exemptions received by CWRM.

By August 1992, approximately 140 medium and large users of water from well sources were submitting regular reports of their monthly water use to CWRM. CWRM continued to pursue approximately 20 other users who did not respond to the request for water use reports, and also followed up on requests from medium and large well users to be exempted from reporting, or to be approved for modified reporting requirements.

Meanwhile, CWRM had not attempted to enforce reporting requirements for the 1,300 water use declarants identified as “small users,” or for approximately 100 medium-to-large users who indicated water use from stream sources and third-party distribution systems. At the time,

CWRM anticipated that the majority of these 1,400 users would find the reporting requirements to be burdensome. CWRM further anticipated that these users would request exemption from, or modification of, the reporting requirements.

Therefore, in August and September 1992, CWRM staff submitted to CWRM a request for authority to exempt certain cases of water use from reporting requirements and to modify the reporting requirements in other cases.¹ CWRM voted to unanimously approve the staff's request, effectively creating priorities and exemptions regarding measurement and reporting of water use. These priorities and exemptions are listed below:

1. The following cases of water use are exempt from the requirements for measuring and reporting monthly water use, unless CWRM determines a specific need for these data for purposes such as resolving disputes, establishing instream flow standards, or quantifying the amount of water use for a water use permit in a water management area:
 - Individual end uses of water on multi-user distribution systems, where the end user does not control or operate the water supply source(s) to the system, providing that the operator of the system reports the total usage from the system and also maintains records which are available to CWRM upon request to describe the specific location, type, and quantity of individual end uses;
 - Water uses from individual water systems where the quantity of use averaged over a one-year period does not exceed 50,000 gallons per month (1,700 gallons per day);
 - Passive agricultural consumption, such as when crops are planted in or adjacent to springs and natural wetland areas; and
 - Livestock drinking from dug wells or stream channels.
2. The following cases of water use are allowed to report monthly water use on an appropriate quarterly, semi-annual, or annual basis, as determined by CWRM staff, unless a specific need is determined for monthly reporting:
 - Water uses from individual water systems where the quantity of use averaged over a one-year period does not exceed five million gallons per month;
 - Water uses from saltwater or brackish water sources; and
 - Water uses from surface water sources.
3. The requirement for monthly measurement and reporting of water use from gravity-flow, open-ditch stream diversion works which are not already being measured and which are not in designated surface water management areas is deferred until CWRM adopts guidelines regarding appropriate devices and means for measuring water use which are not unduly burdensome on water users.

¹ Commission on Water Resource Management, 1992, Staff Submittal, Approval to Allow Exemptions from Requirements or Measuring and Reporting Monthly Water Use.

CWRM's action had the effect of focusing water use monitoring and reporting where it was most needed at the time: large ground water sources and drinking-water wells. The exemptions and modifications allowed for more effective allocation of staff resources and prioritization of water use monitoring and tracking. Enforcement of the ground water use reporting requirement currently remains focused on large water users (e.g. municipal purveyors), and uses in designated water management areas,² where competition for water is greatest and aquifers may be pumping close to their sustainable yields (SY). Unfortunately, the focus on ground water sources has resulted in a lack of historical surface water use data. To date, very few users report surface water use to CWRM.

In 2014, CWRM unanimously approved rescinding the 1992 priorities and exemptions and replacing it with the following.³

1. The following exemptions from the requirement to measure and report monthly water use for the activities listed below are allowed, UNLESS the Commission determines a specific need for this data to resolve disputes, establish instream flow standards, or quantify the amount of water use for a water use permit in a water management, or for similar needs.
 - Passive agricultural consumption (e.g. when crops are planted in or adjacent to natural springs and natural wetland areas);
 - Livestock drinking from dug wells or stream channels;
 - In non-surface water management areas, individual end uses on multi-user ditch systems where IFS or water use permits are not an issue;
 - Salt-water wells may continue to report monthly estimates of pumpage and monthly actual measured water-levels and salinity on an annual basis.
2. Affirmatively require that unused and observation wells report monthly water-levels and salinity as determined by staff.

The repeal of the exemption for small individual domestic users was prompted in part by the Commission's adoption of the first edition of the Hawai'i Well Construction and Pump Installation Standards (HWCPIS, 1997) in accordance with HRS §174C-86 and its Administrative Rule (HAR §13-168-14). This version required all post-1997 permitted production wells, including small capacity wells, to install flow meters and to record and report monthly pumping, non-pumping static water-levels, and salinity. This has been a standard condition for all well construction and pump installation permits approved by the Commission statewide since 1997. The 2004 second edition of the HWCPIS clarified that salt water wells (greater than 17,000 parts per million [PPM] chlorides) need not install flow meters. Thus, consistent with the

² CWRM Internal Enforcement Guideline

³ Commission on Water Resource Management, 2014, Staff Submittal, Rescinding Water Use Reporting Exemptions and Deferrals Established under September 16, 1992 Commission Action, Statewide, Hawai'i.

HWCPIS, salt water wells continue to be exempt from the monthly reporting requirement and may instead report annually, and small capacity wells are no longer exempt from reporting, as all post-1997 wells are now equipped with flowmeters to measure water use.

CWRM also hired a consultant to produce a handbook with guidelines for appropriate devices and means of measuring surface water use that would not be unduly burdensome on water users,⁴ the reason for deferment of surface water use reporting in 1992. Therefore, under the current policy, monthly measurement and reporting of all surface water uses, including from gravity-flow, open-ditch stream diversion works, is required statewide.

Finally, reporting exemptions were repealed because CWRM's Water Resource Management Information System (WRIMS) went live in 2012. The WRIMS system allows water use reporters to file their reports on-line, monitor their historical use from their source(s), and have access to all information about their source(s) on file via the internet. This new tool was developed to facilitate reporting by water users, provide owners access to all CWRM information about their source(s), and to enable CWRM staff to more efficiently enforce compliance with the reporting requirement. See **Appendix G Monitoring of Water Resources** for a more detailed discussion of WRIMS and the online reporting features.

H.3.1 Water Use Reporting for Ground Water Sources

In 2016, CWRM collected ground water pumpage data from 1,251 well owners/water users statewide. summarizes the status of ground water use reporting by island. See **Appendix G Monitoring of Water Resources** for the policy on water use reporting requirements.

Table H-2 shows that for all islands except Lānaʻi and Molokaʻi, the major portion of most ground water use reports is submitted by the county water departments. Better reporting is needed for non-municipal wells.

The coverage for ground water pumpage data varies by island, and pumpage reporting is only complete for the island of Lānaʻi. Water use data is reported for only 1,251 of the 2,699 existing production wells in the state, a compliance rate of 46%.

⁴ Commission on Water Resource Management. (2009). *Stream Diversion Measurement Methods*. Honolulu, HI. Prepared by Element Environmental LLC.

Table H-2 Status of Ground Water Use Reporting by Island for 2016

Island	Total # of Production Wells ¹	# Production Wells Reported	Largest Reporter/ # Production Wells Reported
Kaua'i	288	139	DOW ² /67
O'ahu	818	491	BWS ³ /220
Moloka'i	89	40	KPHA ⁴ /7
Lāna'i	10	10	LWC ⁵ /10
Maui	567	240	DWS ⁴ /46
Hawai'i	927	331	DWS ⁶ /71
TOTAL	2,699	1,251	

1. Production Wells are defined as all wells that are not abandoned, observation, or unused wells.
2. Kaua'i Department of Water
3. Honolulu Board of Water Supply
4. Kawela Plantation Homeowners Association
5. Lāna'i Water Company
6. Hawai'i Department of Water Supply

H.3.2 Reported Ground Water Use by Island and Category

Table H-3 summarizes reported total ground water use during the calendar year 2016 for the six major Hawaiian Islands by ground water use category. Based on the values shown in the table, O'ahu uses the most ground water, withdrawing over 177 MGD primarily for municipal purposes (which includes many categories and subcategories of use). By contrast, ground water use is lowest on both Moloka'i and Lāna'i, with approximately 4.25 MGD of ground water being withdrawn. Municipal uses account for about 56% of total reported water use statewide. This is partly a reflection of the high reporting compliance rate of the municipalities, relative to other ground water users. Statewide, total reported ground water use exceeds 395 MGD. It should be noted that the figures in the table above exclude wells that are categorized as "other" in their use category, which results in a slight discrepancy with later tables that depict water use from all fresh water well sources.

Table H-3 Summary of 2016 Reported Ground Water Use¹

Island	Use Category (MGD)						Island Total
	Agriculture	Domestic	Industrial	Irrigation	Military	Municipal	
Kaua'i	9.17	0.02	0.18	0.30	0.25	13.13	23.06
O'ahu	9.3	3.00	1.72	4.81	21.22	137.78	177.85
Moloka'i	0.43	0.00	0.0	0.04	0.00	2.00	2.47
Lāna'i	0.00	0.00	0.00	0.70	0.00	1.08	1.78
Maui	14.57	0.03	35.96	5.01	0.00	27.83	83.39
Hawai'i	0.68	0.06	49.18	16.08	0.00	41.42	107.41
Use Total	34.16	3.11	87.03	26.94	21.4	223.23	395.96

1. Values shown as a 12-month average from 1/1/2016 to 12/31/2016 for all fresh ground water sources, which excludes wells categorized as "other", saltwater and caprock sources.

Based on the values shown above, O'ahu uses the most ground water, withdrawing over 177 MGD primarily for municipal purposes (which includes many categories and subcategories of use). By contrast, ground water use is lowest on both Moloka'i and Lāna'i, with approximately 4.25 MGD of ground water being withdrawn. Municipal uses account for about 56% of total reported water use statewide. This is partly a reflection of the high reporting compliance rate of the municipalities, relative to other ground water users. Statewide, total reported ground water use exceeds 395 MGD. It should be noted that the figures in the table above exclude wells that are categorized as "other" in their use category, which results in a slight discrepancy with later tables that depict water use from all fresh water well sources.

H.3.2.1 Gaps in Ground Water Use Reporting

Better reporting is needed for all islands, except Lāna'i. Ground water pumpage reporting on all other islands is not adequate to supply a reasonable representation of total water usage.

H.3.2.2 Recommendations for Ground Water Use Reporting

The following actions are recommended for improving ground water use reporting:

- CWRM should continue development of the ground water use database to implement an automatic notification system that will flag delinquent reports and send notices to well owners/water users that have neglected to send in pumpage reports by aquifer system area. This will help to prioritize ground water management areas and other aquifer system areas where outreach has been completed.

- CWRM should consider resurrecting the monthly newsletter (see **Section I.2 of Appendix I “CWRM Regulatory Programs”**) to provide up-to-date information on deep monitor well, chloride, water-level, and/or water use information currently collected by CWRM.
- Continue staff efforts and also hire consultants to conduct online water use reporting outreach, field verification, and to encourage compliance throughout the State.
- Enforce reporting compliance using the Department's Civil Resource Violation System.

H.3.3 Water Use Reporting for Surface Water Sources

To date, relatively few users report surface water use to CWRM. However, these users represent many of the large irrigation systems which use the majority of surface water statewide. CWRM staff is continuing to work with water users in the field and promote the use of the WRIMS to improve reporting and data record accessibility.

H.3.3.1 Reported Surface Water Use by Island

Table H-4 summarizes reported surface water use as of December 31, 2016, for six of the major Hawaiian Islands, by water use category:

Table H-4 Summary of Reported Surface Water Use (2016)

Island	Total (MGD) ¹
Kaua'i	186.907
O'ahu	13.811
Moloka'i	0.000
Lāna'i	0.000
Maui	117.508
Hawai'i	56.340

¹ Sum of 12-month moving averages for available water use reported from January to December 2016.

H.3.3.2 Gaps in Surface Water Use Reporting

Surface water use data: There remains a deficit of surface water use data statewide; however, CWRM has made great strides in water use data collection. The focus remains on water use reporting for large irrigation systems.

CWRM is continuing to develop and refine its database system to store and manage surface water data similar to that of the Ground Water Regulation Branch's database for ground water use data. CWRM is also working closely with landowners and system operators statewide to get more surface water gaging and water use reporting data into its information management system.

Guidelines for measuring water use: Although some stream diversions without monitoring devices were previously allowed to defer reporting, those 1992 exemptions, which have since been repealed, still identified reporting of use as important. This is evident in that CWRM directed its staff to create and adopt guidelines for appropriate measuring devices and methods for measuring diverted flow. In response to this directive, CWRM compiled various methods for measuring diverted streamflow. This handbook⁵ serves as a starting point to inform users of the various types of methods that are available as CWRM continues to develop its surface water use reporting program.

Field Verification of Declared Stream Diversions: When CWRM conducted the Registration/Declaration process in 1990, many of the Registration of Stream Diversion Works and Declaration of Water Use applications were not field verified. In 2009, CWRM hired a contractor to verify stream diversions statewide based on a prioritized listing. The project resulted in only Maui and Kaua'i being studied in large part due to high travel and staffing costs. CWRM was also in the process of transitioning to a new information management system, meaning that much of the data has yet to be reviewed and the records updated. CWRM will continue to work towards development of a regular field-investigation schedule to inspect surface water diversions and monitor water use.

Plantation-Ditch Systems: Formerly, surface water use was tied primarily to sugar cane and other plantation crops. Many plantation-ditch operators monitored streams and ditch systems for flow volumes and kept detailed records of rainfall conditions and diverted flows. The remaining plantation-ditch systems are typically underutilized, as former sugar cane lands are no longer in crop production or have been converted to other uses. Different portions of a ditch system may be under the ownership of several different entities, and maintenance and monitoring efforts may vary considerably between owners. Also, flow monitoring gages for these systems may no longer be in existence or may no longer be useful for monitoring the total diverted flow. As part of its efforts to implement priority actions identified in the 2013 Hawai'i Water Conservation Plan, CWRM staff contracted with the USGS in 2013 to conduct on-site training workshops

⁵ Commission on Water Resource Management. (2009). Stream Diversion Measurement Methods. Honolulu, HI. Prepared by Element Environmental LLC.

statewide for measuring water flow and reporting water use for large-scale stream diversion ditch systems. This education and outreach effort, which was completed in 2014, will aid current ditch operators and owners in meeting the mandate for surface water use reporting. Outreach and education on surface water use reporting is being conducted by CWRM staff for small surface water diversions systems.

H.3.3.3 Recommendations for Surface Water Use Reporting

The following actions are recommended for improving surface water use reporting:

- CWRM must continue expanding its education and outreach to landowners and surface water system operators to further develop its collection of surface water use data statewide.
- CWRM needs to vigorously work on updating its information system with previously completed efforts to verify surface water diversions (Kaua'i and Maui) in order to identify key surface water users to focus implementation of surface water use reporting requirements.
- Complete efforts to verify surface water diversions on all islands.
- Enforce reporting requirements using the DLNR's Civil Resource Violation System.

H.4 Assessing Existing Water Demands

Existing water demands are recorded and archived to varying degrees by several entities statewide. However, water demand data provided by different sources may not represent the same water users or water demand categories, as each agency or entity produces demand information in the form most useful for their respective purpose.

CWRM examines water demands in terms of hydrologic units. CWRM demand data is regional in scale and dependent upon the accuracy and completeness of water use reports provided to the agency by users.

In contrast, municipal water agencies can monitor water demand by looking at customer service areas and billing categories. This data provides an excellent picture of water use by customer distribution, but typically does not provide information on water use outside of the system service area.

The USGS also compiles water demand from public and private water systems, including military bases. Water demand data as assessed by CWRM, county water agencies, and the USGS are provided in the following sections.

H.4.1 CWRM Assessment of Existing Water Demands

CWRM relies on reported water use data to quantify ground water and surface water demands. While CWRM receives considerable information on statewide ground water demand, surface water demand data is lacking.

H.4.1.1 Summary of Existing Ground Water Demands

CWRM is able to track and quantify ground water demand through its water use reporting program. To protect ground water resources, CWRM must continually monitor water use, to ensure that the total withdrawal from an aquifer does not exceed its sustainable yield. Pumping an aquifer above its sustainable yield can result in seawater intrusion and negative impacts to the resource. CWRM uses a twelve-month moving average to assess water use (see **Section I.2.5 of Appendix I CWRM Regulatory Programs**).

As discussed in **Appendix I**, when actual ground water withdrawals or authorized planned uses may cause the maximum rate of withdrawal to exceed 90% of the aquifer's sustainable yield, CWRM may designate the area as a water management area and regulate water use through the issuance of water use permits. Once an area has been designated, CWRM continues to monitor water use for compliance with allocation limits.

Table H-5 to Table H-10 summarize existing demands as of December 2016, in relation to aquifer system area sustainable yields for each of the six major Hawaiian Islands. Water use is based on reported pumpage as of December 31, 2016, unless otherwise noted. Differences in values from **Table H-3** are a result of reported pumpage from all production wells being listed, and not limited to the categories in **Table H-3**. Aquifer sustainable yields are those are being proposed in this update of the WRPP. Because caprock and saltwater withdrawals do not count against aquifer sustainable yields, water withdrawn from caprock and saltwater sources are excluded from the tables. The only exception is the inclusion of the 'Ewa Caprock Aquifer Sector Area on O'ahu, consisting of the Malakole, Kapolei, and Pu'uloa Aquifer System Areas, which overlies portions of the Pearl Harbor Sector Area. The 'Ewa Caprock Aquifer Sector Area has been designated as a separate ground water management area.⁶ For the islands of O'ahu and Moloka'i, where most or all of the aquifer system areas have been designated as ground water management areas, a comparison of total allocations to sustainable yields established is also presented. Existing water reservations in designated water management areas are considered a water allocation and are also counted against sustainable yields.

⁶ The 'Ewa Caprock Aquifer Sector has been declared a non-potable aquifer by CWRM. This brackish resource support mainly irrigation and industrial uses. CWRM has adopted a chloride limit of 1,000 mg/l for individual irrigation wells in lieu of an aggregate sustainable yield figure. No chloride limit has been set for industrial wells.

Table H-5 Existing Demands by Aquifer System Area, Island of Kaua'i 2016

(Aquifer Code Number) Aquifer Sector	Sustainable Yield (SY) (MGD)	Existing Water Use (MGD) 12 MAV	SY minus pumpage (MGD)	Existing Water Use as a Percent of SY
(20101) Koloa	29	4.89	24.11	16.9%
(20102) Hanamā'ulu	27	1.98	25.02	7.3%
(20103) Wailua	51	0.36	50.64	0.7%
(20104) Anahola	21	2.34	18.66	11.2%
(20105) Kilauea	10	0.74	9.26	7.4%
(20201) Kalihiwai	16	1.23	14.77	7.7%
(20202) Hanalei	35	0.18	34.82	0.5%
(20203) Wainiha	24	0.18	23.82	0.8%
(20204) Nāpali	20	NRU	NRU	NRU
(20301) Kekaha	10	1.76	8.24	17.6%
(20302) Waimea	37	0.06	36.95	0.1%
(20303) Makaweli	26	1.52	24.49	5.8%
(20304) Hanapepe	22	7.85	14.15	35.7%
KAUA'I TOTAL	328	23.09	304.91	7.0%

NRU: No reported water use. There are no reports of ground water use to CWRM

NOTE: Kaua'i aquifers are not designated ground water management areas; therefore withdrawals do not require water use permits.

Table H-6 Existing Demands by Aquifer System Area, Island of O‘ahu 2016

(Aquifer Code Number) Aquifer System	Sustainable Yield (SY) (MGD)	Existing Permit Allocation (MGD)	Unallocated SY (MGD)	Existing Water Use (MGD) 12 MAV	SY minus pumpage (MGD)	Existing Water Use as a % of SY
(30101) Pālolo ¹	5	5.646	-0.646	5.68	-0.68	113.6%
(30102) Nu‘uanu ¹	14	15.165	-1.165	13.97	0.03	99.8%
(30103) Kalihi	9	8.776	0.224	5.50	3.50	61.1%
(30104) Moanalua ¹	16	19.960	-3.960	11.50	4.50	71.9%
(30105) Wai‘alae-West ⁷	2.5	2.797	-0.297	1.75	0.75	70%
(30106) Wai‘alae-East	2	0.79	1.210	0.16	1.84	7.8%
(30201) Waimalu	45	46.951	-1.951	37.60	7.41	83.6%
(30203) Waipahu-Waiawa	105	85.465 ⁵	18.535	54.52	50.48	51.9%
(30204) ‘Ewa-Kunia	16	15.045	0.955	9.60	6.40	60.0%
(30205) Makaīwa	<1					
(30207) Malakole ³	1,000 mg/l					
(30208) Kapolei ³	1,000 mg/l					
(30209) Pu‘uloa ³	1,000 mg/l					
(30301) Nānākuli ²	1	N/A	N/A	NRU	NRU	NRU
(30302) Lualualei ²	3	N/A	N/A	0.13	2.87	4.3%
(30303) Wai‘anae ²	3	N/A	N/A	2.77	0.23	92.3%
(30304) Mākaha ²	3	N/A	N/A	2.68	0.32	89.3%
(30305) Kea‘au ²	3	N/A	N/A	0.00	3.00	0.0%
(30401) Mokulē‘ia	17	7.620	9.380	0.33	16.67	1.9%
(30402) Waialua	17	13.250	3.750	3.83	13.17	22.5%
(30403) Kawaiiloa	22	1.641	20.359	0.12	21.88	0.5%
(30501) Wahiawā	23	22.978	0.022	8.70	14.30	37.8%
(30601) Ko‘olau Loa	35	19.970	15.030	6.78	28.22	19.4%
(30602) Kahana	15	1.101	13.899	0.96	14.05	6.4%
(30603) Ko‘olau Poko	28	10.312	17.688	10.38	17.62	37.1%
(30604) Waimānalo	9	1.843 ⁶	7.157	0.90	8.10	10.0%
O‘AHU TOTAL⁴	393.5	292.351	101.149	177.84	215.66	45.2%

1. For the Pālolo, Nu‘uanu, Moanalua, and Waimalu ASYAs, total water use permit allocations exceed the aquifers' sustainable yields because declared existing uses at the time of designation exceeded the subsequent establishment of SYs for these aquifers. CWRM is monitoring the conditions in these over-allocated aquifers to determine whether the SYs can be adjusted based on operational experience or water use permit allocations may be reduced due to nonuse as land use changes or new sources come online.
2. No ASYAs in the Wai‘anae Sector Area have been designated as ground water management areas.
3. The ASYAs within the ‘Ewa Caprock Sector Area are managed by a chloride limit of 1,000 mg/l for individual irrigation wells rather than an aggregate SY number. CWRM has not yet established a chloride limit for individual industrial wells.
4. Excludes ‘Ewa Caprock Aquifer Sector Area.

5. Includes DHHL reservation for 1.358 MGD, which should not be considered available for allocation. The 1.358 mgd reservation amount is the remaining balance for the 1.724 mgd reservation established under HAR 13-171-61, of which 0.366 mgd has been converted to water use permits.
6. Includes DHHL reservation for 0.124 MGD, which should not be considered available for allocation.
7. Updated recharge data suggest a sustainable yield of 3 mgd; however, upon its July 16, 2019 adoption of the updated WRPP, the Commission amended the proposed sustainable yield for Wai'alaie-West from 3 to 2.5 mgd, conditioned on the Honolulu Board of Water Supply providing: 1) 100% compliance with their water use reporting requirement (i.e., monthly reporting of water levels, chlorides, and pumpages); and 2) Installation of a new deep monitor well in the Wai'alaie-West Aquifer System Area.

NRU: No reported water use. There are no reports of ground water use to CWRM for this aquifer system

Table H-7 Existing Demands by Aquifer System, Island of Maui, December 2016

(Aquifer Code Number) Aquifer System	Sustainable Yield (SY) (MGD)	Existing Water Use (MGD) 12 MAV	SY minus pumpage (MGD)	Existing Water Use as a Percent of SY
(60101) Waikapū	3	0.19	2.81	6.3%
(60102) ʻĪao	20	14.19	2.84	71.0%
(60103) Waiheʻe	8	4.67	3.33	58.4%
(60104) Kahakuloa	5	NRU	NRU	NRU
(60201) Honokōhau	9	NRU	NRU	NRU
(60202) Honolua	8	2.56	5.44	32.0%
(60203) Honokōwai	6	3.25	2.75	54.2%
(60204) Launiupoko	7	0.40	6.61	5.7%
(60205) Olowalu	2	0.12	1.88	6.0%
(60206) Ukumehame	2	0.04	1.96	2.0%
(60301) Kahului	1	52.58	-51.49	5257.5%
(60302) Pāʻia	7	0.51	6.49	7.3%
(60303) Makawao	7	0.37	6.64	5.2%
(60304) Kamaʻole	11	2.93	8.07	26.6%
(60401) Haʻikū	24	0.78	23.22	3.3%
(60402) Honopou	16	0.01	15.99	0.1%
(60403) Waikamoi	37	NRU	NRU	NRU
(6404) Keʻanae	75	0.04	74.96	0.1%
(60501) Kūhiwa	14	0.02	13.98	0.2%
(60502) Kawaipapa	31	0.72	30.28	2.3%
(60503) Waihoʻi	18	NRU	NRU	NRU
(60504) Kīpahulu	15	0.01	14.99	0.1%
(60601) Kaupō	13	0.00	13.00	0.0%
(6062) Nakula	7	NRU	NRU	NRU
(60603) Lualaʻilua	11	0.00	11.00	0.0%
MAUI TOTAL	357	83.39	273.61	23.4%

NRU: No reported water use. There are no reports of ground water use to CWRM for this aquifer system

NOTE: Only the ʻĪao ASYA is a designated ground water management area; therefore, withdrawals from the remaining ASYAs do not require water use permits. 2018 permitted allocations (excluding high level sources) in the ʻĪao ASYA total 19.089 MGD, or about 95% of sustainable yield.

Table H-8 Existing Demands by Aquifer System, Island of Moloka'i, December 2016

(Aquifer Code Number) Aquifer System	Sustainable Yield (SY) (MGD)	Existing Permit Allocations (MGD)	Unallocated SY (MGD)	Existing Water Use (MGD) 12 MAV	SY minus pumpage (MGD)	Existing Water Use as a Percent of SY
(40101) Kaluako'i	2	0.016	1.984	NRU	NRU	NRU
(40102) Punakou	2	0	2.000	NRU	NRU	NRU
(40201) Ho'olehua	2	0	2.000	NRU	NRU	NRU
(40202) Pala'au	2	0.663	1.337	0.34	1.66	17.1%
(40203) Kualapu'u	5	3.824 ¹	1.176	1.42	3.58	28.4%
(40301) Kamiloloa	3	0.211	2.789	0.04	2.96	1.3%
(40302) Kawela	5	0.786	4.214	0.35	4.65	6.9%
(40303) 'Ualapu'e	8	0.246	7.754	0.29	7.71	3.6%
(40304) Waialua	6	0.437	7.563	0.00	6.00	0.0%
(40401) Kalaupapa	2	.094	1.9	NRU	NRU	NRU
(40402) Kahanui	3	0.094	2.906	NRU	NRU	NRU
(40403) Waikolu	5	0.853	4.147	0.03	4.97	0.6%
(40404) Hā'upu	2	0	2.000	0.00	2.00	0.0%
(40405) Pelekunu	9	0	9.000	NRU	NRU	NRU
(40406) Wailau	15	0	15.000	NRU	NRU	NRU
(40407) Hālawā	8	0	8.000	NRU	NRU	NRU
MOLOKA'I TOTAL	79	7.130	71.87	2.46	76.54	3.1%

¹ Includes DHHL reservation for 2.905 MGD, which should not be considered available for allocation
NRU: No reported water use. There are no reports of ground water use to CWRM for this aquifer system.

Table H-9 Existing Demands by Aquifer System Area, Island of Lānaʻi, December 2016

(Aquifer Code Number) Aquifer System	Sustainable Yield (SY) (MGD)	Existing Water Use (MGD) 12 MAV	SY minus pumpage (MGD)	Existing Water Use as a Percent of SY
(50101) Windward	3	0.27	2.73	8.9%
(50102) Leeward	3	1.51	1.49	50.4%
(50201) Hauola	0	NRU	NRU	NRU
(50202) Maunalei	0	NRU	NRU	NRU
(50203) Paomaʻi	0	NRU	NRU	NRU
(50301) Honopū	0	NRU	NRU	NRU
(50302) Kaumalapau	0	NRU	NRU	NRU
(50401) Lealia	0	NRU	NRU	NRU
(50402) Mānele	0	NRU	NRU	NRU
LĀNAʻI TOTAL	6	1.78	4.22	30%

NRU: No reported water use. There are no reports of ground water use to CWRM for this aquifer system.

NOTE: Lānaʻi aquifers are not designated ground water management areas; therefore, withdrawals do not require water use permits.

Table H-10 Existing Demands by Aquifer System Area, Island of Hawai'i, December 2016

(Aquifer Code Number) Aquifer System	Sustainable Yield (SY) (MGD)	Existing Water Use (MGD) 12 MAV	SY minus pumpage (MGD)	Existing Water Use as a Percent of SY
(80101) Hāwī	11	0.60	10.40	5.4%
(80102) Waimanu	110	NRU	NRU	NRU
(80103) Māhukona	10	1.61	8.39	16.1%
(80201) Honokaa	29	0.615	27.385	2.2%
(80202) Pa'auilo	56	0.090	52.910	0.2%
(80203) Hakalau	150	0.159	149.841	0.1%
(80204) Onomea	147	0.312	146.688	0.2%
(80301) Waimea	16	13.83	2.17	86.4%
(80401) Hilo	349	44.26	304.74	12.7%
(80402) Kea'au	395	11.06	383.94	2.8%
(80501) 'Ōla'a	125	NRU	NRU	NRU
(80502) Kapāpala	19	NRU	NRU	NRU
(80503) Naalehu	118	1.05	116.95	0.9%
(80504) Ka Lae	31	NRU	NRU	NRU
(80601) Manukā	25	0.06	24.94	0.2%
(80602) Ka'apuna	51	0.00	51.00	0.0%
(80603) Kealakekua	38	1.96	36.04	5.2%
(80701) 'Anaeho'omalu	30	5.45	24.55	18.2%
(80801) Pahoā	432	0.86	431.14	0.2%
(80802) Kalapana	158	0.06	157.94	0.0%
(80803) Hilina	20	NRU	NRU	NRU
(80804) Keaīwa	17	NRU	NRU	NRU
(80901) Keauhou	38	18.13 ¹	19.87	48%
(80902) Kīholo	18	8.01	9.99	44.5%
HAWAI'I TOTAL	2393	108.12	2284.88	4.5%
HAWAI'I STATE WIDE	3556.5	409.75	3146.75	11.5%

1 Includes DHHL reservation for 3.398 MGD, which should not be considered available for allocation.

NRU: No reported water use. There are no reports of ground water use to CWRM for this aquifer system.

NOTE: Hawai'i island aquifers are not designated ground water management areas; therefore, withdrawals do not require water use permits.

Table H-5 shows that total reported pumpage on Kauaʻi is well within the sustainable yield for all aquifer system areas. Islandwide, reported water use is only 7% of the island’s total sustainable yield. Unlike Oʻahu, Kauaʻi does not have an extensive municipal distribution system. Residents in many areas rely on individual, domestic wells. For the most part, water used by individual, domestic users is not reflected in **Table H-5**, due to past exemptions from water use reporting, and lack of compliance and enforcement of reporting requirements for small-capacity, domestic wells.

Table H-6 shows that total reported pumpage on Oʻahu is within the sustainable yield for most aquifer system areas. However, pumpage from the Pālolo aquifer exceeds the sustainable yield limit by 0.68 MGD because existing uses at the time of designation exceeded the subsequent establishment of sustainable yields for these aquifers. CWRM should establish a deep well monitoring network in aquifers that are either overpumped or close to sustainable yield to determine if the pumpage is sustainable, and if so, amend the theoretical sustainable yields based on operational experience. If the data show unacceptable impacts to the aquifers, CWRM should require pumpage and permitted uses to be reduced. Historically these aquifers, along with several others in the Honolulu and Pearl Harbor sector areas, have been over-allocated.

Table H-6 also shows that the total existing ground water withdrawals for Oʻahu are about 114 MGD less than total water use permit allocations (including DHHL reservations). A portion of the unused allocation is earmarked to provide for future demands. There is also a significant volume of water allocated to agricultural water use permits that remains unused due to the closure of plantation agriculture, particularly in the Central and North Sector Areas. CWRM may revoke permitted allocations due to four years or more of continuous non-use.

Existing ground water demand on Maui is summarized in **Table H-7**. The table indicates that the Kahului Aquifer System Area within the Central Aquifer Sector Area is being overpumped by over 5,000%. Pumpage is currently sustainable at these levels because there is a substantial quantity of return irrigation recharge in the Central Aquifer Sector Area that has not been factored into the established sustainable yields of these two aquifers. Much of the irrigation water applied on the central isthmus comes from surface water delivered via ditch systems from East Maui. Should these diversions be reduced, the artificial recharge will also be reduced. Further discussion on sustainable yields is contained in **Appendix F “Inventory and Assessment of Resources”** of the WRPP.

Another noteworthy statistic on Maui is the pumpage of the Īao Aquifer System Area at about 71% of its sustainable yield. CWRM designated the Īao Aquifer System Area as a ground water management area, effective July 21, 2003. Water use permits are now required for all non-individual domestic ground water uses. Īao Aquifer has a sustainable yield of 20 MGD, with the existing permit allocations of 19.089 MGD counted against the sustainable yield. It should also be noted that high level ground water sources are not counted against the total water use permit allocation for Īao Aquifer.

Also noteworthy on Maui is the concentration of Waihe'e pumpage along the Īao-Waihe'e Aquifer System Area boundary. Roughly half the sustainable yield of Waihe'e is pumped along this boundary which is a concern as water can flow across system boundaries, exacerbating the pressure on the Īao ground water management area.

Water use permit allocations on Moloka'i are only about 9% of the island's total sustainable yield. Existing withdrawals are even less, at approximately than 3% of total sustainable yield (see **Table H-8**). The Kualapu'u Aquifer System Area is the most heavily utilized, with reported water use at about 28% of the aquifer's sustainable yield. Additionally, the remanded contested case hearing for Moloka'i Ranch's actual needs in the Kualapu'u Aquifer System Area have yet to be determined.

Lāna'i is mostly privately owned and is the least populated of the major islands, with the exception of Ni'ihau. Ground water pumpage is reported for two of its nine aquifer system areas. Existing withdrawals, shown in **Table H-9**, total about 30% of total sustainable yield for the island.

The island of Hawai'i has the greatest amount of ground water resources, with over 2,300 MGD estimated to be available for development. Islandwide, only 4.5% of ground water is reportedly being used, as shown in **Table H-10**. Like Kaua'i, the municipal water distribution system does not cover large parts of the island. There are many private domestic wells that serve residential needs. For the most part, these uses are not reflected in the table.

H.4.1.2 Summary of Existing Surface Water Demands

Surface water demands are difficult to quantify for numerous reasons. Presently, there is a deficiency in surface water use data. In addition to past exemptions, which deferred the requirement for surface water use reporting (see **Section H.3**), quantification of surface water demand is hindered by the lack of information on stream diversions (field verification information), changes in water use by large-scale agricultural systems, and the difficulties associated with measuring diverted flow. The types of diversion structures range widely from PVC pipes or large concrete structures set within the stream bed, to hand-built rock walls for taro lo'i. As a result, diversion amounts may also vary widely with rainfall freshets, as well as the relative ease with which some diversions can be installed, removed, or altered.

Another difficulty in measuring surface water use is the utilization, cost and location of accurate and appropriate water measurement devices. For many large irrigation systems, it is not practical to measure every stream diversion, therefore only a handful of gaging stations may exist at key locations along the length of the system to provide cumulative flow amounts. For smaller water users, the cost, operation and maintenance of installing a gaging device is a prohibitive factor. However, as noted earlier, CWRM staff has worked with the USGS to conduct on-site training workshops statewide for measuring water flow and reporting water use for large-scale stream diversion ditch systems. This education and outreach effort will aid current ditch operators and owners in meeting the mandate for surface water use reporting. Outreach and education for small surface water diversion systems is being conducted by CWRM staff. CWRM data on surface water demand is limited to information on reported water use, as shown in **Table H-4**.

CWRM has limited information to contribute to the quantification of historical surface water use and demand. **Section H.3** discusses CWRM's 1989 efforts to register declarations of water use and stream diversion works in accordance with the State Water Code and administrative rules. Through the registration process, CWRM collected information on stream diversions and surface water use at that time. The registration provides a "snapshot in time" of the existing water sources and uses at that time.

Appendix P is a summary of the 1989 declared surface water use for each Surface Water Hydrologic Unit. Field verifications of declared stream diversions and surface water use were conducted for diversions on Moloka'i, in parts of O'ahu, Kauai, and Maui. However, while the existence of declared diversions were verified, there was difficulty in quantifying the diverted amounts. Therefore, most of the quantities listed in **Appendix P** are unverified and may represent the declarant's desire to reserve or claim water for intended future use. Many water use declarations indicate volumes of water that do not correlate with the declared use, while other declarations claim use of all available stream flow. Furthermore, some declared water use volumes are omitted from **Appendix P** because the declarant provided cumulative use amounts across several Surface Water Hydrologic Units; these volumes could not be assigned to specific hydrologic units. Thus, much of the information in **Appendix P** is based on unverified and dated user declarations and the information is included in this document for reference purposes only. However, this represents the best available information on diverted surface water amounts for most areas in the State.

H.4.2 County Assessments of Existing Water Demands

For the purposes of this report, county water departments provided municipal water use data to characterize existing water demands in terms of the agency's customer billing categories. This data represents existing water use only from county water systems and is intended to provide information on the relative distribution of demands across various use categories. County assessments of existing water demand data are presented in the tables below.

Table H-11 County of Kaua'i 2012 Municipal Water Use (MGD)

Water Use Category	2012
Department of Water Premise Type	
Agriculture	
Agriculture	0.291
Domestic – Residential	0.007
Single-Family Dwelling	6.032
Multi Family Dwelling	1.285
Housing – State	0.002
Domestic – Non-Residential	
Commercial	0.960
Hotel	1.713
Resort	0.030
Religious	0.084
Schools – State	0.031
Industrial	
Industrial	0.040
Irrigation	
Golf Course – Private ¹	0.000
Irrigation – Private	0.061
Parks – County	0.006
Irrigation - City	0.004
Military	
United States Military Facility	0.020
Municipal	
County of Kaua'i	0.394
State Facility	0.512
United States Non-Military Facility	0.011
Total	11.483

¹ Private golf course water use was 59,000 gallons.

Note: Consumption data for Fiscal Year 2011-2012.

Source: Kaua'i Department of Water, November 22, 2013 Letter and January 9, 2104 Email.

Table H-12 City and County of Honolulu 2012 Municipal Water Use (MGD)

Water Use Category Honolulu BWS Metered User Type	2012
Agriculture	3.40
Agriculture	3.40
Residential	73.41
Mixed Residential	0.54
Multi-Family High Rise	4.56
Multi-Family Low Rise	7.30
Single-Family Dwelling	47.39
Multi-Family Dwelling	13.36
Housing - State	0.26
Non-Residential	34.33
Commercial	20.87
Hotel	5.07
Mixed Use	3.63
Private Schools	0.38
Religious	0.43
Resort	0.01
State Schools	3.95
Industrial	2.51
Industrial	2.51
Irrigation	7.59
Irrigation - City	0.13
Irrigation – Private	2.08
Irrigation - State	0.64
City Golf Courses	0.32
Private Golf Courses	0.97
City Parks	3.43
State Parks	0.03
Military	2.87
United States Military	2.87
Municipal	4.85
City	1.32
State	3.38
United States Non-Military	0.15
Other	0.03
Unknown	0.03
Total	128.99

Source: Honolulu Board of Water Supply, May 21, 2014 Email.

Table H-13 County of Maui 2012 Municipal Water Use (MGD)

Billing Class	2012
Agriculture ¹	1.649
Single-Family Dwelling	16.588
Multi-Family Dwelling ²	4.467
Commercial	3.273
Hotel	2.376
Industrial	0.884
Government ³	2.344
Religious Users	0.147
Total	31.728

1 Includes Irrigation-Private

2 Includes Multi-Family High Rise, Multi-Family Low Rise, Mixed Use

3 Includes Housing-County, Schools-Private, Schools-State, Irrigation-City, Irrigation-State, U.S. Military, City Facility, Parks-City, Parks-State, State Facility, U.S. Non-Military

Note: Unknown is 0.070 MGD

Source: Maui Department of Water Supply, November 26, 2013 Email.

Table H-14 County of Hawai'i 2012 Municipal Water Use (MGD)

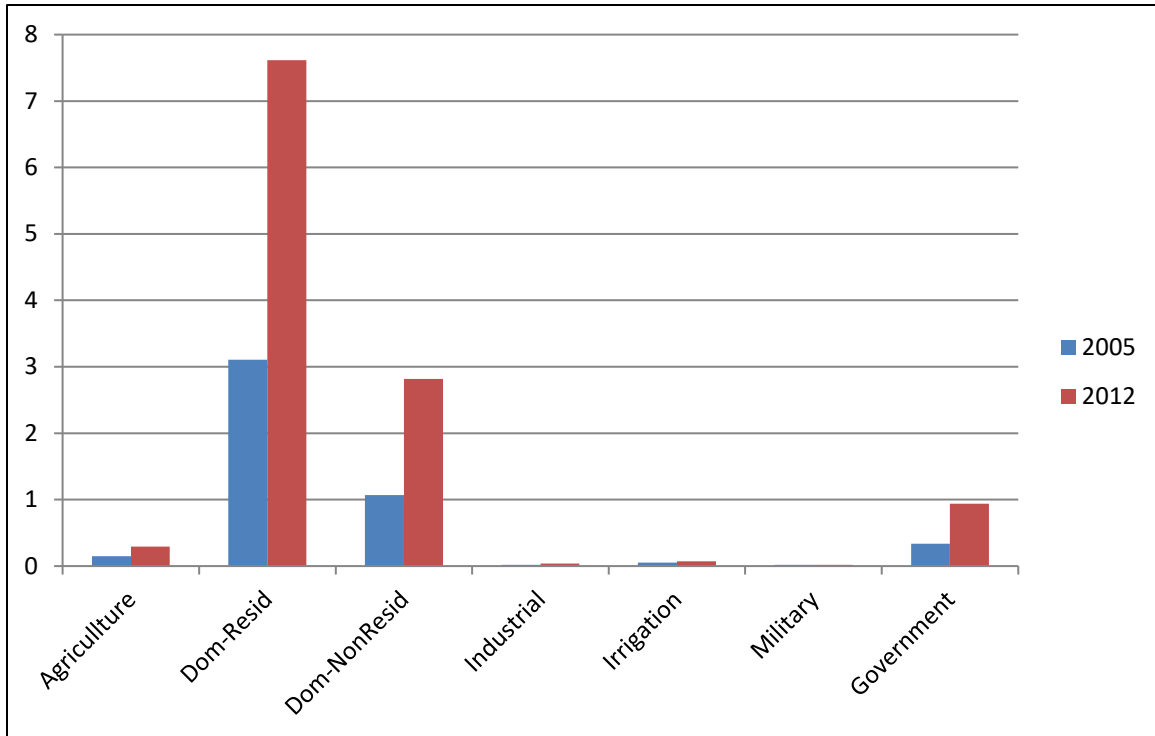
Water Use Category DWS Category	2012
Agriculture	
AG Agriculture Rate	2.238
AO Agriculture-Other	0.186
Domestic – Residential	
RM Residential – Multi	3.385
RO Residential – Other	0.010
RS Residential – Single	11.811
Domestic – Non-Residential	
SK Schools – K/12	0.078
SO Schools – Other	0.027
SU Schools – Univ	0.020
CH Comm – Hotel	1.878
CO Comm – Other	4.121
CR Comm – Restaurants	0.018
CS Comm – Stores	0.046
CV Comm – Service Station	0.001
CY Comm – Laundry	0.000
F TD Flat Rate	0.000
MH Medical – Hospital	0.005
MO Medical – Other	0.062
NC Nonprofit – Church	0.317
NO Nonprofit – Other	0.025
Industrial	
DC DC Meters	0.007
IG Industrial – General	0.000
IL Industrial – Limited	0.000
IO Industrial – Other	0.000
SP Standpipe	0.017
Irrigation	
IC Irrigation – Comm	0.090
IR Irrigation – Res	0.260
Military	0.00
Municipal	
GC Gov't – County	2.699
GF Gov't – Federal	0.062
GS Gov't – State	1.166
Total	28.527

Source: Hawai'i Department of Water Supply, December 13, 2013 Email.

H.4.2.1 Municipal Water Use Trends

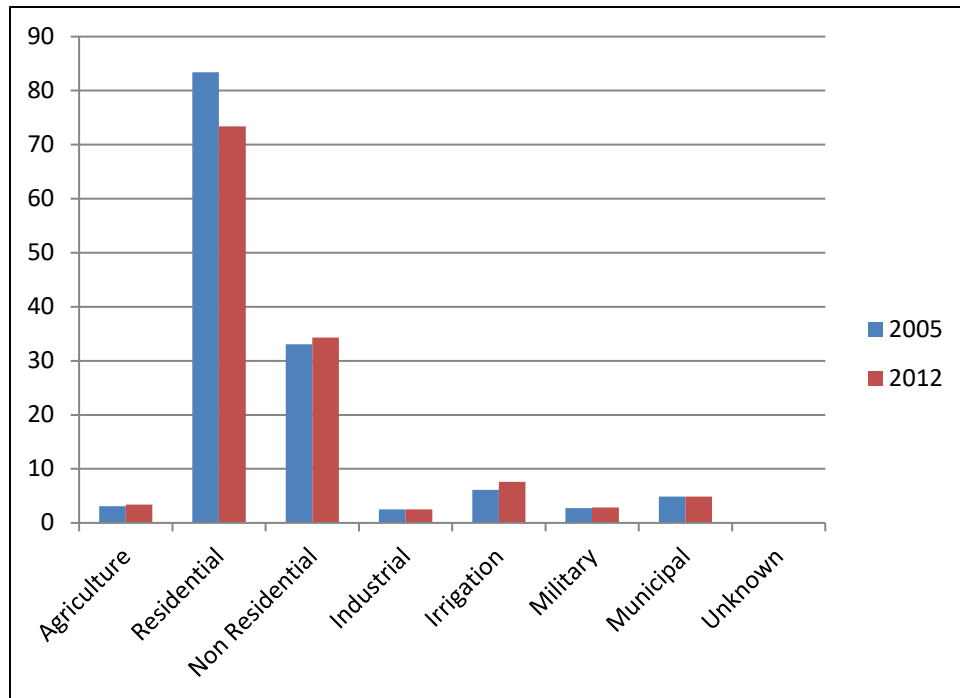
Municipal water use data from 2005-2006, documented in the 2008 WRRP, is compared to 2012 municipal water use data provided by the water departments in the figures below. **Figure H-5 to Figure H-8** show the relative changes in various water use sectors over the selected time period.

Figure H-5 County of Kaua'i 2005-2012 Municipal Water Use (MGD)



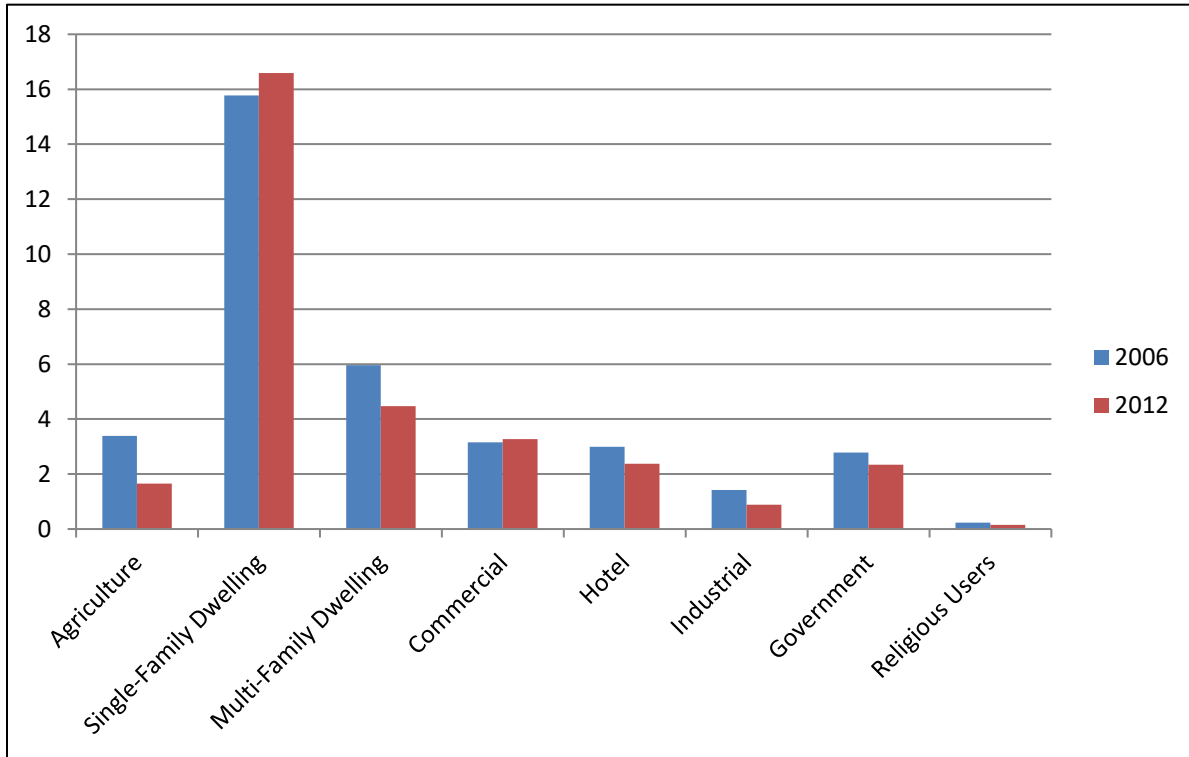
Large increases in domestic use, both residential and non-residential, have occurred since 2005. Government use has also more than doubled. The Kaua'i Department of Water is researching the reasons for these observed trends.

Figure H-6 City and County of Honolulu 2005-2012 Municipal Water Use (MGD)



Water use for all sectors on O’ahu remained flat or increased slightly, as is to be expected with an increasing population. The only sector experiencing a decrease between 2005 and 2012 is the residential component. This is probably due to ongoing public outreach and education on water conservation and initiatives.

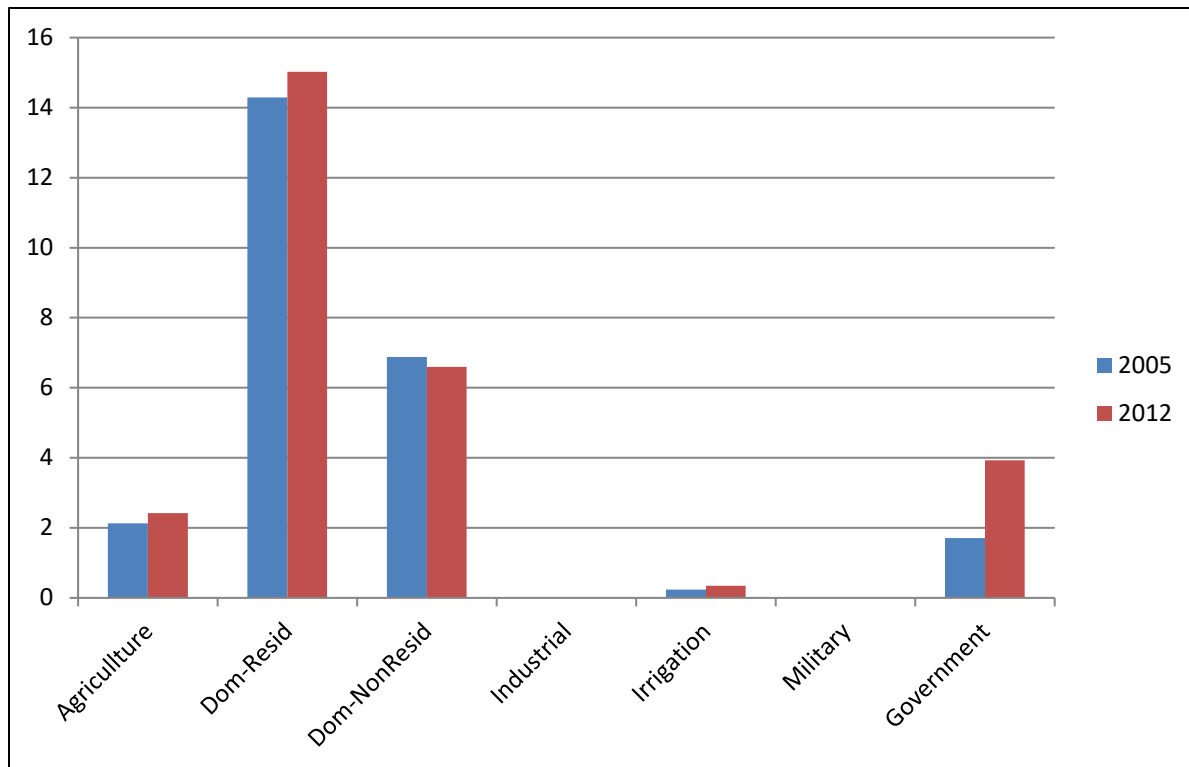
Figure H-7 County of Maui 2006-2012 Municipal Water Use (MGD)



On the island of Maui, most sectors have experienced a decline in water use. Conservation measures are likely a contributing factor, but the economic recession beginning in 2008 has also contributed to the observed trend. Single family use is directly correlated to population growth, so this sector has seen an overall increase, even with targeted conservation measures. It might also be assumed that there are more persons per single family household due to the current housing shortage.⁷

⁷ Maui Department of Water Supply, June 19, 2017 email communication.

Figure H-8 County of Hawai'i 2005-2012 Municipal Water Use (MGD)



Except for non-residential domestic use which shows a slight decrease from 2005 to 2012, water use for all categories in the County of Hawai'i showed slight increases, which is most likely attributable to population increases. Government water use increased significantly due to the expansion or construction of new facilities, such as the airport and harbors expansions; elementary, high school and university (Hilo) expansions; new West Hawai'i Civic Center; new judiciary building in Hilo, and new police and fire departments in Pahoa.⁸

⁸ Hawai'i Department of Water Supply, August 29, 2014 email communication.

H.4.3 2015 USGS Assessment of Existing Water Demands

Freshwater use data is compiled by the USGS and is updated approximately every five years. Most recently completed in 2015, the data includes water use from public and private water systems serving cities and military bases. Water used for domestic, commercial, recreational, industrial, and thermoelectric purposes is included, as well as water used in water and wastewater treatment, pools, parks, and other facilities.

Table H-15 2015 Freshwater Use by Type and by County

Use	State total	Hawai'i	Honolulu	Kalawao ²	Kaua'i	Maui
	(Million gallons per day)					
Ground water	502.53					
Public supply ¹	252.31	37.38	168.78	0.01	13.67	32.47
Domestic	144.48	0	143.81	0.01	0.54	0.12
Industrial	0.24	0.21	0	0	0.03	0
Irrigation	73.8	14.47	15.09	0	1.88	42.36
Livestock	0.51	0	0.11	0	0.20	0.20
Aquaculture	8.58	6.21	1.92	0	0.34	0.11
Mining	0.89	0.34	0.48	0	0.05	0.02
Thermoelectric ³	21.72	1.48	3.74	0	0	16.50
Surface water	701.72					
Public supply ¹	14.61	2.32	0	0	2.67	9.62
Domestic	7.44	7.44	0	0	0	0
Industrial	0	0	0	0	0	0
Irrigation	311.26	12.19	68.65	0	23.97	206.45
Livestock	1.1	1.10	0	0	0	0
Aquaculture	10.04	6.75	3.08	0	0	0.21
Mining	0.03	0	0	0	0	0.03
Thermoelectric ³	357.24	0	356.80	0	0.44	0
Total	1204.25	89.89	762.46	0.02	43.79	308.09

- 1 Includes water withdrawn by public and private water systems for use by cities and military bases. Water withdrawn by these facilities may be delivered to users for domestic, commercial, industrial, and thermoelectric purposes, or may be used for water and wastewater treatment, pools, parks and city buildings.
- 2 Kalawao County consists of the Kalaupapa peninsula on Moloka'i and is a judicial district of Maui County. Source: U.S. Geological Survey, Water Resources, *Water Use in the United States, Estimated Use of Water in the United States County-Level Data for 2015* (<https://waterdata.usgs.gov/hi/nwis/wu>)
- 3 Does not include water withdrawn for recirculation and once-through.

H.5 Estimating Future Water Demands

The accuracy of future water use projections over the long term is subject to many influences, including economic conditions, population growth, land use policies, and conservation practices. Several methods are used to derive water demand projections and increase the accuracy of estimates.

Land use-based water demand projections are intended to evaluate the water demands of an area, relative to a certain density level based on zoning and/or land use type. Land use-based demand projections indicate the water needs anticipated with current land use policies and entitlements. This method, however, can produce unrealistically high water demand projections in the full build-out scenario at maximum allowable density. Projections based on more moderate development densities may be more useful.

Future water demand can also be estimated based on population growth projections, which assume a per-capita water demand to provide estimates over planning horizon increments of 5, 10, 15, or 20 years. Multiple growth scenarios are evaluated for each time increment to provide a range of projected demand, with the most conservative projection derived from the “high population growth” scenario. Regional population growth rates for various land use categories can also be applied to predict future residential water demand. Additionally, recent consumption rates by region and land use type can help to improve predictions of future water demand.

The primary vehicles for refining water demand projections for each of the four Counties in Hawaii are the WUDPs. Whether the demands are derived from land use, population projections, or a combination, the WUDPs provide the means to refine those demands by incorporating the information from the other components of the Hawaii Water Plan such as the State Water Projects Plan (SWPP) and the Agricultural Water Use and Development Plan (AWUDP). Additionally, the WUDP should also incorporate information on federal and private water systems, and historical water use data. The SWPP identifies future water demands for State of Hawai‘i projects. The AWUDP identifies both State and private agricultural water system demands.

H.5.1 Projected Future DHHL Water Demands

As a State agency, the water needs of the Department of Hawaiian Home Lands (DHHL) are identified in the SWPP. DHHL water needs are an identified purpose of the water resources public trust and given high priority under the Hawai‘i State Constitution and Water Code. Please refer to **Appendix C Legal Authorities and Guidance** for a discussion of DHHL’s rights under the State Constitution, Water Code, and Section 221 of the Hawaiian Homes Commission Act. In order to ensure that DHHL’s foreseeable future needs are provided for, CWRM has established water reservations by rule pursuant to HRS §174C-49(d) in designated water management areas on O‘ahu and Moloka‘i, and by regular Commission action in non-designated areas, as summarized in **Table H-16**.

Table H-16 Current DHHL Water Reservations

Hydrologic Unit	Quantity of Water Reserved (MGD)	Effective Date
Waipahu-Waiawa	1.358 ⁹	February 18, 1994
Waimanalo	0.124 ¹⁰	February 18, 1994
Kualapu'u	2.905 ¹¹	June 10, 1995
Keauhou	3.398	August 17, 2015
Waimea River	6.903	June 20, 2017

These reservations are counted against available sustainable yields or are incorporated in established instream flow standards and may not be used by other parties. The existing water needs and future demands of DHHL protected through water reservations, as well as those identified in the SWPP, must be incorporated and recognized in the Hawai'i Water Plan.

On May 16, 2017, CWRM adopted an updated SWPP prepared by DLNR's Engineering Division, the agency responsible for developing and updating the SWPP.¹² Due to limited funding, the SWPP update was only done for DHHL projects. The decision to focus on DHHL was made for several reasons: DHHL's high priority rights to water, an actively evolving project list, ownership of significant land areas, and exemption from County zoning. The 2017 SWPP update projects both potable and non-potable water needs to 2031 based on DHHL's Island Plans.

Table H-17 below summarizes mid-range cumulative potable and non-potable water demand projections to 2031 by island, based on DHHL's Island Plans. Two non-potable scenarios are presented: 1) total non-potable demands and 2) non-potable demands requiring infrastructure development. The latter scenario does not include demands from General Agricultural land use designations (unless a specific use was identified for the particular area). Most General Agriculture lands were designated as such in the Island Plans as a temporary land use designation until better uses become feasible; therefore, the plan is not recommending infrastructure development for land uses that are not permanent.

A breakdown by hydrologic unit is provided in the 2017 SWPP for both potable and non-potable needs. While DHHL does own and operate water systems, the plan envisions most of DHHL's potable development needs will be served by municipal water systems. Therefore, information contained in the 2017 SWPP update is a critical input to county water use and development planning.

⁹ HAR 13-171-61 reserves 1.724 mgd, of which 0.366 mgd has been converted to water use permits.

¹⁰ HAR 13-171-62

¹¹ HAR 13-171-63

¹² <http://files.hawaii.gov/dlnr/cwrm/planning/swpp2017.pdf>

Table H-17 Cumulative Potable and Non-Potable Water Demand Projections to 2031 by Island

Island	Primary Use	Cumulative Average Day Demand (MGD)							
		2012	2013	2014	2015	2016	2021	2026	2031
Kaua'i	Potable	0.000	0.000	0.000	0.026	0.353	0.919	2.208	2.918
	Non-Potable for Water Development	0.819	0.819	0.819	0.819	29.966	31.298	33.548	34.765
	Non-Potable	0.819	0.819	0.819	0.819	30.831	32.163	34.413	35.807
	Total for Water Development	0.819	0.819	0.819	0.845	30.319	32.217	35.756	37.684
	Total	0.819	0.819	0.819	0.845	31.184	33.082	36.621	38.726
O'ahu	Potable	0.009	0.009	0.031	0.609	0.739	0.965	5.290	5.426
	Non-Potable for Water Development	0.000	0.000	0.000	0.000	1.800	1.814	19.503	19.503
	Non-Potable	0.000	0.000	0.000	0.000	1.800	1.814	19.503	22.539
	Total for Water Development	0.009	0.009	0.031	0.609	2.539	2.779	24.793	24.929
	Total	0.009	0.009	0.031	0.609	2.539	2.779	24.793	27.965
Moloka'i	Potable	0.000	0.000	0.000	0.000	0.259	0.662	1.061	1.061
	Non-Potable for Water Development	0.000	0.000	0.000	0.000	4.721	5.360	6.091	6.091
	Non-Potable	0.000	0.000	0.000	0.000	4.721	5.360	6.091	34.985
	Total for Water Development	0.000	0.000	0.000	0.000	4.980	6.022	7.153	7.153
	Total	0.000	0.000	0.000	0.000	4.980	6.022	7.153	36.046
Lāna'i	Potable	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.067
	Non-Potable for Water Development	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Non-Potable	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total for Water Development	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.067
	Total	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.067
Maui	Potable	0.000	0.000	0.000	0.000	2.213	2.715	3.457	3.521
	Non-Potable for Water Development	0.000	0.000	0.000	0.000	1.870	11.397	11.397	11.652
	Non-Potable	0.000	0.000	0.000	0.000	1.870	11.397	11.397	27.557
	Total for Water Development	0.000	0.000	0.000	0.000	4.083	14.112	14.853	15.173
	Total	0.000	0.000	0.000	0.000	4.083	14.112	14.853	31.078
Hawai'i	Potable	0.076	0.113	0.149	0.269	1.766	3.184	4.227	9.002
	Non-Potable for Water Development	0.000	0.000	0.000	0.102	0.932	4.114	5.266	31.721
	Non-Potable	0.000	0.000	0.000	0.102	0.932	4.114	5.606	62.582
	Total for Water Development	0.076	0.113	0.149	0.371	2.698	7.298	9.493	40.722
	Total	0.076	0.113	0.149	0.371	2.698	7.298	9.833	71.584
State	Potable	0.085	0.121	0.180	0.904	5.331	8.445	16.243	21.996
	Non-Potable for Water Development	0.819	0.819	0.819	0.921	39.288	53.982	75.805	103.732
	Non-Potable	0.819	0.819	0.819	0.921	40.153	54.847	77.011	183.470
	Total for Water Development	0.904	0.941	0.999	1.825	44.619	62.427	92.048	125.728
	Total	0.904	0.941	0.999	1.825	45.484	63.292	93.253	205.466

Note: Non-Potable for Water Development represents the non-potable demands used to determine water development strategies within the 20-year planning window; Non-Potable represents the total non-potable demands, including General Agriculture demands not anticipated to be developed within the 20-year planning window.

H.5.2 Projected Future County Water Demands

According to county water agency projections, by the year 2035, water demands will approach 268 MGD statewide.

Table H-18 summarizes the water demands projected by the county water agencies through 2035. **Table H-19** through **Table H-22** provides a breakdown by county and by water demand categories or billing classes (as designated by the water departments). The tables are useful in comparing demands associated with potable and non-potable water uses. Notwithstanding the discussion of land use and population-based projections in **Section H.4**, it is noted that the demand forecasts in the tables below were prepared independently by each county; therefore, assumptions and forecast methods vary between counties.

Figure H-9 through **Figure H-16** are provided to illustrate the data in the tables and show the actual municipal use for each county from 1990 to 2010 relative to its 5-year projected future demands from 2015 to 2035. Please refer to each County's Water Use and Development Plan for more information on existing and projected future water demands.

Table H-18 Projected Water Demand for All Counties, 2020 to 2035 (MGD)

County	2020	2025	2030	2035
Kaua'i ¹	17.795	18.744	19.696	20.526 ⁶
Honolulu ²	144.8	144.3	147.2	150
Maui ³ (DWS system - includes Maui & Moloka'i)	39.945	42.913	45.856	48.808 ⁶
Lāna'i (private system) ⁴				
Hawai'i ⁵	36.941	40.786	45.031	49.718
TOTAL	239.481	246.743	257.783	268.852

1 Source: Kaua'i Department of Water, November 22, 2013 Letter.

2 Source: Honolulu BWS, June 20, 2018 Email.

3 Source: Maui Department of Water Supply, January 7, 2014 Email.

4 Lāna'i water demand information was not available from Pūlama Lāna'i at the time of this writing.

5 Source: Hawai'i Department of Water Supply, December 13, 2013 Email.

6 Data interpolated from county demand projections from 2015 to 2030.

NOTE: Water use reporting and metered data is incomplete, particularly in earlier years.

Table H-19 Kaua'i County Projected Water Demand by Use Category, 2015 to 2035 (MGD)

Use Category	2015	2020	2025	2030	2035*
Single Family	8.998	9.431	9.934	10.438	10.878
Multi Family/Resort	4.244	4.449	4.686	4.924	5.132
Commercial	1.358	1.424	1.500	1.576	1.643
Industrial	0.170	0.178	0.187	0.197	0.205
Government	1.528	1.601	1.687	1.773	1.848
Agriculture	0.679	0.712	0.750	0.788	0.822
Total	16.977	17.795	18.744	19.696	20.526

* Data Interpolated from county demand projections from 2015 to 2030.

Source: Kaua'i Department of Water, November 22, 2103 Letter.

Figure H-9 Kaua'i County Projected Water Demand by Use Category, 2015 to 2035

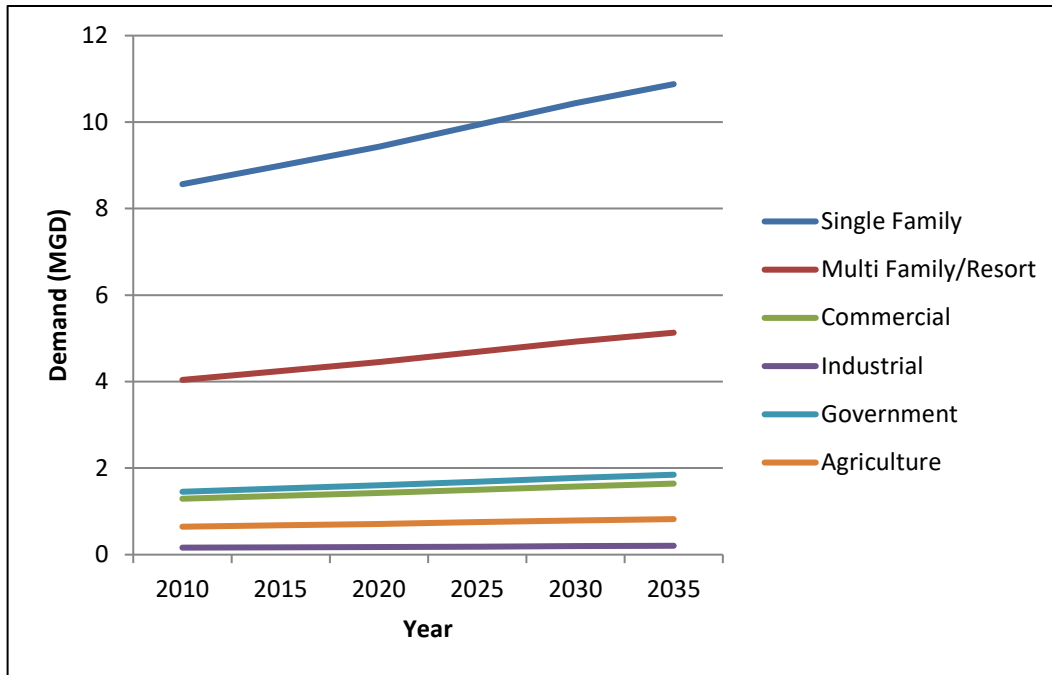
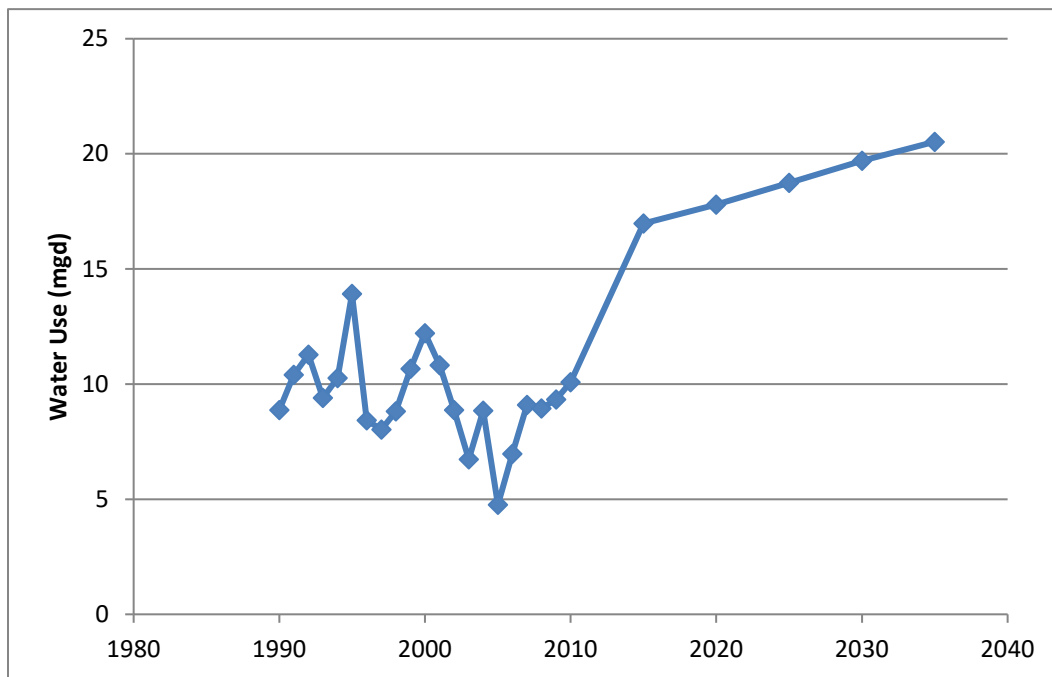


Figure H-10 Kaua'i County Water Use and Projected Water Demand to 2035



Note: Water use reports for 2005 not available; 2005 estimated water use provided by Kaua'i DWS

Table H-20 City and County of Honolulu Projected Water Demand, 2015 to 2035 (MGD)

Use Category	2015	2020	2025	2030	2035
Agriculture	3.8	3.9	3.9	4.0	4.1
Domestic Residential ¹	80.2	83.5	83.3	84.9	86.5
Domestic Non-Residential ¹	52.5	54.4	54.3	55.3	56.3
Industrial	1.2	1.3	1.3	1.3	1.3
Irrigation	1.6	1.7	1.7	1.7	1.8
Total	139.3	144.8	144.5	147.2	150

¹ Includes potable and non-potable water needs.

Source: Honolulu BWS, June 20, 2018 Email.

Figure H-11 City and County of Honolulu Projected Water Demand 2010 to 2035

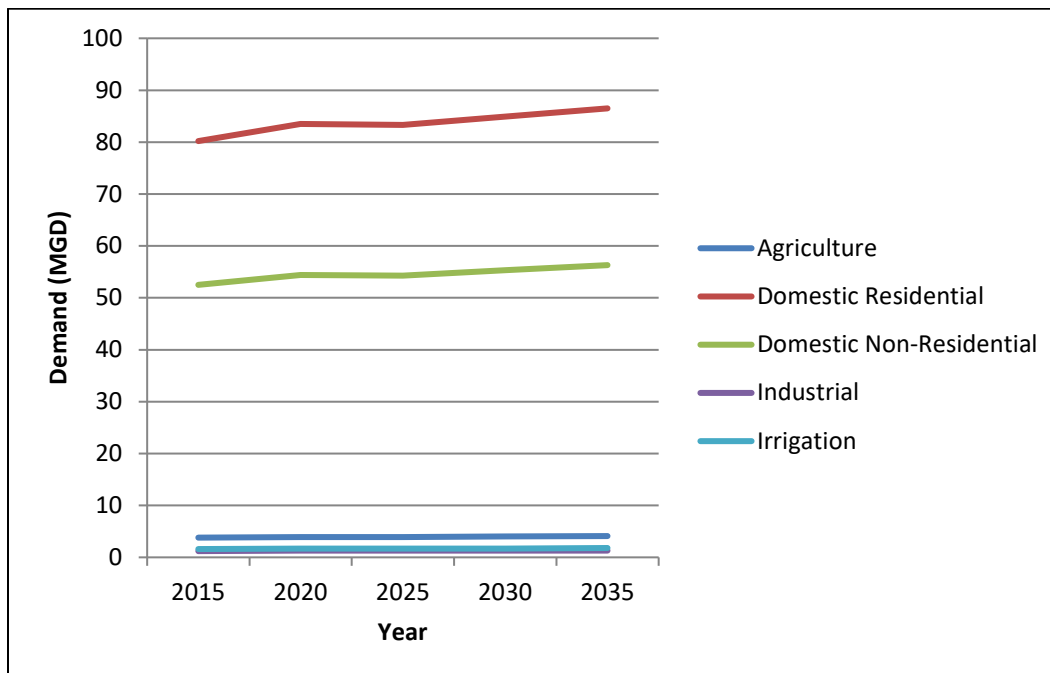


Figure H-12 City and County of Honolulu Water Use and Projected Water Demand to 2035

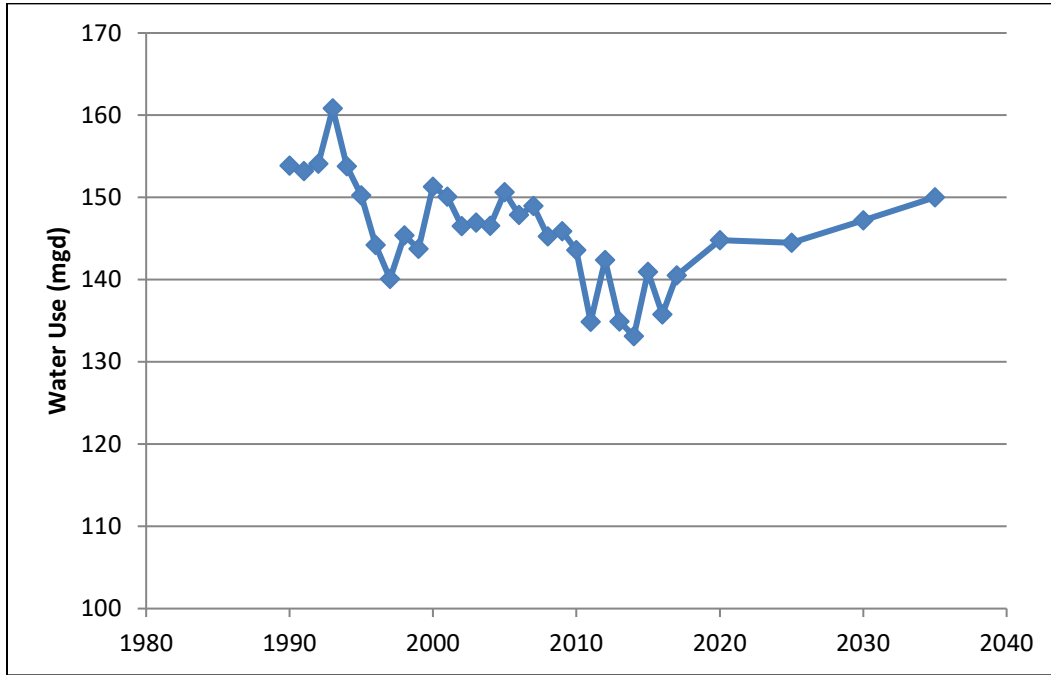


Table H-21 Maui County Projected Water Demand by Use Category, 2015 to 2035 (MGD)

Use Category	2015	2020	2025	2030	2035*
Single Family	19.680	21.241	22.819	24.384	25.954
Multi-Family/Resort	8.465	9.136	9.815	10.488	11.163
Commercial	3.686	3.978	4.274	4.567	4.861
Industrial	1.081	1.167	1.253	1.339	1.425
Government	2.628	2.836	3.047	3.256	3.466
Agriculture	1.399	1.510	1.622	1.733	1.845
Unknown	0.071	0.077	0.082	0.088	0.094
Total	37.010	39.945	42.913	45.856	48.808

* Data Interpolated from county demand projections from 2015 to 2030.

Notes: "Use Category" corresponds to the Maui Department of Water Supply billing class.

Source: Maui Department of Water Supply, January 7, 2014 Email.

Figure H-13 Maui County Projected Water Demand by Use Category, 2015 to 2035

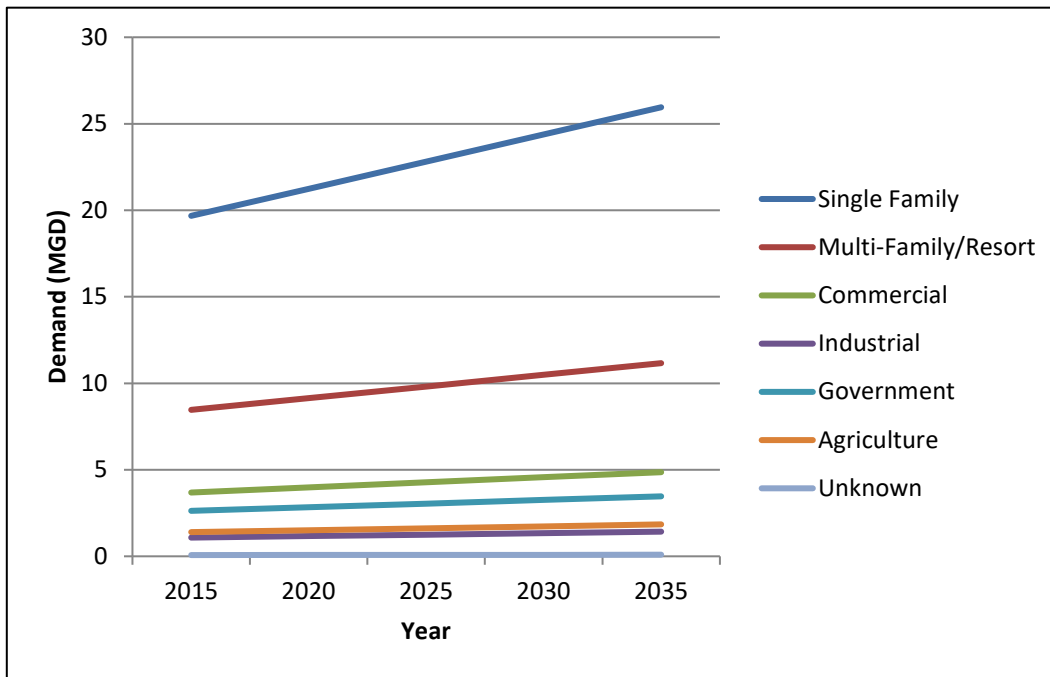


Figure H-14 Maui County Water Use and Projected Water Demand to 2035

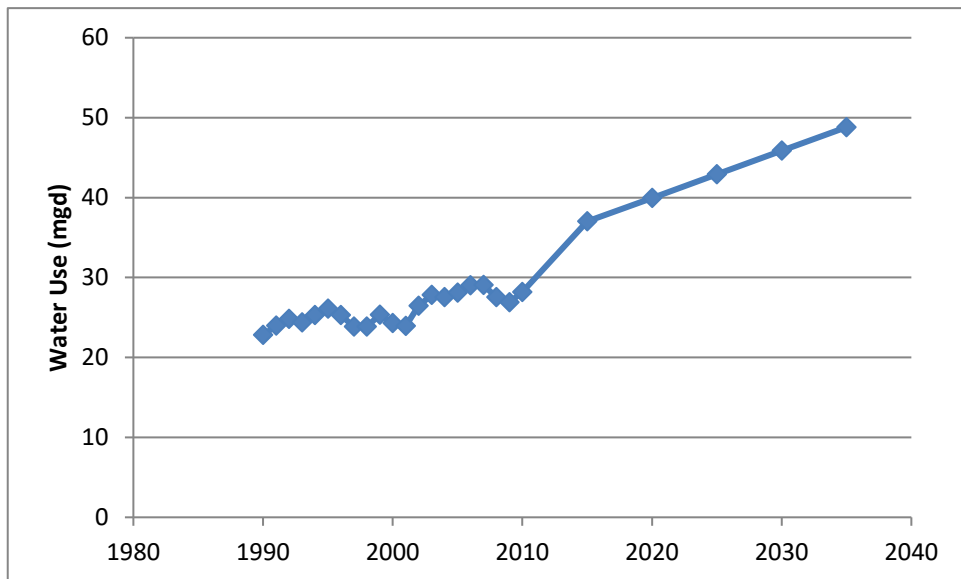


Table H-22 Hawai'i County Projected Water Demand by Use Category, 2015 to 2035 (MGD)

Use Category	2015	2020	2025	2030	2035
Agriculture	2.572	2.840	3.136	3.462	3.822
Domestic-Residential	16.137	17.816	19.671	21.718	23.978
Domestic-Non-Residential	7.002	7.731	8.535	9.424	10.404
Industrial	0.025	0.028	0.031	0.034	0.038
Irrigation	0.371	0.410	0.453	0.500	0.552
Military	0.000	0.000	0.000	0.000	0.000
Municipal	4.167	4.601	5.080	5.609	6.192
Un-Accounted Water	3.184	3.515	3.881	4.285	4.731
Total	33.459	36.941	40.786	45.031	49.718

Note: Projections for 2015, 2020, 2025, 2030, & 2035 were made after recalibrating 2012 for actual production levels. Percent Average Annual Growth was assumed to be 2% in all categories. The 2010 Water Use and Development Plan Update considered 2% growth to be moderate. (Note: Average Annual Total Growth Island wide from 2005 to 2012 was 1.755 % but the economy was relatively slow for much of this period.)

Source: Hawai'i Department of Water Supply, December 13, 2013 Email.

Figure H-15 Hawai'i County Projected Water Demand by Use Category, 2015 to 2035

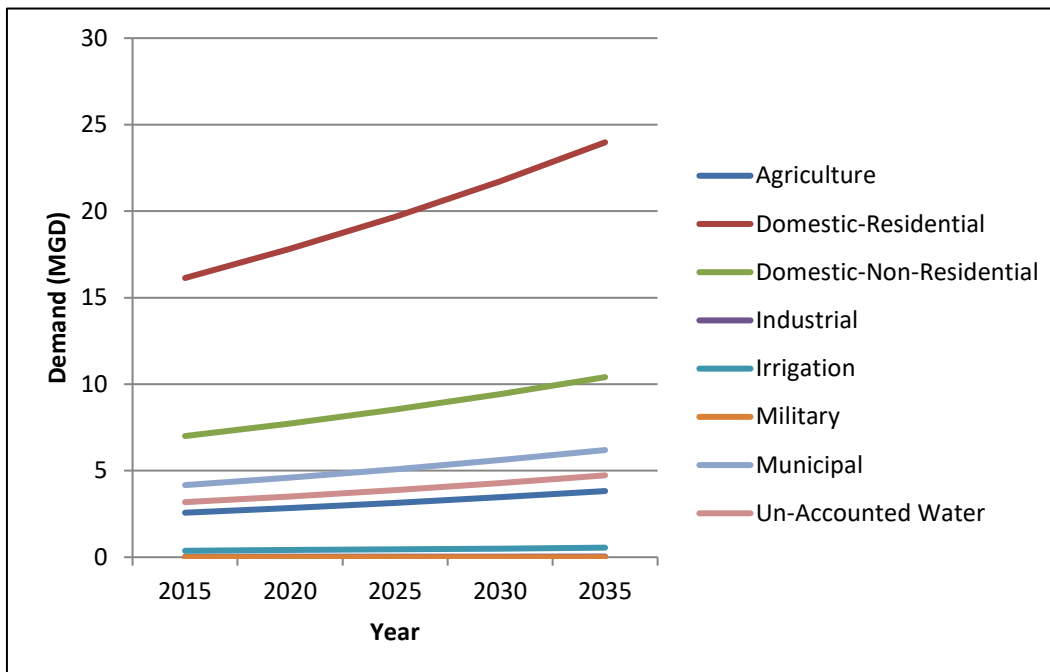
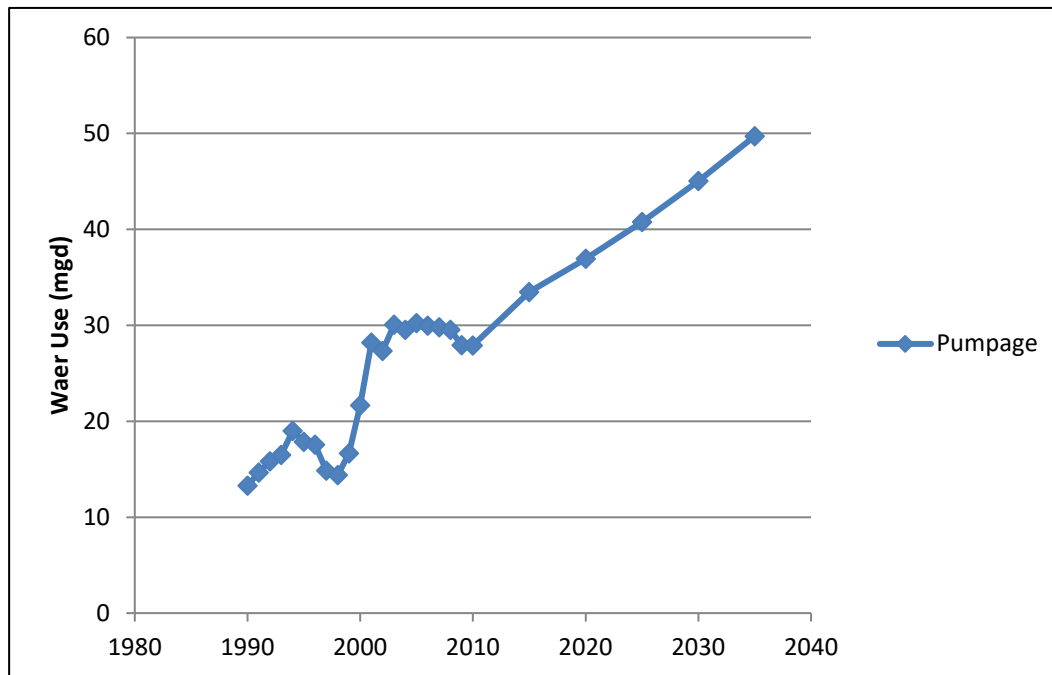


Figure H-16 Hawai'i County Water Use and Projected Water Demand to 2035



H.6 Water Planning at the County Level

One of the primary objectives of the State Water Code is the development of a program of comprehensive water resource planning to address the supply and conservation of water. A major component of this program is the Water Use and Development Plan that must be prepared by each county. The Water Code also provides for planning consistency across government levels by requiring the County WUDPs to be adopted by CWRM, and integrated into the Hawai'i Water Plan.

The initial County WUDPs were prepared in 1990 to meet the deadline set by the State Water Code legislation, but the County WUDPs were adopted by CWRM with the condition that the plans be updated with more information on certain plan elements. In 1992, CWRM was briefed on draft updates to the County WUDPs, but deferred adoption of the updates, pending the refinement of the plans. The following describes the purpose and content of the County WUDPs, the process for updating the plans, and the status of each county's planning efforts.

H.6.1 The County WUDP Update Process

The State Water Code requires each county to prepare and regularly update its County WUDP to address future water demands and to set forth the “allocation of water to land use in that county.” It is important to note that the WUDPs are the instruments by which all other Hawai‘i Water Plan components are integrated, and are used to implement comprehensive water resource planning at the county level. This is emphasized through the adoption of the WUDP as a County ordinance.

The County WUDP objectives include the following planning activities:

- Assess existing and future land uses and associated municipal water demands;
- Incorporate agriculture, military, private, State, and other non-municipal water demand projections; and
- Evaluate the cost and adequacy of proposed development plans and identify preferred and alternative water development plans to meet projected demands.

Requirements, recommendations, and guidance for preparing the County WUDPs are found in the State Water Code and the Statewide Framework for Updating the Hawai‘i Water Plan. The pertinent sections of the State Water Code and the Framework are summarized below.

H.6.1.1 State Water Code and Administrative Rule Requirements

The purpose of the County Water Use and Development Plans is to inventory all projected water demands and ensure that the future water needs of the county are met. The plans allocate water to land use, and provide additional guidance to CWRM for decision-making regarding water management area designation, water use, and water reservation requests.

The State Water Code mandates that each county update and modify its WUDP as necessary, to maintain consistency with zoning and land use policies. It also specifies that County WUDPs must be adopted by county ordinance.

HRS §174C-31(f) states that the County WUDPs must include, but are not limited to the following information:

- (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.*

Hawai'i Administrative Rules §13-170-32 provides additional guidelines for preparation of the County WUDPs:

- (b) *All water use and development plans shall be prepared in a manner consistent with the following conditions:*
- (1) *Each water use and development plan shall be consistent with the water resource protection plan and the water quality plan.*
 - (2) *Each water use and development plan and the state water projects plan shall be consistent with the respective county land use plans and policies, including general plan and zoning as determined by each respective county.*
 - (3) *Each water use and development plan shall consider a twenty-year projection period for analysis purposes.*
 - (4) *The water use and development plan for each county shall also be consistent with the state land use classification and policies.*
 - (5) *The cost of maintaining the water use and development plan shall be borne by the counties; state water capital improvement funds appropriated to the counties shall be deemed to satisfy Article VIII, section 5 of the State Constitution.*

H.6.1.2 Framework Requirements

The Statewide Framework for Updating the Hawai'i Water Plan¹³ is intended to help integrate and update the components of the Hawai'i Water Plan. With respect to the County WUDPs, several key Framework objectives are listed below:

- To achieve integration of land use and water planning efforts that are undertaken by federal, State, county, and private entities so that a consistent and coordinated plan for the protection, conservation and management of water resources is achieved;
- To recommend guidelines for the HWP update so that the plan and its component parts are useful to CWRM, other State agencies, the counties, and the general public;
- To develop a dynamic planning process that results in a “living document” for each component of the HWP which will provide county and State decision-makers with well formulated options and strategies for addressing future water resource management and development issues;
- To better define roles and responsibilities of all State and county agencies with respect to the development and updating of the HWP components; and
- To describe and outline the techniques and methodologies of integrated resource planning as the basic approach that should be utilized in developing and updating the County WUDPs.

¹³ Commission on Water Resource Management, Department of Land and Natural Resources, State of Hawaii, 2000, *Statewide Framework for Updating the Hawaii Water Plan*

The County WUDPs respond to the need for integration of resource development strategies at the county level. It is emphasized that the County WUDPs are required to encompass all water usage and water development plans projected throughout the county. Since the various State agencies ultimately build their projects within one of the four counties, State agency water use demands and proposals for development of various resources to meet those demands must be factored into the overall water demands and development strategies of each of the counties. The responsibility for preparation of the County WUDP rests with the specific entities charged with water planning within that county, as may be enumerated by county ordinance.

The Framework advocates the use of an integrated resource planning (IRP) approach. IRP is a comprehensive form of planning that encompasses least-cost analyses of resource management options, as well as a participatory decision-making process. It involves the development of water resource alternatives that take into consideration communities and environments that may be affected, the numerous institutions concerned with water resource development and protection, and the potential for competing policy goals.

In adopting the Framework, the Commission recognized that each county faces a unique set of conditions that have an impact on the county's planning process, including:

- The nature and occurrence of water resources and existing infrastructure in the county;
- The planning issues and water use priorities the county must address;
- The financial resources available to the county; and
- The financial and organizational structure that has been established by its County Council and administration.

Thus, the Framework recognizes the need for appropriate flexibility and versatility to encourage innovation as well as to accommodate unique and county-specific concerns that may be addressed within the WUDP. In light of the above conditions, the Framework requires that each county develop a scope of work for updating its WUDP which best meets its overall objectives. The process by which these objectives are to be achieved should be set forth in a detailed project description and schedule for updating the County WUDP.

Now that the agencies involved in the Hawai'i Water Plan process have gained experience implementing the Framework, the Framework should be reassessed to determine what changes can be made to improve the updating process.

H.6.2 Status of County WUDP Updates

The status of the County updates, as well as the other components of the Hawai'i Water Plan are shown in **Table H-23** below. Since the deferral of adoption of the 1992 draft updates, the Framework was adopted in 2000 to provide guidance to agencies responsible for preparing HWP components. That same year, the Hawai'i Supreme Court's decision in the Waiāhole Ditch Combined Contested Case imparted and reaffirmed the application of the Public Trust Doctrine and the precautionary principle in Hawai'i's water resource planning efforts.

Both the City and County of Honolulu and the County of Maui had begun the WUDP update process as the HWP Framework and the Waiāhole case were developing. Therefore, these counties have adapted and adjusted their programs to incorporate policy developments and to formulate planning mechanisms best suited to them. The sections below provide information on the current WUDP update activities in each county, and summarize the status of planning efforts. Some of the following discussion is taken directly from published WUDPs.

Table H-23 Status of County Water Use and Development Plans

County Island or District	Current WUDP Adoption Date	Status of WUDP Update	Strategies to Meet Future Water Needs
Kaua'i	February 1990	In progress	
O'ahu			
Central O'ahu	March 1990	In progress	
East Honolulu	March 1990	Awaiting funding	
'Ewa	March 1990	In progress	
Ko'olau Loa	March 2011	Current	<ul style="list-style-type: none"> • Ground water development • Water reuse expansion • Conservation
Ko'olau Poko	September 2012	Current	<ul style="list-style-type: none"> • Ground water development • Water reuse expansion • Surface water for kalo expansion • Conservation
North Shore	December 2016	Current	<ul style="list-style-type: none"> • Current supplies sufficient
Primary Urban Center	March 1990	In progress	
Wai'anae	March 2011	Current	<ul style="list-style-type: none"> • Decrease ground water development • Increase import from Pearl Harbor ASYA • Conservation
Maui			
Maui	March 1990	In progress	
Moloka'i	March 1990	Awaiting completion of Maui Island WUDP update	
Lāna'i	August 2012	Current	<ul style="list-style-type: none"> • Ground water development • Water reuse expansion • Desalination • Conservation
Hawai'i	December 2011	Current	<ul style="list-style-type: none"> • Extend ground water system service areas • Water transfers • Alternative source development • Demand-side management

H.6.3 Summary of Water Resource Implications for Updated WUDPs

The following sections summarize the findings of the updated WUPDs in terms of existing and future water demands, resource options and strategies, and the implications for natural supplies.

H.6.3.1 Lānaʻi WUDP, County of Maui¹⁴

In August 2012, CWRM adopted the Lānaʻi WUDP. The WUDP emphasizes the many challenges Lānaʻi faces in meeting its water needs. The total sustainable yield of the island is only 6 MGD. Virtually all of the island's available ground water resources are confined to dike compartments in the Central Aquifer Sector Area, which is divided into two aquifer system areas having sustainable yields of 3 MGD each (see **Table H-24**). Recharge is highly dependent on the forested mauka watershed, with a significant amount deriving from fog drip. Although historical evidence suggests the existence of perennial streams, no surface water sources currently exist on the island. Lānaʻi has two drinking water systems, one brackish water system used for irrigation, and two recycled water systems, also used for irrigation.

Total pumpage in 2008 was about 2.24 MGD. However, metered consumption was found to be 1.66 MGD. Therefore, Lānaʻi's water loss was over 25% of production. This analysis revealed opportunities for supply-side savings, which are included in the proposed capital plan. However, water losses are already being addressed and are currently less than that identified in the plan.

Future water demands were assessed based on the estimated rate of increase in demand predicted by economic and demographic considerations through 2030 and based on build-out of known projects and projects with Phase II approval. The estimated demand for projects with Phase II approval is over 5 MGD. However, with water conservation measures, total pumpage would be limited to 3.7 MGD.

The resource development strategy includes new ground water source development, water reuse expansion, and desalination in addition to both supply-side and demand-side conservation. Pumpage from the Leeward Aquifer System Area, where most of the existing supply is currently derived, would be limited to 2.67 MGD under the plan. New Windward sources are identified and would be brought online as needed. Identified source contributions from the Windward Aquifer System Area total 2.58 MGD. **Table H-24** shows maximum planned ground water withdrawals in relation to aquifer system area sustainable yields.

Table H-24 shows maximum planned ground water withdrawals for both the Windward and Leeward Aquifer System Areas, which includes estimated demand for projects with Phase II approvals, are just below 90% of the respective aquifers estimated sustainable yields. This highlights the importance of implementing water conservation and resource augmentation measures that are included as part of the long-term resource development strategy.

¹⁴ County of Maui, Department of Water Supply, 2011, *Lānaʻi Island Water Use and Development Plan*

Table H-24 Maximum Planned Ground Water Withdrawals in Relation to Sustainable Yields, Island of Lānaʻi

Aquifer System Area	Sustainable Yield (MGD)	2035 Maximum Planned Withdrawals (MGD)	2035 Maximum Planned Withdrawals As a Percent of SY
Windward	3	2.67	89%
Leeward	3	2.58	86%

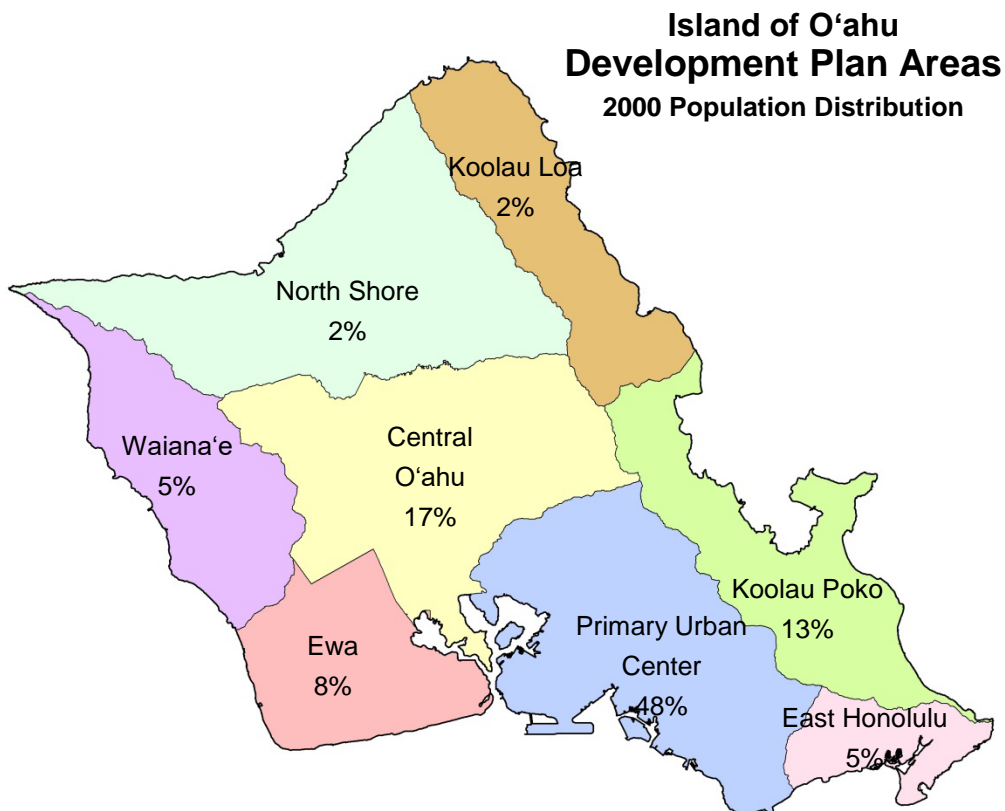
Water conservation measures, which would contribute 0.485 MGD toward meeting demands, include pipe repair/replacement, fixture replacement, leak detection and repair, reservoir loss reduction, and various demand-side management programs. Total reclaimed water use, currently at 0.307 MGD, would rise to 0.416 MGD under the planning horizon. Under the strategy, desalination of 0.300 MGD would only be needed to meet build out demands.

A significant portion of the Plan addresses the issues of source water protection and watershed protection. The importance of watershed management and drinking water source protection are recognized along with proposed actions to achieve both. These include but are not limited to inventorying wells at risk from overland contamination, refinement of a well-head protection strategy, fencing valuable watershed areas, ungulate control, weed removal, and education.

As illustrated in **Table H-24** above, Lānaʻi faces challenges with respect to its limited natural supplies, water needs for existing land use entitlements, watershed decline, and aging infrastructure. The following measures are identified as essential elements to be implemented in order to maintain the sustainability of ground water resources and meet demands:

- Watershed protection — development of a new watershed protection plan, fencing, ungulate removal, fire protection, invasive plant eradication, and erosion management.
- Water resource protection — well head protection, aquifer monitoring and reporting, watershed monitoring and recharge assessments, water use monitoring, and enforcement of existing water management allocation agreements.
- Water conservation — water recycling, demand-side management, education, replacement and/or repair of leaking pipes, leak detection and repair, and reservoir loss control.
- New supply resource development — develop Leeward Aquifer System Area sources, expand wastewater recycling, develop Windward Aquifer System Area sources.
- Land use entitlements — determine whether sufficient water resources are available for new land use entitlements without unreasonable risk or harm to existing users or water resources.

Figure H-17 O’ahu Development Plan Areas



H.6.3.2 Ko’olau Loa Watershed Management Plan, City and County of Honolulu¹⁵

In March 2011, CWRM adopted the Ko’olau Loa WMP. The Ko’olau Loa district encompasses the entire Ko’olau Loa Aquifer System Area and most of the Kahana Aquifer System Area, with sustainable yields of 35 and 16 MGD, respectively. The northern part of the Ko’olau Loa study area also includes a small sliver of the North Shore Aquifer Sector Area’s Kawailoa Aquifer System Area. The Ko’olau Loa district contains five perennial streams (Ka’a’awa, Kahana, Punalu’u, Kaluanui, and Mālaekahana).

¹⁵ City and County of Honolulu, Honolulu Board of Water Supply. 2009. *Ko’olau Loa Watershed Management Plan*.

In 2000, the total water demand in Ko'olau Loa was 26.14 MGD. Of the 26.14 MGD total demand in 2000, potable demand accounted for 11.01 MGD, while non-potable needs were 15.13 MGD. 2000 demands were met by three main water sources: Ko'olau Loa Aquifer Sector pumpage, surface water, and recycled water. Ground water supplies most of Ko'olau Loa's residential, commercial and agricultural needs. Of the 17.9 MGD of pumped ground water, 8.60 MGD was exported to the Ko'olau Poko and North Shore districts. Surface water provided 7 MGD of agricultural irrigation water for Punalu'u and Kahana Valleys. A small amount of recycled water, 0.6 MGD, supplied irrigation water need in Lā'ie and at Turtle Bay.

The most likely growth scenario shows Ko'olau Loa projected 2030 demand is 32.93 MGD, 12.34 MGD of which are potable demands and 20.59 MGD are non-potable. The 6.79 MGD projected 2030 increase in water demand will be met primarily through increased ground water pumpage from the Ko'olau Loa Aquifer System Area, increased use of recycled water, and increased water conservation. No additional withdrawals from the Kahana and Kawaihoa Aquifer System Areas are planned. Exports to Ko'olau Poko and North Shore will not change significantly. Future agricultural water demand is the largest unknown. If more agricultural water were needed, the plan identifies ground water as the largest, most readily-available source.

There is a need for additional diversification in water supply, and the development of additional non-potable sources can replace some potable water currently being used for non-potable purposes. Additional use of surface water will be deferred pending the establishment of measurable instream flow standards. The lack of surface water use information is a significant data gap that hinders water use and development planning.

The resource strategy for meeting 2030 demands is summarized in **Table H-25 and Figure H-18** below.

Table H-25 Ko’olau Loa Projected Water Demand and Supply Options

DEMAND (mgd)	2000	2005	2010	2015	2020	2025	2030
BWS Potable	1.46	1.57	1.86	1.89	1.92	1.96	2.15
BWS Potable export to Ko’olau Poko & North Shore	8.60	8.60	8.60	8.60	8.60	8.60	8.60
LWC Potable	0.95	1.15	1.32	1.39	1.46	1.52	1.59
Total Potable Demand	11.01	11.32	11.78	11.87	11.97	12.08	12.34
Non-Potable Agriculture	13.25	13.79	14.37	14.99	15.68	16.42	17.22
Non-Potable Other	1.88	2.28	2.39	2.40	2.67	3.02	3.37
Total Non-Potable Demand	15.13	16.07	16.75	17.39	18.34	19.44	20.59
TOTAL DEMAND	26.14	27.39	28.53	29.26	30.32	31.52	32.93

SUPPLY (mgd)	2000	2005	2010	2015	2020	2025	2030
Ko’olau Loa GWMA ¹	17.24	18.47	19.49	20.01	21.06	22.05	23.36
Kahana GWMA ²	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Kawailoa GWMA	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Surface Water ³	6.98	6.98	6.98	6.98	6.98	6.98	6.98
Recycled Water	0.56	0.57	0.68	0.89	0.90	1.10	1.20
Agriculture Water Savings	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Water Conservation	0.00	0.01	0.02	0.02	0.02	0.03	0.03
TOTAL SUPPLY	26.14	27.39	28.53	29.26	30.32	31.52	32.93

¹ Sustainable yield for Ko’olau Loa GWMA is 36 mgd.

² Sustainable yield for Kahana GWMA is 15 mgd.

³ Surface Water is assumed to be the existing water use pending measurable instream flow standards.

Figure H-18 Ko’olau Loa Projected Water Demand and Supply Options

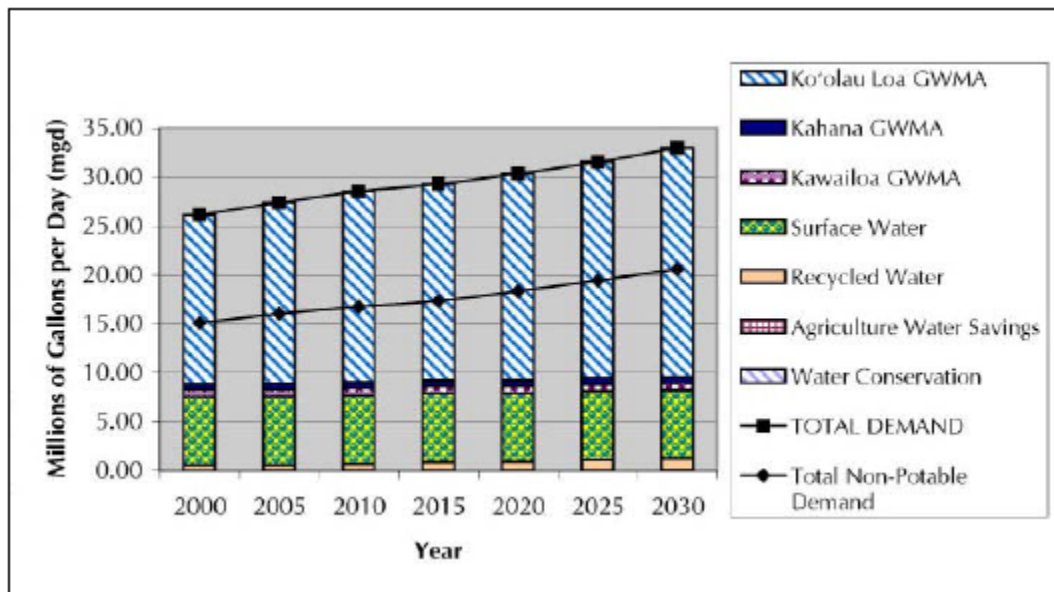


Table H-26 2030 Ground Water Withdrawals in Relation to Sustainable Yields, Ko’olau Loa District, Island of O’ahu

Aquifer System Area	Sustainable Yield (SY) (MGD)	2030 Proposed Withdrawals (MGD)	2030 Proposed Withdrawals As a Percent of SY
Ko’olau Loa	36	23.36	65%
Kahana	15	0.06	<1%
Kawailoa	29	0.75	2.3%

Table H-26 shows that 2030 proposed ground water withdrawals for all aquifer system areas are well within the respective aquifer’s sustainable yields.

H.6.3.3 Wai’anae Watershed Management Plan, City and County of Honolulu¹⁶

In March 2011, CWRM adopted the Wai’anae WMP. The Wai’anae district boundaries generally coincide with the Wai’anae Aquifer Sector Area. There are 5 individual aquifer system areas within the Wai’anae Aquifer Sector Area. Individual aquifer system areas and their sustainable yields are show in **Table H-27** below. The Wai’anae district contains six perennial streams (Nānākuli, Ulehawa, Mā’ili’ili, Kaupuni, Mākaha, and Mākua).

Table H-27 Wai’anae Aquifer System Area Sustainable Yield (SY)

Hydrologic System Area	SY (MGD)
Nānākuli	2
Lualualei	4
Wai’anae	3
Mākaha	3
Kea’au	4
Wai’anae Total	16

In 2000, the total water demand in Wai’anae was 11.43 MGD. Of the 11.43 MGD, potable demand accounted for 6.81 MGD, while non-potable needs were about 4.27 MGD. 2000 demands were met by four main water sources: Wai’anae Aquifer Sector pumpage (potable BWS sources), Glover Tunnel (non-potable BWS source), Wai’anae Aquifer Sector pumpage (non-BWS sources), and water imports from Pearl Harbor. While previously used for irrigation of both native Hawaiian and western plantations, stream flow is currently intermittent and no longer commonly used. There are several anchialine ponds located in Wai’anae that provide critical habitat to crustaceans that are candidates for listing as threatened or endangered species.

¹⁶ City and County of Honolulu, Honolulu Board of Water Supply. 2009. *Wai’anae Watershed Management Plan*.

Studies to identify impacts of ground water pumpage on anchialine pond salinity levels, impacts of land-based pollution, and sensitivity of biota to changes in water quality are ongoing in other parts of the State.

The most likely growth scenario shows Wai‘anae projected 2030 demand is 13.75 MGD, 8.82 MGD of which are potable demands and 4.54 MGD are non-potable. The 2.32 MGD projected 2030 increase in water demand will be met through increased imports from Pearl Harbor (including potential desalination from Kalaeloa), and water conservation. No additional withdrawals from Wai‘anae Aquifer Sector sources are planned. In fact, Honolulu BWS will continue to reduce the pumpage of Mākaha and Wai‘anae Valley sources as a drought mitigation strategy to increase ground water storage and to allow for an increase in the natural flows in the Mākaha and Kaupuni streams. Future agricultural water demand is the largest unknown. If more agricultural water were needed, the plan identifies ground water as the largest, most readily-available source.

As was found to be the case in Ko‘olau Loa, there is a need for additional diversification in water supply, and the development of additional non-potable sources can replace some potable water currently being used for non-potable purposes. Ground water is limited and fully developed in Mākaha and Wai‘anae and not readily accessible in Lualualei and Kea‘au so additional large-scale in-district ground water source development is not feasible. Surface water is unreliable and not available in sufficient volumes for large-scale development. Water conservation will become increasingly important as water demands continue to grow. The resource strategy for meeting 2030 demands is summarized in **Table H-28** and **Figure H-19** below.

Table H-28 Wai‘anae Projected Water Demand and Supply Options

All units in mgd	2000	2005	2010	2015	2020	2025	2030
BWS Potable Demand	6.62	6.97	7.29	7.69	8.03	8.33	8.63
Non-BWS Potable Demand	0.19	0.19	0.19	0.19	0.19	0.19	0.19
Potable Demand	6.81	7.16	7.49	7.88	8.22	8.52	8.82
BWS Non-Potable Demand	3.00	2.85	2.95	3.01	3.08	3.18	3.25
Non-BWS Non-Potable Demand	1.27	1.28	1.30	1.30	1.30	1.30	1.30
Non-Potable Demand	4.27	4.13	4.25	4.31	4.38	4.47	4.54
Buffer	0.35	0.38	0.38	0.38	0.38	0.38	0.38
TOTAL DEMAND	11.43	11.67	12.11	12.57	12.98	13.38	13.75
Waianae Aquifer Sector Area - BWS (Potable)	4.96	4.50	4.34	4.34	4.34	4.34	4.34
Glover Tunnel - BWS (Non-Potable)	0.51	0.51	0.51	0.51	0.51	0.51	0.51
Waianae Aquifer Sector Area - Non-BWS	1.46	1.46	1.46	1.46	1.46	1.46	1.46
Pearl Harbor Import, including potential Desal from Kalaeloa	4.50	5.16	5.73	6.15	6.52	6.88	7.21
Conservation	0.00	0.04	0.08	0.11	0.15	0.19	0.23
TOTAL SUPPLY	11.43	11.67	12.11	12.57	12.98	13.38	13.75

Figure H-19 Wai‘anae Projected Water Demand and Supply Options

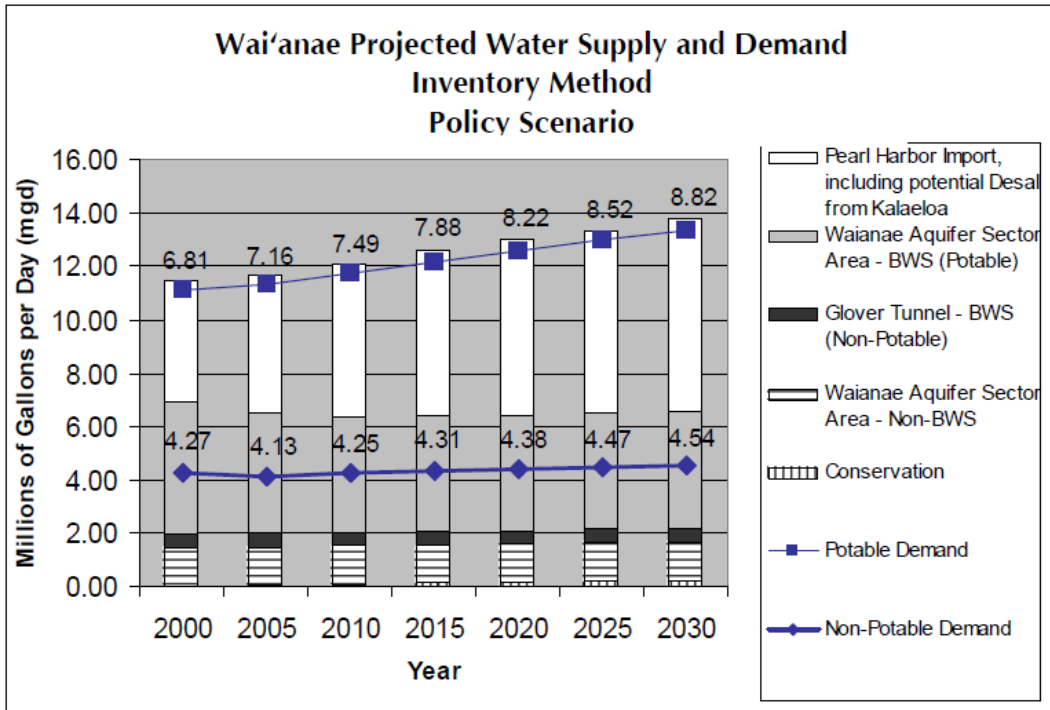


Table H-29 shows proposed 2030 ground water withdrawals in relation to aquifer system area sustainable yields.

Table H-29 2030 Ground Water Withdrawals in Relation to Sustainable Yields, Wai‘anae District, Island of O‘ahu

Aquifer System Area	Sustainable Yield (MGD)	2030 Proposed ¹⁷ Withdrawals (MGD)	2030 Proposed Withdrawals As a Percent of SY
Nānākuli	2	N/A	N/A
Lualualei	4	N/A	N/A
Wai‘anae	3	2.67	89%
Mākaha	3	1.67	56%
Kea‘au	4	N/A	N/A

¹⁷ Staff communication, Honolulu BWS, June 16, 2018

The following recommendations are made for Waiʻanae and Mākaha Aquifer System Areas:

- Obtain all available water level and salinity data.
- Expand ground water monitoring network.
- Obtain all available streamflow monitoring data.
- Carefully manage pumpage to prevent salt water upconing at Mākaha Shaft.
- Conduct an informational hearing and invite the participation of water users in the Waiʻanae Aquifer System Area to assess the ground water situation and devise other appropriate mitigative measures.
- Consider initiation of water management area designation proceedings for the Waiʻanae Aquifer System Area.

H.6.3.4 Koʻolau Poko Watershed Management Plan, City and County of Honolulu¹⁸

Honolulu BWS submitted the project description for the Koʻolau Poko WMP in July 2008, and it was adopted by CWRM in September 2012. The Koʻolau Poko district encompasses the entire Koʻolau Poko and Waimānalo Aquifer System Areas, having sustainable yields of 30 MGD and 10 MGD, respectively. The district also contains a sliver of the Kahana Aquifer System Area. There are 13 perennial streams in Koʻolau Poko. The major portion of baseflow derives from dike-impounded ground water that originates in the upland areas in the back of the valleys. There is interaction between ground and surface waters, and in general, withdrawal of ground water will impact streamflow. Therefore, all of the estimated sustainable yield may not be readily available as impacts to established instream flow standards must first be considered. Many of the streams are diverted. A survey by Honolulu BWS documented 109 stream diversions in Koʻolau Poko, as well as 24 diversions in Kahana and Kaʻaʻawa.

In 2005, the total water demand in Koʻolau Poko was 31.204 MGD. Most of the district's water demand, 23.004 MGD (excluding Waiāhole Ditch water), was met by ground water from Honolulu BWS sources, which provided for both potable and non-potable needs. About 5.6 MGD of ground water was imported from Koʻolau Loa, while about 0.500 MGD is exported to East Honolulu. Surface water sources contributed 7.650 MGD for non-potable needs. A small amount of recycled water, 0.550 MGD, serves the Klipper Golf Course at the Marine Corps Air Station at Kāneʻohe Bay. DHHL has a water reservation of 0.124 MGD from the Waimānalo Aquifer System Area to support three residential development projects.

¹⁸ City and County of Honolulu, Honolulu Board of Water Supply. 2012. *Koʻolau Poko Watershed Management Plan*.

The most likely growth scenario shows Ko‘olau Poko projected 2030 demand will increase to 32.346 MGD. Potable water demand is expected to decrease, due to projected declines in the district’s population in 2030. Most of the increase in demand is for non-potable agricultural irrigation needs. 2030 non-potable demands are projected to be 14.271 MGD, with much of the increase over current levels mainly attributable to possible future kalo production. The increases in non-potable needs will be met through water conservation, increased use of recycled water, and increased diversion of surface water. It was estimated that half of base stream flow (defined as Q70, the volume of daily mean stream flow present in the stream 70 percent of the time) would potentially be available for off-stream uses. Where streams were ungaged, the Q70 was estimated based on watershed size and adjacent streamflow. The estimated amount of stream water available for additional use, 1.88 MGD, was calculated by subtracting the estimated amount of stream water in use in 2005 from half of base flow. Proposed increases in the diversion of surface water may require an instream flow standard amendment.

The resource strategy for meeting 2030 demands is summarized in **Table H-30 and Figure H-20** below.

Table H-30 Ko‘olau Poko Projected Water Demand and Supply Options

	2000	2010	2015	2020	2025	2030
SUPPLY	34.569	36.404	37.702	38.335	39.672	40.551
Ko‘olau Loa Import – Ground Water	8.838	7.000	6.900	6.800	6.700	6.600
BWS Permitted Use – Ground Water	16.595	16.595	16.595	16.595	16.595	16.595
State and Private Permitted Use – Ground Water	0.936	3.942	4.077	4.147	4.222	4.537
Surface Water	7.650	7.894	8.734	8.975	9.215	9.456
Recycled Water	0.550	0.550	0.550	0.550	1.250	1.250
Agricultural Conservation	0.000	0.227	0.455	0.682	0.909	1.137
Conservation	0.000	0.195	0.391	0.586	0.781	.977
DEMAND	29.494	29.324	29.950	30.257	31.574	32.346
Potable Demand*	18.060	17.695	17.977	17.972	17.789	18.075
Non-Potable Demand:	11.434	11.629	11.973	12.286	13.785	14.271

Figure H-20 Ko’olau Poko Projected Water Demand and Supply Options

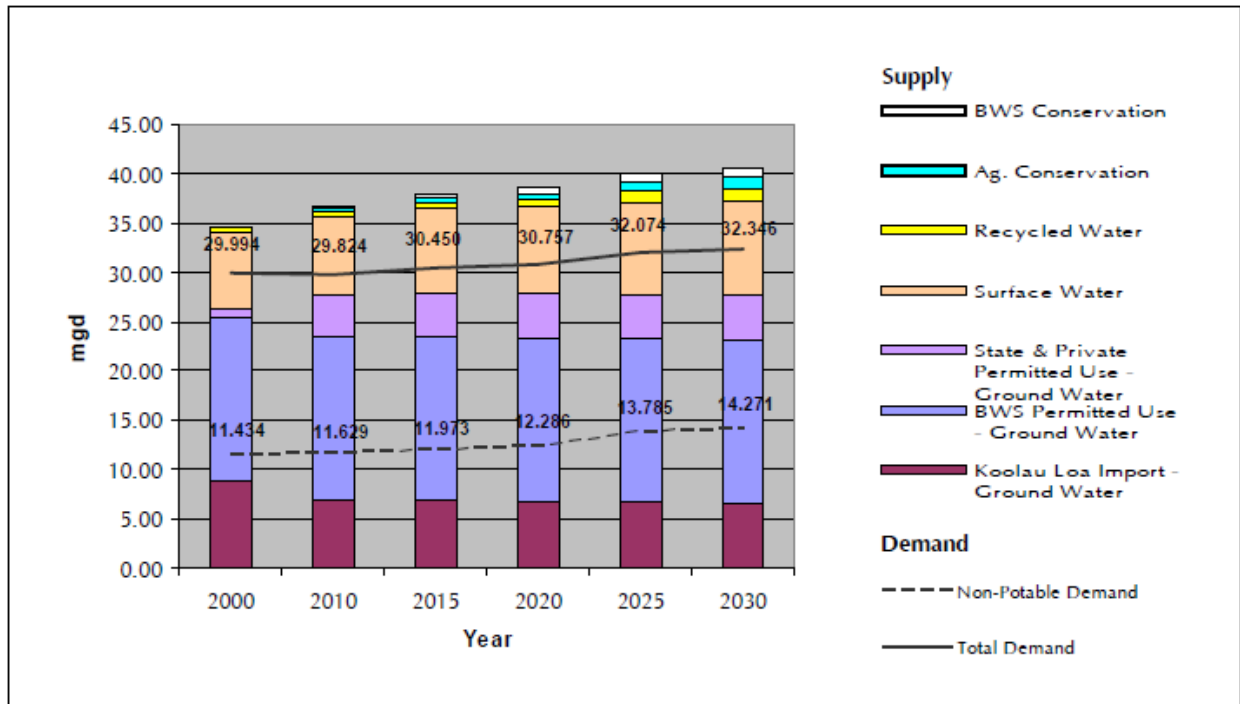


Table H-31 shows proposed 2030 ground water withdrawals in relation to aquifer system area sustainable yields. 2030 proposed ground water withdrawals for the Ko’olau Poko and Waimānalo Aquifer System Areas are well within the aquifers’ sustainable yields. However, full utilization of the sustainable yields may be constrained due to surface water impacts.

Table H-31 2030 Ground Water Withdrawals in Relation to Sustainable Yields, Ko’olau Poko District, Island of O’ahu

Aquifer System Area	Sustainable Yield (SY) (MGD)	2030 Proposed Withdrawals ¹⁹ (MGD)	2030 Proposed Withdrawals As a Percent of SY
Ko’olau Poko	30	16.52	55%
Waimanalo	10	4.61	46%

¹⁹ Staff communication, Honolulu BWS, June 8, 2018

H.6.3.5 North Shore Watershed Management Plan, City and County of Honolulu²⁰

In December 2016, CWRM adopted the North Shore Watershed Management Plan. The North Shore district stretches from Ka'ena Point in the west to Waiale'e Gulch near Kawela Bay in the east and overlays four ASYAs for ground water: Mokulē'ia, Waialua, and Kawaihoa ASYAs of the North Aquifer Sector Area, and a portion of the Wahiawa ASYA in the Central Aquifer Sector Area, with sustainable yields of 8 MGD, 25 MGD, 29 MGD, and 23 MGD, respectively. There are ample surface water resources, and the Wahiawa Irrigation System is supplied by diversions both within and outside of the district and served about 5,500 acres of pineapple and diversified agricultural farms in 2007. The surface water system is supplemented with recycled water from the Wahiawa and Schofield Wastewater Treatment Plants.

In 2010, existing water use totaled about 27 MGD, with about 25 MGD of the use for agriculture. The plan projects that potable water needs in 2035 will increase by about 0.2 MGD, and agricultural demands will increase by about 5 MGD based on the most probable demand scenario. Existing potable and non-potable water sources and systems are adequate to meet current and future potable water needs, and so no additional development of ground or surface waters are anticipated. Water for planned kalo expansion, which is projected to be 10 MGD in 2035, will need to be met with additional surface water from springs and Anahulu stream diversions, which may require amendments to existing interim instream flow standards.

²⁰ City and County of Honolulu, Honolulu Board of Water Supply. 2016. *North Shore Watershed Management Plan*.

The resource strategy for meeting 2035 demands is summarized in **Table H-32** and **Figure H-21** below.

Table H-32 North Shore Projected Water Demand and Supply Options

	2010	2015	2020	2025	2030	2035
DOMESTIC WATER SYSTEMS						
BWS Potable Water System Demand	2.81	2.80	2.89	2.94	3.00	3.01
BWS System - Permitted Ground Water Supply¹						
Waialua GWMA	3.00	3.00	3.00	3.00	3.00	3.00
Kawailoa GWMA	0.75	0.75	0.75	0.75	0.75	0.75
Dole Potable Water System Demand	0.00	0.13	0.13	0.13	0.13	0.13
Dole - Permitted Ground Water Supply¹						
Waialua GWMA	0.26	0.26	0.26	0.26	0.26	0.26
North Shore Water Company Potable Water System Demand	0.12	0.12	0.13	0.15	0.16	0.18
North Shore Water Company - Ground Water Supply¹						
Mokule'ia GWMA	0.15	0.15	0.15	0.15	0.18	0.18
US Army/State DOT Dillingham Airfield System Demand	0.06	0.06	0.06	0.06	0.06	0.06
Federal Systems - Ground Water Supply¹						
Mokule'ia GWMA	0.07	0.07	0.07	0.07	0.07	0.07
Domestic Water Demand	2.99	3.10	3.21	3.27	3.34	3.37
Domestic Water Supply	4.24	4.24	4.24	4.24	4.27	4.27
AGRICULTURE						
Agriculture Water Demand	24.15	25.17	26.19	27.21	28.23	29.25
Ag Surface Water Supply						
KS Surface Water Supply	3.50	3.50	3.50	3.50	3.50	3.50
Dole Surface Water Supply (Wahiawa Irrigation System) ²	8.90	8.90	8.90	8.90	8.90	8.90
Ag Recycled Water Supply						
Wahiawa Wastewater Treatment Plant ³	1.60	1.60	1.60	1.60	1.60	1.60
Ag Ground Water Supply⁴						
Mokule'ia GWMA Permitted Use ⁵	7.80	7.80	7.80	7.80	7.77	7.77
Waialua GWMA Permitted Use ⁶	6.49	6.49	6.49	6.49	6.49	6.49
Kawailoa GWMA Permitted Use ⁵	1.16	1.16	1.16	1.16	1.16	1.16
Wahiawa GWMA Permitted Use ⁷	5.16	5.16	5.16	5.16	5.16	5.16
Agriculture Water Demand	24.15	25.17	26.19	27.21	28.23	29.25
Agriculture Water Supply	34.62	34.62	34.62	34.62	34.59	34.59
TOTAL WATER DEMAND	27.14	28.27	29.40	30.48	31.57	32.62
TOTAL WATER SUPPLY	38.85	38.85	38.85	38.85	38.85	38.85
Kalo Water Demand	1.00	2.80	4.60	6.40	8.20	10.00

¹ CWRM Water Use Permit (WUP) Index (2012) and revised 2013 Waialua GWMA WUP

² Existing use with current losses; add'l water demands to be met with water conservation savings (eg. piping)

³ Effluent from Wahiawā WWTP used for North Shore irrigation and will eventually be used for Galbraith lands irrigation

⁴ WIS system improvements should be implemented before future water use permits are granted

⁵ Private wells used to meet agricultural needs; excludes wells used to meet potable water demands

⁶ Private wells; KS (3.212 mgd), Dole (1.785 mgd - domestic use), and 1.725 mgd of various wells

⁷ The permitted uses in North Shore Development Plan/NB area (3103-01 Galbraith Estate Del Monte #5, 3203-01 Helemano Pump 25, and 3203-02 Waialua Sugar Pump 26) with a total WMP of 5.162 mgd

Figure H-21 North Shore Projected Water Demand and Supply Options

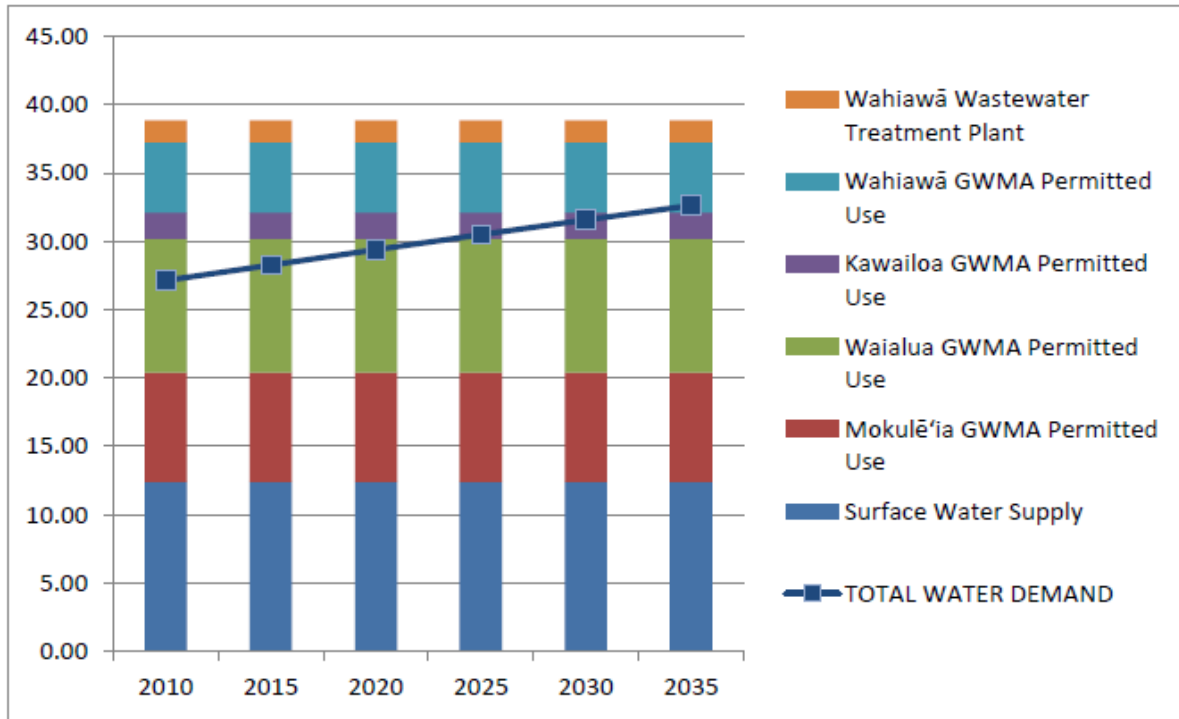


Table H-33 2035 Ground Water Withdrawals in Relation to Sustainable Yields, North Shore District, Island of O’ahu

Aquifer System Area	Sustainable Yield (SY) (MGD)	2035 Proposed Withdrawals (MGD)	2035 Proposed Withdrawals As a Percent of SY
Mokulē'ia	8	7.77	97%
Waialua	25	9.49	38%
Kawailoa	29	1.91	1%
Wahiawā	23	5.162*	22%

* Includes only those wells located in the North Shore District.

Table H-33 shows proposed 2035 ground water withdrawals in relation to aquifer system area sustainable yields. An Ultimate Demand Scenario was done for the North Shore District and assumes the full build-out of residential units within the community growth boundary and irrigation of all the prime and unique agricultural lands outside of it. Under this scenario, total estimated demand for domestic uses is 6 MGD, 72 MGD for agriculture, and 40 MGD for kalo, for a grand total of 118 MGD. Proposed supply sources include the entire North Shore aquifer SY (62 MGD), currently permitted well amounts from the Wahiawā ASYA (5 MGD), allowable surface diversions (estimated to be 33 MGD), and recycled water from the Wahiawā Wastewater Treatment Plant (2 MGD). Total available supply is 102 MGD, which is insufficient to meet ultimate demands of 118 MGD. Additional diversions from springs and streams would be needed to make up the deficit.

H.6.3.6 County of Hawai'i WUDP²¹

In December 2011, CWRM adopted the updated WUDP for the County of Hawai'i. Existing water use is calculated based on available data, including reported ground water pumpage, water purveyor records, DOH records, and available GIS data. The current and future needs of agriculture are identified as a significant planning gap. Existing agricultural water use was extremely difficult to determine due to lack of data. While the AWUDP recommends using 3,400 gallons per acre per day (GPAD) as a planning guide for diversified agriculture, public input during plan formulation suggested that the need for irrigation water was not predicated on the classification of agricultural lands. Rather, agricultural users would grow crops that are feasible based on climatic conditions, and irrigation from ground water sources would be minimal. In response, the plan recommended that detailed agricultural demand projections be relegated to the next update of the AWUDP, and used a range of agricultural water use, from no irrigated agriculture to the AWUDP-recommended average daily demand of 3,400 GPAD. Based on this analysis, the following table shows the estimated existing uses for the various aquifer sector areas:

Table H-34 2005 Existing Water Use by Aquifer Sector Area

Sector	SY (MGD)	W/Out Agriculture	With Agriculture
Kohala	140	2.32	6.49
E Mauna Kea	388	2.84	12.4
W Mauna Kea	24	7.71	11.05
NE Mauna Loa	744	6.41	8.27
SE Mauna Loa	293	1.18	4.77
SW Mauna Loa	114	2.57	5.57
NW Mauna Loa	30	7.97	8.15
Kīlauea	621	4.37	6.58
Hualālai	56	15.62	16.33
Total	2,410	50.99	79.61

Table H-34 shows of Hawai'i Island's total sustainable yield of 2,410 MGD (revised in the 2008 WRPP to be 2,345 MGD), about 51 MGD was used in 2005. If estimated agricultural demands are included, there is almost 80 MGD of existing water use. Besides agriculture, existing uses include domestic, irrigation, municipal, industrial demands. While ground water supplies most of the Island's water existing water needs, surface water sources support agriculture and other irrigation uses, rainwater catchment is the only available source for many individual domestic users, and reclaimed wastewater is used for golf course, pasture and landscape irrigation.

²¹ County of Hawaii, Department of Water Supply. 2010. *Hawaii County Water Use and Development Plan Update*.

The approach for assessing future water needs and resource strategies involved projecting water demand for the full build-out land use policies (i.e., County General Plan Land Use Pattern Allocation Guide [LUPAG], and zoning), and 5-year incremental water demand projections based on the rate of population growth to the year 2025 for each of the island's nine aquifer sector areas. The 20-year demand projections based on the medium rate of population growth were assumed to be the most realistic water demand scenarios. The projections were then evaluated to determine master plan level resource and facility needs and options. This process involved: 1) evaluation of water source adequacy and determination of source development requirements, 2) evaluation of conventional water infrastructure capabilities and identification of conceptual water system upgrades, 3) exploration of alternative water resource enhancement measures, and 4) evaluation of conventional and alternative measures and selection of recommended alternative.

While the Hawai'i DWS serves the majority of the population, accounting for 25.3 MGD of the 2005 demand, there are numerous smaller private water systems that serve rural communities of various sizes. Due to the large size of Hawai'i County and the fact that there are many dispersed communities, it is not feasible to fully integrate the county water system into an island-wide system.

Table H-35 shows projected 2025 demands based on both land use water demand projections (LUPAG and zoning) and population and rate-of-growth projections. Land use-based evaluations provide the full build-out projections, or the ultimate water needs, if the maximum density allowed is developed. This assesses the sustainability of land use policies set by the State and County. It provides a means to integrate land use and water resource planning and inform future land use decisions and policy-setting. In addition, the island-wide approach taken by Hawai'i County has the advantage of identifying and highlighting potential "problem" areas early on, where more detailed regional planning should ensue.

Projected 2025 demands that are at or above 90% of the aquifer's sustainable yields are highlighted in red in the table below. If all agricultural lands in the General Plan are irrigated at 3,400 GPAD, the underlying ground water would be insufficient to support 11, or almost one-half, of the aquifer system areas. If it is assumed that no irrigation of agricultural lands will occur, then only five of the 24 aquifer system areas are deficient. Irrigation of all agricultural-zoned lands will result in insufficient ground water supplies in 8 of the 24 aquifer system areas, while no irrigation on agricultural-zoned lands will result in only one of the aquifers, Keauhou Aquifer System Area, being insufficient. However, if only population and growth rate projections are analyzed, no aquifers would be pumped above 90% of its sustainable yield, although the Waimea Aquifer System Area comes close, at 83%.

Table H-35 Projected 2025 Demands With and Without Agricultural Irrigation by Aquifer System Area

Aquifer System Area	SY (MGD)	LUPAG				Zoning				20-Yr Projected Demands			
		W/Out Ag (MGD)	% SY	With Ag (MGD)	% SY	W/Out Ag (MGD)	% SY	With Ag (MGD)	% SY	W/Out Ag (MGD)	% SY	With Ag (MGD)	% SY
Hāwī	13	6.75	52	74.24	571	1.09	8	67.72	521	1.08	8	4.49	35
Waimanu	110	0.82	1	10.21	9	0.07	0	9.33	8	0.16	0	0.56	1
Māhukona	17	32.59	192	123.16	724	7.74	46	97.43	573	3.11	18	7.23	43
Honoka'a	31	9.48	31	105.21	339	2.10	7	92.56	299	2.38	8	5.89	19
Pa'auilo	60	2.46	4	135.62	226	0.55	1	131.77	220	0.43	1	4.60	8
Hakalau	150	5.19	3	98.02	65	2.54	2	93.07	62	0.32	0	3.03	2
Onomea	147	8.27	6	66.61	45	2.97	2	60.72	41	0.65	0	2.26	2
Waimea	24	52.14	217	186.75	778	13.80	58	150.63	628	13.95	58	19.98	83
Hilo	349	69.20	20	70.67	20	21.86	6	28.04	8	5.17	1	5.19	1
Kea'au	395	49.41	13	131.96	33	4.41	1	79.37	20	2.50	1	5.18	1
'Ōla'a	125	1.52	1	22.07	18	0.40	0	20.26	16	0.53	0	1.49	1
Kapāpala	19	0.00	0	0.98	5	0.00	0	0.98	5	0.00	0	0.04	0
Nā'ālehu	118	10.75	9	113.33	96	2.88	2	105.07	89	1.00	1	4.63	4
Ka Lae	31	1.41	5	22.91	74	0.40	1	21.33	69	0.28	1	0.99	3
Manukā	25	7.72	31	33.21	133	0.00	0	25.15	101	0.78	3	1.71	7
Ka'apuna	51	0.02	0	40.77	80	0.02	0	40.41	79	0.42	1	1.96	4
Kealakekua	38	10.26	27	68.53	180	1.43	4	57.52	151	2.67	7	4.73	12
'Anaeho'omalu	30	81.67	272	88.74	296	10.99	37	18.06	60	14.41	48	14.74	49
Pāhoa	437	33.34	8	67.57	15	3.77	1	37.59	9	7.10	2	8.61	2
Kalapana	158	3.05	2	53.14	34	0.83	1	50.41	32	1.08	1	3.41	2
Hilina	9	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
Keaīwa	17	0.06	0	6.59	39	0.00	0	6.52	38	0.00	0	0.17	1
Keauhou	38	171.06	450	245.70	647	39.42	104	111.91	295	17.50	46	18.60	49
Kīholo	18	36.13	201	36.22	201	3.23	18	3.23	18	6.66	37	6.66	37
Total	2,410	593.30		1,802.21		120.50		1,309.08		82.18		126.14	

As indicated in the table above, the Keauhou ASYA, in particular, requires attention and more detailed planning. In July 2014, the County of Hawai'i informed CWRM that it was initiating a regional WUDP update focusing on the Keauhou ASYA. The update is well underway.

For all aquifers studied, the WUDP contains specific resource and facility recommendations for each aquifer studied. These include extension of ground water system service areas, water transfers, alternative source development, demand-side management (development density control and water conservation). The WUDP also offers the following general recommendations:

- The highest quality water should be reserved for the most valuable end use.
- Water conservation should be promoted.
- Additional monitoring and studies are recommended to determine the “safe” sustainable yields and to improve the accuracy of the island’s ground water hydrologic units.
- Regional studies should be initiated to examine the impacts of water transfers amongst sectors to satisfy increasing competition for water resources.
- Future updates of the WUDP should promote a policy of well-planned source development.
- Water development coordination and cooperation between public and private sectors are emphasized to assist the success of future planning.
- The involvement of collaborative and advisory groups has had a positive impact on water resources planning, and these groups are encouraged to continue to provide input and insight.

H.7 Recommendations for County Water Planning

The State Water Code mandates that the County WUDPs “be prepared by each separate county...setting forth the allocation of water to land use in the county.” To achieve this objective, water planning efforts related to municipal and non-municipal water demands should be coordinated and integrated at the county level. The responsible county agency will need to bring the many other water planning agencies at the State and federal levels, stakeholders, and representatives from the private sector into a collaborative process.

Water allocation planning must be accomplished in accordance with State and county policies and be in line with county-specific strategies for sustainable development. In addition to addressing the availability of water resources, planning activities must also relate to the community’s desires for development, economic growth, environmental protection, and competing uses in managing the relationship between water demand and water supply.

Demand projections for the planning horizon must account for and reflect the cumulative effects of consumptive use. Consumptive uses reduce the source water level or flow; water is not returned to its source (for example, water used for irrigation or urban supply). Typically, all water use in Hawai‘i is consumptive, with the exception of stream diversions for ornamental ponds or taro lo‘i that return water to the stream over the course of a short period of time and at a point relatively near the initial diversion. Water loss due to evaporation, seepage, and evapotranspiration in such diversion scenarios can be considered as negligible, due to the relatively small displacement in location and limited time frame.

While the Framework provides overall guidance and recommended elements for the County WUDPs, the following list of recommendations is provided to help guide the counties in their allocation of water to land use and to encourage the assessment of cumulative impacts to the resource. Recommendations for measuring existing consumptive uses and assessing future demand are presented, along with recommendations for associated land use planning issues.

Recommendations for county water planning are as follows:

- Promote coordination and collaboration among agencies, private entities, and users to account for the cumulative effects of water use and to mitigate negative impacts to the resource.
- Establish strategies for increasing system efficiency and for managing higher water demand associated with land use and planned development.²²
- Compare the total water demand projection associated with land use plans and zoning, to assess the need to evaluate/revise of land use policies (e.g., full build-out scenario).
- County Planning Departments should consider findings from the WUDPs in their future updates of general plans, community development plans, and zoning decisions.
- Seek the optimization of infrastructure to minimize local stress on aquifers and increase confidence in ground water modeling of sustainable yields.
- Increase drought preparedness and awareness, and implement Hawai'i Drought Plan recommendations for county actions.
- Implement economic incentives for resource stewardship, conservation, and reuse.
- Monitor agricultural demand for potable water and use alternative non-potable water for agricultural demands wherever possible.
- Gather information on community values and expectations for water use.²³
- Encourage local stakeholder partnerships to implement County WUDP recommendations.

²² Denotes recommendations adapted from the *Guidance Notes for Planning for Water Allocation* prepared in August 2003 by Ton Snelder, NIWA and Richard Keys, Marlborough District Council for the Quality Planning Project, a partnership between the New Zealand Planning Institute, the Resource Management Law Association, Local Government New Zealand, the NZ Institute of Surveyors and the Ministry for the Environment.

²³ Denotes recommendations adapted from the *Guidance Notes for Planning for Water Allocation* prepared in August 2003 by Ton Snelder, NIWA and Richard Keys, Marlborough District Council for the Quality Planning Project, a partnership between the New Zealand Planning Institute, the Resource Management Law Association, Local Government New Zealand, the NZ Institute of Surveyors and the Ministry for the Environment.

- Consider the impacts of climate change in long-range planning.
- Promote aggressive water conservation.
- Prioritize the needs of public trust purposes and consider and protect water rights, including traditional and customary Hawaiian rights.
- Extend the planning horizon and assess the implication of current land use plans, policies, and entitlements on water resources.

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