Hawai‘i Water Plan

WATER RESOURCE PROTECTION PLAN

2019 UPDATE

State of Hawai‘i
Commission on Water Resource Management

Townscape, Inc.

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1 Introduction

Ola I ka wai a ka `ōpua
There is life in the water from the clouds

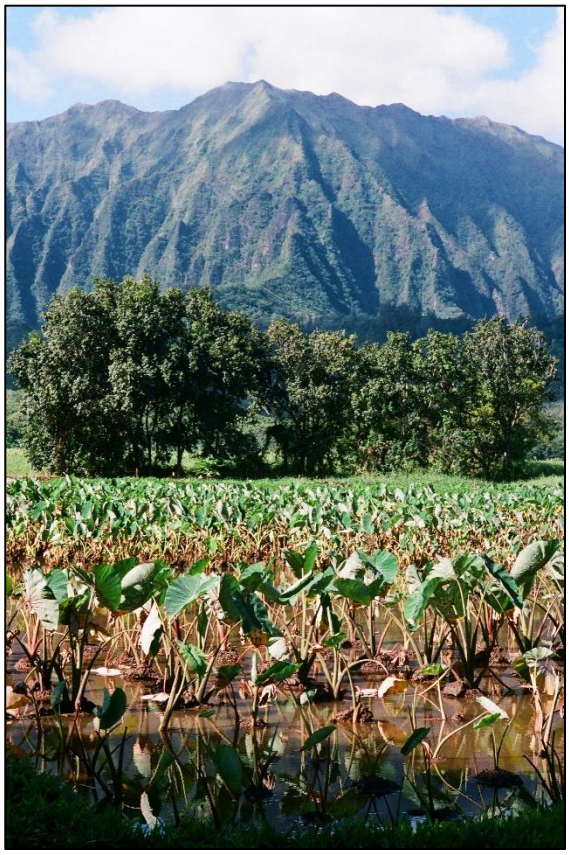
-ʻŌlelo Noʻeau: Hawaiian Proverbs and Poetical Sayings,
Mary Kawena Pukui

1.1 Importance of Water in Hawaiʻi

The Hawaiian Islands are some of the most isolated islands on earth, located approximately 2,500 miles from the nearest continent. Surrounded as they are by the ocean, the six major populated Hawaiian Islands – Kauaʻi, Oʻahu, Molokaʻi, Lānaʻi, Maui, and Hawaiʻi - are solely reliant on precipitation to meet drinking water and all other freshwater needs. Unlike the continental United States, Hawaiʻi does not have the ability to transport freshwater from one county to another, thus careful and wise management is critical to sustain this most precious life-giving resource.

Ancient Hawaiians understood the critical importance of fresh water. According to moʻolelo (stories) passed down from generation to generation, fresh water streams and springs were created throughout Hawaiʻi by the gods Kāne and Kanaloa. This established a spiritual connection between the indigenous inhabitants of the islands and the resource that is so vital to life. The importance of water in Hawaiʻi is also evidenced in the many place names that include "wai", as well as important words, such as those describing wealth (waiwai) and law (kānāwai). In accordance with their reverence and respect for water, land management units were organized around freshwater supplies in a traditional system known as the ahupua'a resource-management system. Water was viewed as such a critical resource to the health and well-being of the people of ancient Hawaiʻi, that the concept of private ownership did not exist. Today, our State Constitution and Water Code (**Hawaii Revised Statues Chapter 174C**) continue to reflect these traditional values by declaring that Hawaiʻi's water resources are part of the public trust.

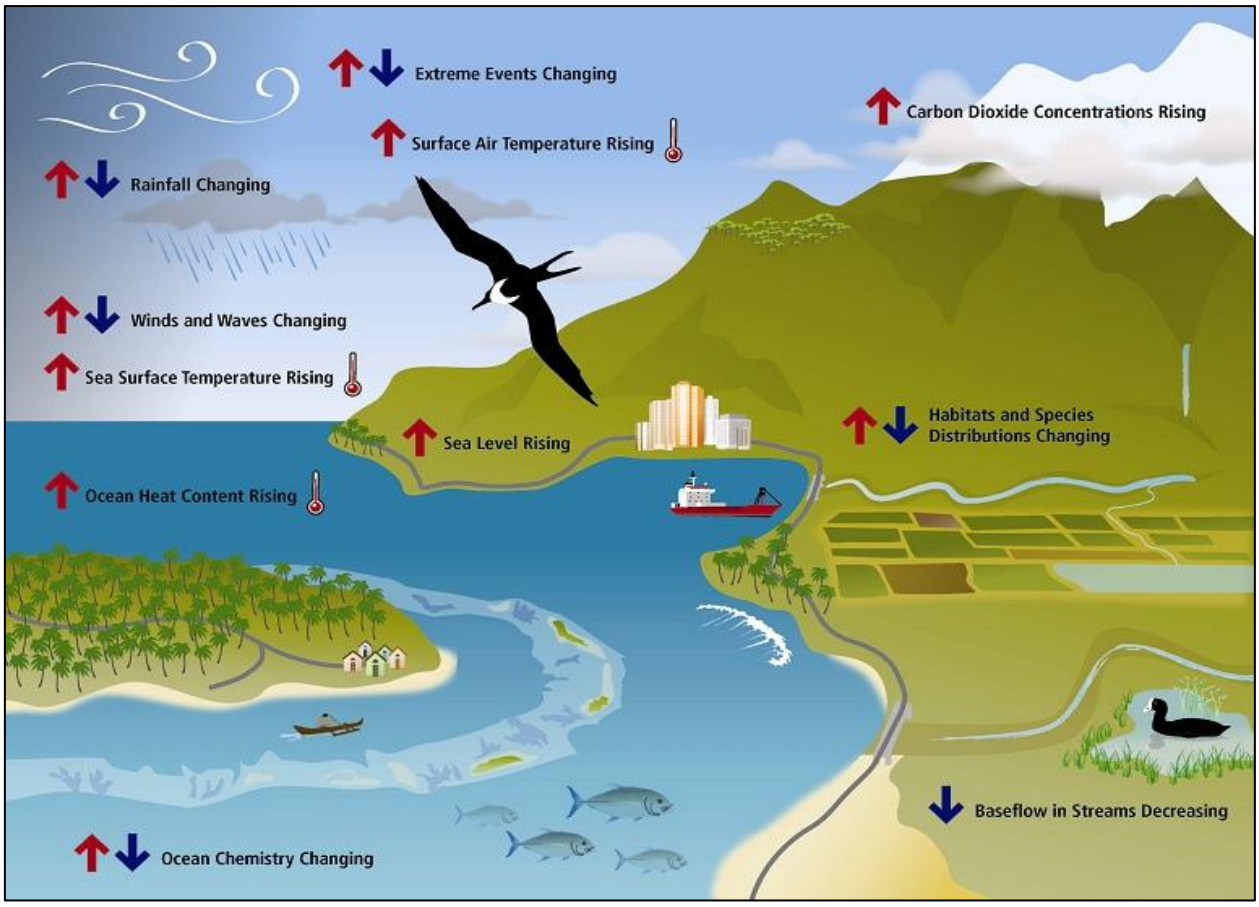
Photo credit:
https://douglaspooloatolentino.files.wordpress.com/2011/10/kanekanaloa.jpg,



1.2 The Need for Long-Range Water Planning

To ensure the long-term protection of the water resources trust, the State Water Code recognizes the need for a program of comprehensive water resources planning. The Hawai‘i Water Plan, a multi-component, long-range plan, fulfills this need. Comprised of five component plans, each prepared by a different agency, the Hawai‘i Water Plan seeks to protect, conserve, and enhance the quantity and quality of existing water resources, while providing for existing and future water demands within each county through an integrated water resource management approach.[1]

Figure 1-1 Indicators of Climate Change in the Pacific Islands Region



Source: Keener, V.W., Marra, J.J., Finucane M.L., Spooner, D., & Smith, M.H. (Eds.). (2012). Climate Change and Pacific Islands: Indicators and Impacts. Report for the 2012 Pacific Islands Regional Climate Assessment (PIRCA).Washington, D.C.: Island Press

[1] For more information about the Hawai‘i Water Plan and its component plans, visit http://dlnr.hawaii.gov/cwrm/planning/hiwaterplan/

The need for water resources planning and sustainable management has never been greater. Hawai‘i’s population is projected to increase by about 20% from 2010 to 2040,[2] and with it, the demand for more drinking water. Balanced against that is the growing awareness of Hawaiian water rights and the recognition of environmental needs and the critical ecosystem services that are dependent on healthy watersheds and natural water flows. Hawai‘i’s land use is in flux. The cessation of sugarcane plantation agriculture is resulting in large swaths of productive agricultural lands becoming available for new land uses, creating opportunities to rebalance instream and offstream needs and fostering greater use of alternative water sources.

The future impact of climate change on water resources is still being studied but the best available information indicates that, for the most part, the impact will be negative. Scientists have already observed decreases in rainfall over the last 30 years, along with an associated decline in stream flows. This uncertainty requires both a precautionary and adaptive approach to water management to ensure the long-term protection of our water resources while providing flexibility for revisions of prior decisions in light of new and better information.

The Water Resource Protection Plan (WRPP) is the component of the Hawai‘i Water Plan that seeks “to protect and sustain statewide ground and surface water resources, watersheds, and natural stream environments.”[3] The WRPP is prepared by the State Commission on Water Resource Management (CWRM), which is established as the primary trustee of the water resources trust under the State Water Code. Among other things, the WRPP includes:

- General water resource management principles and policies;
- The nature and occurrence of water resources in the State;
- Hydrologic units for ground and surface waters and sustainable limits for water supply (i.e., ground water sustainable yields and surface water instream flow standards);
- Existing water uses and projected future demands;
- Programs for hydrologic data collection and analyses;
- Regulatory authorities and permitting systems; and
- Studies and programs to conserve and augment water resources.

Based on a comprehensive review of the current state of water resources and management, the WRPP identifies emerging threats, unresolved issues, management gaps, and recommended actions to further sustainable water management. Initially adopted in 1990, the WRPP was last updated in 2008.

[2] Research and Economic Analysis Division, Department of Business, Economic Development and Tourism. March 2012. *Population and Economic Projections for the State of Hawaii to 2040, DBEDT 2040 Series*.
[3] Statewide Framework for Updating the Hawai‘i Water Plan, February 2000, p. 3-1

1.3 Vision, Mission, and Guiding Policies

Our Vision

Flowing streams,
sustainable aquifers,
and functioning watersheds
for the use, enjoyment, and benefit of all.

Our Mission

To protect and manage
the waters of the State of Hawai'i
for present and future generations.

Guiding Policies

A policy is a statement that guides decision-making. As such, policies should be as clear and universally applicable as possible. CWRM's management actions and decisions are guided by policies, which are derived from statements in officially adopted documents, such as the State Constitution and State Water Code, and from CWRM and Supreme Court decisions on specific cases that laid the foundation for future decisions and actions. CWRM's guiding policies include:[4]

1. **The Public Trust Doctrine: The title to water resources is held in trust by the state for the benefit of its people.**
2. **The State recognizes four public trust purposes:**
   (a) maintenance of waters in their natural state;
   (b) domestic water use of the general public, particularly drinking water;
   (c) the exercise of Native Hawaiian traditional and customary rights; and
   (d) reservations of water for Hawaiian Home Lands.
3. **The Precautionary Principle: The State has a duty to take anticipatory action to prevent harm to public resources.**
4. **Apply adaptive management principles in the face of scientific uncertainty.**
5. **The State Water Code shall be liberally interpreted.**
6. **The State Water Code shall be applied in a manner that conforms to the intentions and land use plans of the counties.**
7. **Comprehensive water resources planning is needed for proper management and protection of the resource.**
8. **High standards of water quality shall be maintained.**
9. **Provide for public interest objectives while seeking to obtain maximum reasonable and beneficial use of waters of the state.**
10. **Quality of the water source should be matched to the quality of the water needed.**
11. **If there is a practical alternative water source available, that alternative source should be used in lieu of natural supplies.**
12. **Water use should be efficient, and waste of water is disallowed.**
13. **Appurtenant rights shall be assured.**

[4] For additional discussion on the following policies, please refer to **Appendix C Legal Authorities and Guidance**).

2 The Current State of Water Resources and Management Tools

Current and best-available information on water resources was gathered to identify technical water-related issues that need to be addressed. **Section 2.1** summarizes the water resource issues identified by the community and stakeholders during the CWRM public outreach process. **Section 2.2** describes the state of water resources in Hawai‘i and CWRM programs to manage and protect those resources. **Priority Recommendations** and the Action Plan describes the actions designed to address issues and program management gaps found in **Section 2.1** and **Section 2.2**.

2.1 Water Resource Issues

In order to find out how the public perceives and understands Hawai‘i ‘s water resources, CWRM held public meetings, and met with stakeholders and subject matter experts around the state. Ten key issues were distilled down from information gathered during these interactions. These issues are shown below in bold typeface and followed by a brief description of the issue.

Reliable, long-term data is needed to make sound water-management decisions.

To make sound decisions, water managers need reliable data. Longitudinal data provides the best information for identifying trends in water availability and use and can be helpful in predicting future scenarios to plan for. Monitoring of ground water and streams allows for an accounting of how much water there is, whether natural flows are sufficient for environmental and cultural needs, and how water is made available for human use. Despite current efforts, ground and surface water is not monitored as completely as it should be and the number of stream flow monitoring stations continues to decrease. This makes it difficult to understand long-term temporal and spatial changes in water resources and availability and the impacts of climate change on our water supplies.

In addition to monitoring of the resource itself, managers require an understanding of human water demand to be able to balance various water needs. Therefore, it is critical to have an accurate accounting of water use by various sectors, such as agriculture, domestic consumption, landscape irrigation, and industrial uses. Each owner or operator of a water source (i.e., wells or stream diversion works) is required to report their monthly water use; however, not all owners/operators are compliant. **Table 2-1** below shows the compliance rate for ground water use reporting.

Table 2-1 Water Use Reporting by Island 2016

Island	Total # of Production Wells[1]	# Wells Reporting Water Use	Compliance Rate
Kauaʻi	288	139	48.3%
Oʻahu	818	491	60.0%
Molokaʻi	89	40	44.9%
Lānaʻi	10	10	100.0%
Maui	567	240	42.3%
Hawaiʻi	927	331	35.7%
TOTAL	2,699	1,251	46.4%

1. Production Wells are defined as all wells that are not abandoned, observation, or unused wells.

Analysis of data provides critical guides for water management, such as the sustainable yield of ground water aquifers and instream flow standards for streams; whether existing regulatory controls are working; or whether additional regulation is needed. Water demand projections help to predict the amount of water needed in the future, allowing for early planning at the county level to identify the adequacy of existing resources and infrastructure, plan for the development of alternative sources, determine the need and opportunities for increased conservation and potential reallocation of water, and inform future land use plans and policies.

Water resource management needs to consider all the above considerations of demand, supply, and future water scenarios with decisions only made better with improved and long-term data and analysis. Strategic and coordinated resource monitoring, such as a network of deep monitor wells, stream flow gages, and climate stations would allow for the verification of sustainable yields, contribute to the monitoring of recharge trends in critical ground water aquifers, and provide valuable data for the understanding of ground water/surface water interactions, and the calculation of instream flow standards and surface water allocations. Such monitoring can also be used to study trends attributable to climate change and predict future needs and resources.

Improved water use reporting is another critical component to understanding water needs and availability. Reporting systems should be made as user-friendly as possible and outreach should be conducted to encourage compliance with reporting requirements. Enforcement should also be used to ensure that reporting requirements are met.

There is increasing competition for water resources in certain areas.

Human consumption of water resources continues to increase as Hawai‘i’s population grows and demand for domestic, commercial, industrial, and landscape and agricultural irrigation increases. Societal needs must be balanced against the need to maintain waters in their natural state for environmental uses and ecological health. Additionally, there has been a resurgence in traditional uses of water resources, which often rely on surface water sources and coastal springs for traditional and customary practices and subsistence activities. Such diverse uses of water may result in total demand in some areas exceeding ground water supplies, surface water supplies, or both.

Demand for water resources continues to increase as more and more users compete for both ground and surface water. The State Constitution states that "All public natural resources are held in trust by the State for the benefit of the people."[5] It is CWRM's duty to protect water resources in accordance with its public trust responsibilities. Hawai‘i has recently experienced a multi-year drought and climate change is expected to increase the occurrence of drought in some areas of the state.[6] Proactive planning at the State, County, and individual user level, as well as coordination among all, is needed to minimize negative impacts to the resource, communities, and the economy.

Competition for water resources brings increased urgency for aggressive conservation measures that ensure that water is not wasted or lost. Additionally, alternative water sources, such as recycled water and storm water, offer lower quality water that can be used for non-potable needs, reserving high quality water for potable uses, such as drinking and food preparation. Desalinated could also provide high quality water to supplement potable water supplies. As emerging technologies, potential alternative water users and the public need to be educated on the benefits and actual impacts of using such sources and alternative water providers need guidance from regulators and scientists to ensure that public health and the environment are protected

[5] Constitution of the State of Hawai‘i, article XI, §1.
[6] Keener, V.W., Marra, J.J., Finucane M.L., Spooner, D., & Smith, M.H. (Eds.). (2012). Climate Change and Pacific Islands: Indicators and Impacts. Report for the 2012 Pacific Islands Regional Climate Assessment (PIRCA).Washington, D.C.: Island Press

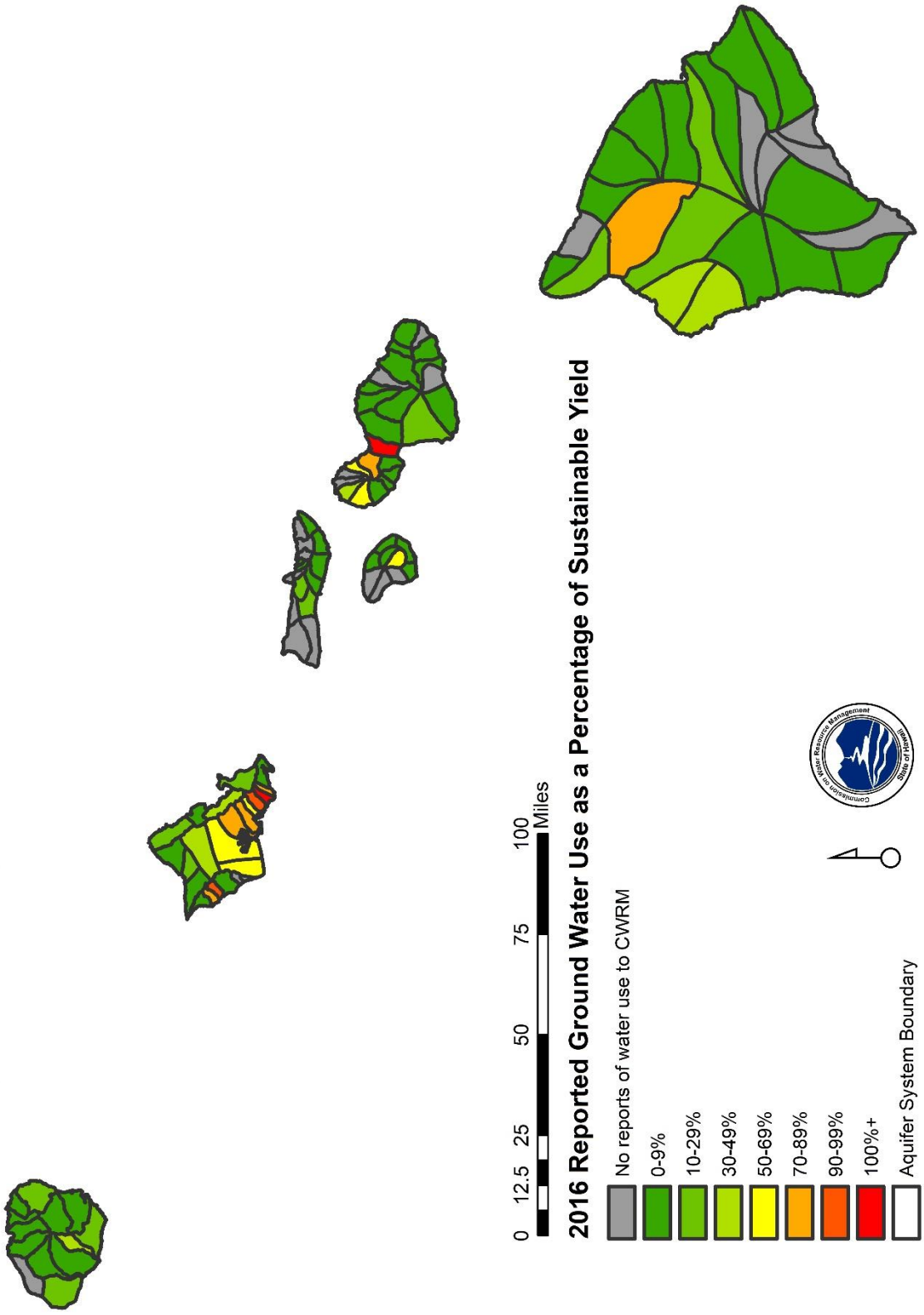


Figure 2-1 2016 Reported Ground Water Use as a Percentage of Sustainable Yield

The availability of, and access to, water must be protected for public trust purposes.

The Hawai‘i State Constitution recognizes that water resources are part of the public trust. The Hawai‘i Supreme Court further established the following four public trust purposes: (1) maintenance of waters in their natural state; (2) domestic water use of the public, particularly drinking water; (3) the exercise of Native Hawaiian and traditional and customary rights, including appurtenant rights; and (4) reservations of water for Hawaiian Home Land allotments.[7]

It has been especially difficult to plan for traditional and customary rights, as practices are site specific, there are no databases of practices from which to plan for, and many practices are not shared publicly. Nonetheless, the State has an obligation to protect traditional and customary practices and should account for them in any natural resource planning effort. To do so, there needs to be a better understanding of the public trust purposes, guidance on how to incorporate public trust needs into decision-making, and education and outreach to water users and managers to understand those needs and management considerations.

Aging and inefficient water infrastructure could potentially waste and impact the quality of the resource.

Much of Hawai’i‘s water infrastructure was constructed decades ago. There are many ground water wells that are no longer in use and have not been properly sealed, providing potential conduits for contamination of ground water aquifers. Some older wells also do not have flow control devices that manage pumpage volumes and measure flow, making it difficult to monitor usage and minimize waste. Similarly, some stream diversions and large-scale agricultural irrigation systems are no longer used for their original purpose, are leaking and inefficient, and do not have flow control devices.

Water use reporting may be used to identify unused water infrastructure and prioritize wells and diversions for sealing and removal. Large agricultural irrigation systems are inventoried by the State Agricultural Water Use and Development Plan, which provides information on the current rehabilitation and maintenance needs for each system. This agricultural water needs assessment should include in their analyses important agricultural lands and the volumes of water needed, as well as the parties responsible for maintenance of these legacy irrigation systems.

[7] The Supreme Court decision No. 21309 *In the Matter of the Water Use Permit Applications, Petitions for Interim Instream Flow Standard Amendments, and Petitions for Water Reservations for the Waiāhole Ditch Combined Contested Case Hearing* (“Waiāhole I”), *Section III. Discussion, B. The Public Trust Doctrine, 3. The State Water Resources Trust, b. Substance of the Trust, i. Purposes of the Trust* (2000) established the first three public trust purposes. The Supreme Court decision No. *22250 In the Matter of the Contested Case Hearing on Water Use, Well Construction, and Pump Installation Permit Applications, Filed By WAI‘OLA O MOLOKA‘I, INC. and MOLOKA‘I RANCH, LIMITED, Section III. Discussion, A. The Commission’s Decision Violated DHHL’s Reservation Rights As Guaranteed by the HHCA, The Hawai‘i Constitution, The Code, And The Public Trust Doctrine, 3. Reservations of water constitute a public trust purpose, which the commission has a duty to protect in balancing the competing interests for a water use permit application* (2004) established the fourth public trust purpose.

Climate change is anticipated to increase water demand and decrease water availability.

Climate change is expected to result in many water resource changes, including intensified flooding and drought, reduced recharge to ground water aquifers in leeward areas, elevation of basal aquifers due to sea level rise, and higher water use. In general, researchers expect wet areas in Hawai‘i to get wetter and dry areas to get drier. However, there is considerable uncertainty in future predictions of climate. This will change water demands and supplies in some areas and require adaptation in demand management, water infrastructure, and distribution.

Proactive planning is needed for such climate change scenarios, including projected water demands and expected water availability in localized areas. Continued research is needed to refine climate change predictions for Hawai‘i as new information is made available and our understanding of this phenomenon is improved.

Man-made pollution threatens fresh water supplies.

The availability of water for human use and consumption is affected not only by the amount of water that is in our ground water aquifers and in our streams; the quality of our water resources also impacts what is available for use. In general, Hawai‘i’s water quality is very good, with ground water requiring little treatment before being distributed for consumption. However, over the years, land uses have intensified and encroached over aquifers, increasing the potential for ground water contamination. Similarly, some land uses may increase the potential for erosion and surface runoff that transports sediment and other pollutants into streams and nearshore waters.

The State Department of Health oversees programs that protect the quality of surface and drinking water, County water departments are responsible for the quality of the drinking water they provide their customers, County environmental services departments manage polluted runoff control, and County planning departments have jurisdiction over land uses. Coordination among these entities and CWRM will ensure clean, healthy waters for drinking and public and environmental health.

Land uses changes are reducing the replenishment of fresh water sources.

To manage our water resources and ensure supplies for cultural needs, human consumption, and ecological sustainability, we need to understand the dynamics of hydrology, ecosystem function, and the impacts of land use and human water use on the resource. Some land uses impact water resources not only in their demands for water, but also in how water supplies are replenished. For example, urban development increases the impervious surfaces (hard surfaces that water cannot seep through). In these areas, less water can soak into the ground replenishing ground water aquifers, and more water runs off into streams. Some land uses also divert or hold back surface water, making it unavailable for uses downstream.

Continued understanding of hydrologic patterns and functions can inform strategies for source water replenishment. Long-range planning that seeks to minimize impacts on the natural flow of water should be used as a tool to protect critical water sources. Low impact development has also been identified as one way to restore some pre-development hydrologic functions by allowing storm water to infiltrate into the ground, rather than run off into drainages.

Communities feel uninformed and underrepresented in water resource management and decision-making.

Water resource management has often been left to government, scientific researchers, and other "experts." As communities become more informed about water resources, they are calling for more information on sources, uses, and water resource health and for the ability to participate in managing their water resources.

As beneficiaries of the public trust and direct users of water resources, the public can and should have a significant role in understanding water resources and its management. But for this to occur, there must be opportunities for information exchange and participation in the decision-making process. Opportunities must exist for government to share water resource and user data and to receive information on uses, users, needs, and observations from those who are affected by management decisions. At the same time, the public also needs to be receptive to the decision-making process, to the multiple demands that must be weighed, the tradeoffs that must be made, and to legal obligations and judicial precedent.

The priorities and processes for enforcement of State Water Code violations need to be clear, proactive, and relevant.

Effective management of any resource requires clear, thoughtful guidance and timely and fair penalties for violations. Many violations go unchecked due to the sheer number of water sources and permits in existence throughout the state and the limited number of staff, none of which are dedicated solely to investigating and correcting violations. Additionally, penalties have been criticized as arbitrary and not fitting of the severity of the violation. Compliance with water management permits and policies, such as reporting of water use or constructing a well or diversion, could benefit from developing enforcement priorities and processes. Updates and refinements to the regulatory process, enforcement policy, and penalty system could also address these concerns.

Water resource issues are complex and require expertise and management by a diverse group of individuals and entities.

Water is a complex resource that touches many facets of daily life and each person in unique ways. While we continue to learn more about the science of water, we have even more to learn about the ecology and cultural and spiritual links of people to water. With water's importance to everyone and with so much to understand, it is necessary that many sources of knowledge and perspectives are accounted for. All levels of government need to partner with private entities, scholars, and communities to monitor the resource, bring forth information and perspectives, and to plan for the future.

Water does not exist in isolation. It cannot be managed in a vacuum, separate from what is going on around it. Therefore, water must be planned for in a holistic way, considering ecological needs and land uses, as well as human needs.

2.2 Current Knowledge of Water Resources and Available Management Tools

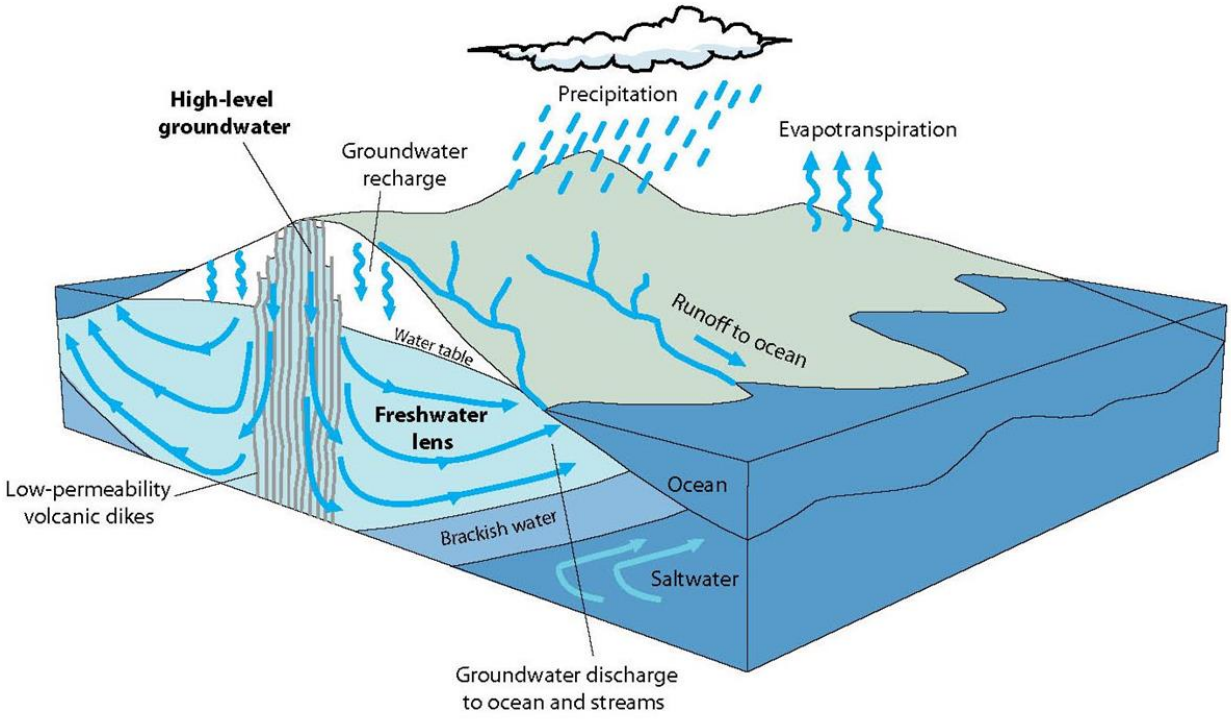
Water resources is a very complex subject in Hawai'i. This section summarizes major water resource management topics and related issues to provide readers a fundamental understanding of how CWRM assesses and analyzes data and information – and how these analyses inform the development of tools and implementation of programs to manage water resources across the State of Hawai'i. As part of this discussion, any program gaps, deficiencies, or issues are identified along with recommendations to address them.

The following sub-sections follow the order of the topical information contained in the appendices of the WRPP Update

2.2.1 The Hydrologic Cycle

The hydrologic cycle refers to the constant movement of water between the ocean, the atmosphere, and the Earth, and includes precipitation, infiltration and recharge, runoff, and evapotranspiration (**Figure 2-2**). **Evapotranspiration** is the loss of water from soils, canopy, and open water bodies through evaporation and the transfer of water from plants to the air through transpiration. Moisture in the air is carried by trade winds up mountain sides, where it cools and condenses, and finally falls to the land surface as **precipitation** (i.e., rain or fog drip). Plants immediately absorb and use some of the rain and fog drip, but the remaining volume of water **infiltrates** through the ground surface, **runs off** to the ocean or streams, **evaporates** into the atmosphere, or ends up **recharging** the ground water aquifers. Additional explanation of the hydrologic cycle may be found in **Appendix F**.

Figure 2-2 Hydrology of Ocean Islands



Source: USGS Pacific Islands Water Science Center (http://hi.water.usgs.gov/studies/GWRP/islhydro.html)

As rainwater wets the land surface, shallow infiltration saturates the uppermost soil layer and replaces soil moisture used by plants. Thereafter, excess water percolates slowly downward to recharge ground water bodies and support stream flow in perennial sections. However, human activities can alter infiltration and runoff patterns by changing the permeability of ground surfaces, thus encouraging or inhibiting infiltration of water into ground water aquifers.

Program Issues: To quantify and make accurate estimates of water availability, it is important to collect data and observations of individual hydrologic cycle processes over a long period of time. This includes observations of precipitation (rainfall), evapotranspiration, runoff (stream flows) and the ground water column.

Recommended Projects: Project 1.1, Project 1.2, and Project 1.4

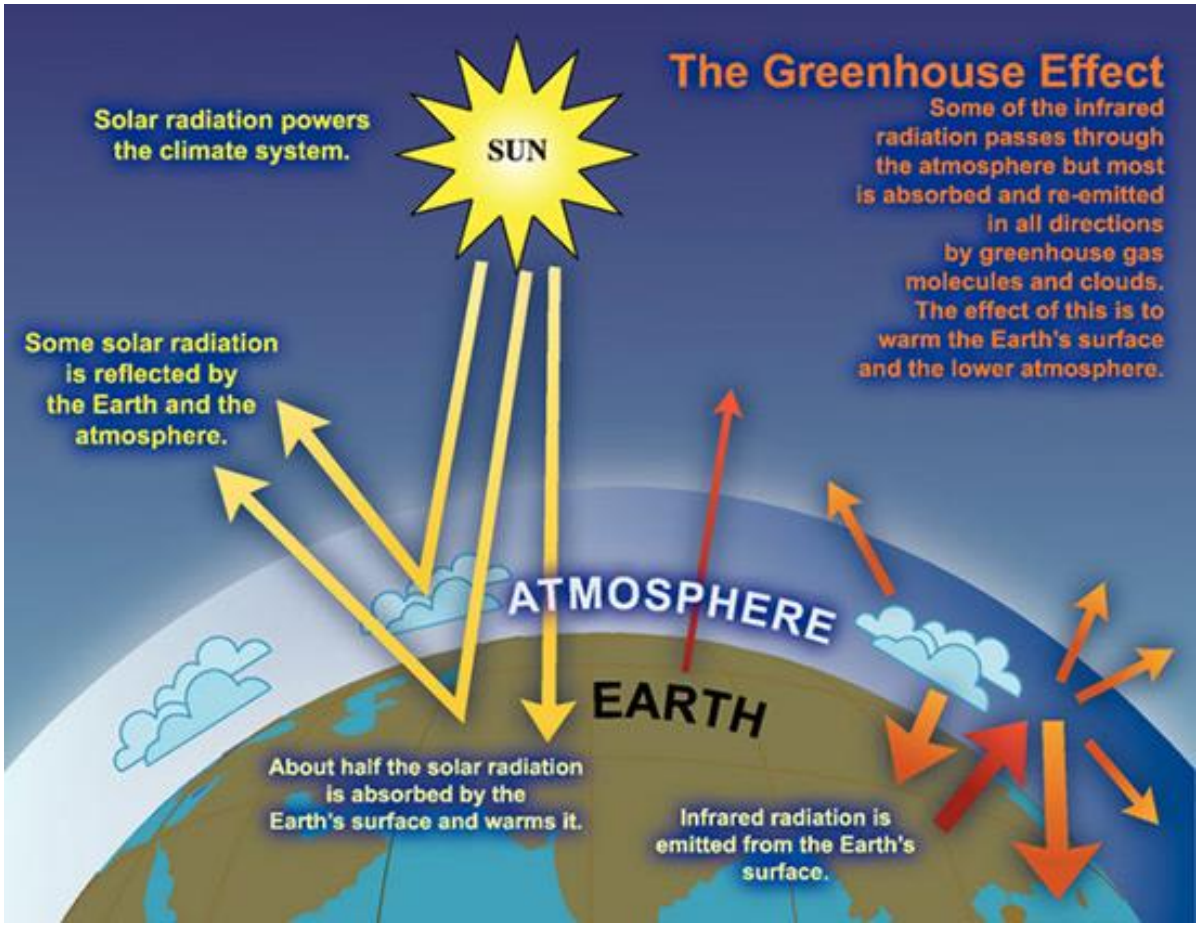
2.2.2 Climate Change

Climate change is "a change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity."

-United Nations Intergovernmental Panel on Climate Change (IPCC, 2007)

Greenhouse gases such as carbon dioxide (CO_2) absorb heat, or infrared radiation, from the Earth's surface, trapping heat in the atmosphere that would otherwise escape into space. While these gases occur naturally, the industrial age resulted in an increase in the burning of fossil fuels and deforestation, which increased their concentrations in the atmosphere. Results of greenhouse gas increases are warming of the Earth's oceans and air, changing precipitation patterns, melting snow cover and ice sheets, ocean acidification, and rising sea levels, which in turn lead to further impacts on natural processes.

Figure 2-3 An Idealized Model of the Natural Greenhouse Effect



Source: Intergovernmental Panel on Climate Change, 2007, IPCC Fourth Assessment Report: Climate Change 2007. Ch.1

Locally, Hawai‘i has experienced changes in measured precipitation and stream flows[8] and is expected to also experience the following water-resource-related impacts from climate change:

- **Decrease/increase in potable water supplies across the region, changing frequency and intensity of climatic extremes.** Drought has been more frequent and prolonged, and there have been fewer tropical cyclones. Over the past century rainfall has decreased across the region. Average surface air temperatures are rising, especially at high altitudes. Ground water discharge to streams has significantly decreased over the past 100 years. This trend indicates a decrease in ground water storage[9]. However windward sides will become wetter during the wet season and leeward sides are expected to become drier in the dry season;[10]

- **Increase in potable and non-potable water demand** for municipal and agricultural uses may result from increases in air temperatures,[11] increases in evapotranspiration and longer and more frequent droughts;

- **Decrease in ground water discharge to streams** due to decreases in rainfall and decreases in fair weather flows from springs and seeps from high level aquifers;[12]

- **Impacts on water supply infrastructure** due to sea level rise and associated inland and coastal flooding, increasing corrosion of metallic pipelines resulting in more main breaks and higher repair and replacement costs;

- **Large increases in the costs of water supply infrastructure and flood mitigation measures** due to this complex array of climate change impacts on the water systems of Hawai‘i.

Program Issues: It is important to establish and maintain long-term climate monitoring stations to track changes in Hawai‘i’s climate elements over time.

Recommended Projects: Project 1.1, Project 1.5

[8] University of Hawai‘i at Mānoa Sea Grant College Program. June 2014 Climate Change Impacts in Hawai‘i - A summary of climate change and its impacts to Hawai‘i’s ecosystems and communities
[9] Keener, et.al. (2012)
[10] USGS Open File Report 2016-1102
[11] Keener, et.al. (2012)
[12] Ibid

2.2.3 Inventory and Assessment of Resources

To meaningfully plan for and manage water resources, it is important to understand the inventory of water resources statewide; the human impact on those resources; and the issues, challenges, and opportunities for improving management and protection practices. Concerns related to water supply, water quality, and degradation of aquatic environments are frequently at the forefront of water management issues.

> *"Effective policies and management practices must be built on a foundation that recognizes that surface water and ground water are simply two manifestations of a single integrated resource."*
>
> - USGS Circular 1139: Ground Water and Surface Water: A Single Resource

A major issue with water resource management is balancing existing water needs with the availability of water for future generations and environmental needs. Over and above actual water withdrawals, other issues include environmental and safety concerns with the siting and maintenance of water infrastructure, such as reservoirs for storage.

The cumulative effects of land use changes, other human activities, and short- and long-term climate change can shift the natural balance of the hydrologic cycle, having profound social, environmental, and economic impacts within our island communities. CWRM has developed goals to guide sustainable water planning and management activities that seek to continually improve the understanding of water resources, collaborate with stakeholders and other water resource professionals, and apply updated information and best practices toward the management of water resources. Further description of CWRM's goals may be found in **Appendix C**.

Additionally, the interaction of ground water and surface water has been, and continues to be, a significant area of focus and deliberation. Most potable water is drawn from ground water aquifers, potentially having impacts on surface water and coastal leakage, the ecosystems dependent upon them, and associated traditional and customary rights. The interaction between ground and surface water also means that there is the potential for each to impact the water quality of the other. Despite this, typical management of water resources separates ground and surface water resources and the limited understanding of their localized interactions make it difficult to characterize actual processes. However, where interaction exists, monitoring and appropriate ground and surface water management programs are integrated and implemented. Further description of these issues may be found in **Appendix F: Inventory and Assessment of Water Resources**.

2.2.3.1 Nature and Occurrence of Ground Water

Ground water in Hawai‘i is stored in several different types of aquifers: basal, dike impounded, perched, caprock, brackish, deep confined freshwater. Descriptions of each type of aquifer may be found in **Appendix F: Inventory and Assessment of Resources**. Basal aquifers are the primary source for municipal water in Hawai‘i. There is a brackish transition zone where the freshwater basal lens meets seawater, with salinity gradually increasing with depth. The upward movement of this transition zone presents a constant potential danger of saline contamination to the freshwater aquifer. Interestingly, previous conceptual ground water models are being modified in response to recent discoveries of freshwater aquifers beneath the salt water underlying basal aquifers on Hawai‘i Island.

> “Aquifer - *a geologic formation(s) that is water bearing…Use of the term is usually restricted to those water-bearing formations capable of yielding water in sufficient quantity to constitute a usable supply for people's uses.”*
>
> - USGS Water Science Glossary of Terms
> http://ga.water.usgs.gov/edu/dictionary.html

CWRM established ground water hydrologic units, or aquifers, and assigned each one a unique code to provide a standard method by which to reference and describe ground water resources, facilitate consistent collection and sharing of information amongst diverse governmental and non-governmental entities, optimize ground water development, and implement resource protection measures. Aquifer boundary lines should be recognized as management lines and not strict hydrologic boundaries where ground water flow does not cross. There are 114 aquifers delineated across the islands of Kaua‘i, O‘ahu, Moloka‘i, Lāna‘i, Maui, and Hawai‘i. Tables of all units by island and accompanying maps of ground water hydrologic unit boundaries may be found in **Appendix F**.

The availability of ground water resources is dependent upon recharge, or the replenishment of fresh ground water, and ground and surface water interactions. However, ground water flow can be difficult to understand and predict because scientists must infer and interpolate its status and characteristics from limited data and modeling tools. CWRM, researchers, and others are constantly working to improve the understanding of ground water flow and the ability to assess the availability of ground water for human consumption.

The amount of ground water that can be developed in any aquifer is limited by the amount of natural recharge and aquifer outflow that must be maintained to prevent seawater intrusion, to maintain perennial streamflow, and to sustain the ecosystems dependent upon ground water discharge. CWRM first adopted **sustainable yield** estimates in the WRPP in 1990 and has revised them based on management approaches, new information and modeling techniques, and the identification of errors in previous models or studies. Explanations of how sustainable yields are estimated, as well as maps of hydrologic units and associated sustainable yields, may be found in **Appendix F**.

> "'*Sustainable yield' means the maximum rate at which water may be withdrawn from a water source without impairing the utility or quality of the water source as determined by the commission.*"
>
> - Hawai'i Revised Statutes §174C-3

2.2.3.2 Nature and Occurrence of Surface Water

Surface water generally occurs in areas that contribute to drainage systems that are confined by topographic divides and are referred to as **watersheds**, drainage basins, or catchments. Streams, springs, ditches and canals, and reservoirs are the most common surface water settings in Hawai'i. Descriptions of each type of surface water body may be found in **Appendix F: Inventory and Assessment of Resources**.

In 2005, CWRM adopted surface water hydrologic units to provide the same consistency and benefits provided by the establishment of ground water aquifers. There are 558 Surface Water Hydrologic Units statewide. Tables of all units by island and accompanying maps of surface water hydrologic units may be found in **Appendix F**.

> *"Instream flow standard means 'a quantity or flow of water or depth of water which is required to be present at a specific location in a stream system at certain specified times of the year to protect fishery, wildlife, recreational, aesthetic, scenic, and other beneficial instream uses.'"*
>
> - Hawai'i Revised Statutes §174C-3

The State Water Code directs CWRM to "*establish instream flow standards on a stream-by-stream basis wherever necessary to protect the public interest in waters of the State*," and that "*in formulating the proposed standard, the commission shall weigh the importance of the present or potential uses of water from the stream for non-instream purposes, including the economic impact of restriction of such use*." CWRM developed a methodology for establishing measurable interim instream flow standards (interim IFS) based upon best available information, along with input from interested parties and agencies.

Interim instream flow standards are "*a temporary instream flow standard of immediate applicability, adopted by the Commission without the necessity of a public hearing, and terminating upon the establishment of an instream flow standard*." [13] Generally, the interim IFS for all streams in a given region were adopted by CWRM and defined as the "*amount of water flowing in each stream on the effective date of this standard, and as that flow may naturally vary throughout the year and from year to year without further amounts of water being diverted offstream through new or expanded diversions*."[14]

The interim IFS of certain individual streams have subsequently been amended as a direct result of petitions to amend the IFS, contested case hearings, other regulatory actions, and staff initiatives. Interim IFS may be amended by CWRM based on a petition and does not require a formal hearing process. On the other hand, an amendment to an Instream Flow Standard can only be initiated by CWRM. For a discussion of the regulatory process for setting instream flow standards, and references to specific actions amending the interim instream flow standard of specific streams, see **Appendix F**. An inventory of surface water resources, including surface water hydrologic unit codes, unit names, area, number of diversions, number of gages, number of active gages, and interim IFS may be found in **Table F-21 in Appendix F**.

Program Issues: Accurate and timely estimates of water availability require: (1) robust data sets; (2) careful analysis and study of the system; and (3) reports and results that are understandable and usable for resource managers and decision makers.

Recommended Projects: Project 1.2, Project 1.3, Project 1.4, Project 1.7, Project 1.8, Project 2.1

2.2.4 Monitoring of Water Resources

Continuous and consistent water data collection is critical to CWRM's ability to protect water resources. CWRM collects, analyzes, and verifies hydrologic data to provide an understanding of water within a particular area. Ground water data are used to observe empirical trends for changes in water levels, pumpage, salinity and the thickness of the transition zone, and to calibrate computer models that will refine conceptual models and sustainable yield estimates, and surface water data are used in the development of instream flow standards. Under the State Water Code, CWRM is primarily responsible for assessing the quantity issues of ground and surface water resources while the Department of Health (DOH) oversees ground and surface water quality issues with respect to public and environmental health. Please refer to **Appendix M: Water Quality** for more information about DOH programs and plans. CWRM's goals, policies, and objectives that guide and focus water resource monitoring programs and the use of resultant monitoring data may be found in **Appendix G: Monitoring of Water Resources**.

[13] Hawai'i Revised Statutes §§ 174C-3.
[14] Hawai'i Administrative Rules § 13-169-49.1

2.2.4.1 Monitoring of Ground Water Resources

Since ground water provides much of the municipal and drinking water supply statewide and demand for high-quality ground water continues to increase, long-term monitoring data is needed to identify emerging trends and problems, provide a basis for comparison, measure the impacts of water development, detect ground water threats, and determine the best management and corrective measures. On O‘ahu, CWRM, the USGS, and the Honolulu BWS have robust monitoring networks; however, monitoring networks in other counties are not as expansive and data is lacking in many areas.

Ground water monitoring activities in Hawai‘i include deep monitoring wells; water-level observation wells; spring discharge; conductivity; rainfall data; and data from well owners including pumpage, salinity (measured as chlorides or conductivity), water-level, and temperature data. Required, regular reporting by well owners is facilitated through the use of an online water use reporting database, the Water Resource Information Management System (WRIMS), which is able to provide reports on water use and other time-series data by aquifer system area, island, user, type of use (e.g., domestic, municipal, and agricultural), and other source information and documentation.

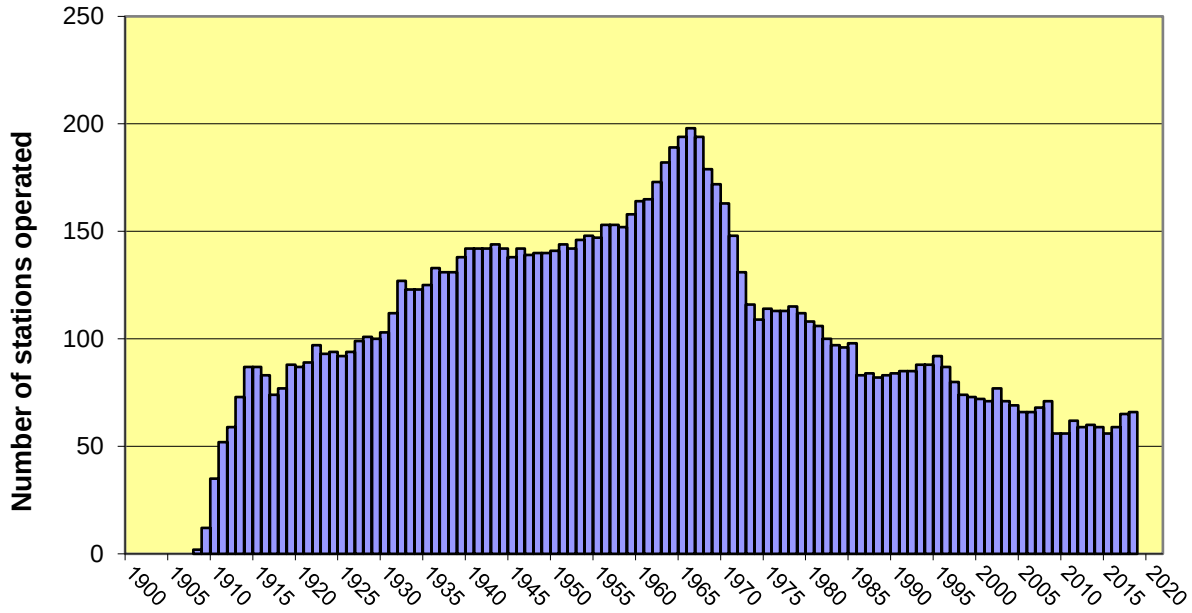
CWRM utilizes several tools to manage information on ground water including: a well index database, verifications of ground water well sources, a digital library of published Hawai‘i related hydrologic reports, and water use reports submitted by individual well owners or operators. These tools, as well as descriptions of monitoring programs, including a complete list of registered observation and deep monitor wells, and the identification of gaps in ground water monitoring activities and recommendations for improving the monitoring of ground water resources, are described in **Appendix G**.

2.2.4.2 Monitoring of Surface Water Resources

Similar to ground water resources, long-term monitoring information is critical to developing appropriate management strategies for surface water resources. Monitoring stream flow, along with appropriate climate and physical data, can provide valuable information on stream health and integrity. Important considerations for surface water monitoring include streamflow, rainfall, diversions, irrigation systems, end uses, biology, and water quality. Descriptions of each of these considerations are provided in **Appendix G**.

CWRM enters into cooperative agreements with the USGS to operate and maintain a statewide network of surface water gaging stations that gather stream, spring flow, water level, and rainfall data, which supports a wide range of statewide studies (e.g., flood analysis, water quality, ground/surface water interaction, biology, etc.). However, as plantation-supported gages were retired, the number of long-term gaging stations has decreased since its peak in 1966 when there were 197 continuous-record gages in the state. CWRM establishes surface water gaging stations in streams where IFS are established and where IFS establishment is anticipated.

Figure 2-4 History of USGS Continuous-Recording Stream Gage Operations



CWRM has a comprehensive information management system to track and maintain data for water use reports, stream channel alterations, and stream diversion works. This Surface Water Information Management (SWIM) System is integrated into CWRM's WRIMS and will facilitate the setting of IFS by helping CWRM to track and manage water use data, location and type of alterations to stream channels, and water use for various off-stream purposes, allowing CWRM to assess impacts upon instream uses and to develop appropriate management scenarios at the watershed level. Additionally, CWRM is working to verify and update diversion information and advance the water use reporting process. Descriptions of these management efforts, as well as an identification of gaps in surface water monitoring activities and recommendations for improving surface water monitoring, are described in **Appendix G**.

2.2.4.3 Rainfall Monitoring

Rainfall is the primary natural source of fresh water for streams, springs, and underground aquifers, and long-term rainfall data is important in analyzing the effects of climate changes; decadal and shorter-term atmospheric fluctuations, such as the Pacific Decadal Oscillation, El Niño, and La Niña events; and the effects of extreme weather events, such as floods and droughts, on water resources. Rainfall data has been collected in Hawai'i since the mid-1800s by sugar and pineapple plantations and ranches. There are currently several principal rainfall data collection networks in Hawai'i operated by the National Weather Service (NWS), USGS, University of Hawai'i, and private entities.

CWRM supported the Hawai‘i Rainfall Atlas project which enhances estimates of normal rainfall across the state. The locations of all the historic and active rain gages as of 2013, a description of the available rainfall data, gaps in rainfall data and analysis, and recommendations for rainfall monitoring may be found in **Appendix G**.

Rain gages provide much-needed monitoring of rainfall.

2.2.4.4 Cloud Water Interception and Fog Drip Monitoring Activities

Cloud water interception, or fog drip, is the direct interception of water, from clouds or fog, by vegetation. Some of this water makes its way into the ground. Fog drip is likely an important contribution to the hydrologic budget in Hawai‘i’s forested areas frequently enveloped in clouds, especially when there is little or no precipitation occurring. Although this subject has been studied to some degree in Hawai‘i and other locations around the world, there are still uncertainties as to what contributions cloud interception and fog drip make to the hydrologic cycle, and specifically to ground water recharge. Descriptions of fog drip monitoring programs, analyses, gaps, and recommendations for improvement may be found in **Appendix G**.

Cloud water monitoring.

2.2.4.5 Evaporation Data

Evaporation data was used extensively in Hawai‘i to assist in developing plantation irrigation practices. It is also an important tool in determining an area’s hydrologic budget by contributing to estimates of **evapotranspiration** (the water evaporated from the soil and other surfaces combined with the transpiration from plants in a vegetated area). Very few pan evaporation stations remain now that the large plantations have shut down. Descriptions of evaporation monitoring programs, analyses, gaps, and recommendations for improvement may be found in **Appendix G**.

Program Issues: Hydrologic and climatic data collection networks must be sustained and expanded to maintain and improve water resource management in Hawai‘i.

Recommended Projects: Project 1.1, Project 1.2, Project 1.8

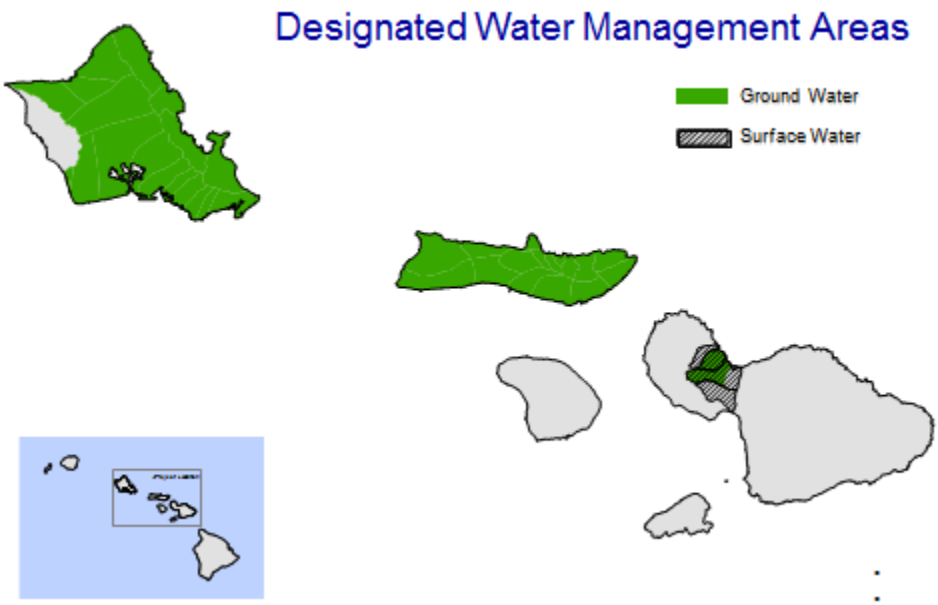
2.2.5 CWRM Regulatory Programs

CWRM uses regulatory controls to protect and conserve water resources, optimize water availability, protect public rights, and obtain maximum reasonable-beneficial uses. Permit systems are used to implement regulations concerning source development and water use. CWRM decisions on permit applications are guided by the Hawai‘i Water Plan, thus implementing the counties’ long-range plans and policies regarding land and water use. The regulations also promote hydrologic data-gathering by requiring specific data to be collected and submitted to CWRM. In turn, this helps to assure informed decision-making in the future based on new and better information.

2.2.5.1 Designation of a Water Management Area

When the water resources of an area are determined to be threatened by existing or proposed withdrawals of water, CWRM shall designate the area as a water management area. This establishes greater administrative control over the withdrawals and diversions of ground and surface waters to ensure reasonable-beneficial use of the water resources in the public interest while protecting those resources. The State Water Code provides eight criteria for CWRM to consider in designating an area for regulation of ground water use (HRS §174C-44) and three criteria for surface water (HRS §174C-45) that are further discussed in **Appendix I**. **Figure 2-5** below shows the location of designated ground and surface water management areas.

Figure 2-5 Designated Water Management Areas



2.2.5.2 Regulatory Permits

There are five main types of permits regulated by CWRM: Water Use Permits, Well Construction Permits, Pump Installation Permits, Stream Channel Alteration Permits, and Stream Diversion Works Permits. These permits are described in **Table 2-2** below.

2.2.5.3 Penalties and Enforcement

CWRM has the authority to assess penalties for any violation of HRS Chapter 174C or HAR Title 13 for failure to comply with CWRM rules and orders, and for any violation of permit conditions.[15] To provide a logical and consistent means to assess penalties and guide the settlement of enforcement cases, CWRM adopted an Administrative and Civil Penalty Guideline with the objectives of deterring violations, removing the economic benefit of violations, providing fair treatment of the regulated community, and offering the violator a chance to undertake a beneficial alternative, under proper conditions, in a partial or total substitution of monetary fines (see **Appendix I**).

[15] HRS §174C-15 and HAR §13-167-10.

Table 2-2 Regulatory Permits

Regulatory Permit	Description
Water Use Permits (WUP)	Water Use Permits are required in designated ground and surface water management areas for both existing uses and prior to commencing any new water uses (HRS §174C-48). WUPs provide for the protection of public trust purposes and allow for maximum reasonable-beneficial use of water resources, while ensuring that the integrity of the resource is not threatened. CWRM is obligated to consider, protect, and advance public trust rights to the resource and make a presumption in their favor over other interests that seek water use permits.
Well Construction and Pump Installation Permits	Well Construction Permits are required statewide prior to the construction, modification, or decommissioning and sealing of any well that will explore for development, recharge (*injection wells are regulated by the State Department of Health's Underground Injection Control Program, environmental wells are regulated under the Department of Health's Underground Storage Tank and the Office of Hazard Evaluation and Emergency Response Programs, and geothermal wells are regulated by the Department of Land and Natural Resources' Engineering Division*), or permanently monitor ground water aquifers. Pump Installation Permits are required prior to the installation or replacement of well pumps (HRS §174C-84). Both permits are done in accordance with the Hawai'i Well Construction and Pump Installation Standards (HWCPIS).
Stream Channel Alteration Permits (SCAP)	Stream Channel Alteration Permits protect streams from alteration, whenever practicable, to provide for fishery, wildlife, recreational, aesthetic, scenic, and other beneficial instream uses. Generally, SCAPs are required for projects that are in the streambed itself or on the banks of the stream and are issued for all projects that alter a stream channel.
Stream Diversion Works Permit (SDWP)	Stream Diversion Works Permit are required for any structure placed within a stream for the purpose of diverting stream water. Any new stream diversion, or expansion of an existing stream diversion, may require a petition to amend the interim instream flow standard.

CWRM has prioritized enforcement of violations in water management areas and in response to complaints. CWRM staff plans to more rigorously enforce Water Code provisions and permit conditions, particularly the water use reporting requirement, with two newly-developed tools: (1) the online Water Resource Information Management System water use reporting system, and (2) DLNR's Civil Resource Violation System (CRVS),[16] which will be implemented to bring administrative enforcement actions for resource violations of a civil, rather than criminal, nature, especially minor, routine violation cases, such as failure to submit required monthly water use reports.

In addition to these enforcement tools, CWRM is also presently conducting outreach and education to facilitate voluntary compliance. One outreach effort focuses on agricultural irrigation system water use reporting to educate users in simple, yet reasonably accurate, methods for measuring diverted surface water flow, which will help to improve surface water use data collection and help agricultural operators to better manage their water use.

2.2.5.4 Complaints and Dispute Resolution

The State Water Code provides CWRM with the authority to process citizen complaints[17] and statewide jurisdiction to hear any dispute regarding water use, resource protection and management, water rights and competing uses, or other water issues, regardless of whether the area involved has been designated as a water management area.[18] Water quality complaints are referred to the DOH.[19] Complaints concerning flooding and flooding-related maintenance of stream banks are referred to the respective county authorities.[20] A person with standing may petition CWRM to establish a water management area or amend an interim instream flow standard.

2.2.5.5 Declaration of Water Shortage

The State Water Code (HRS §174C-62) mandates that CWRM formulate a plan to be implemented during periods of water shortage within a water management area. The water shortage plan must set forth provisions and guidelines for imposing use restrictions on different classes of permits as may be necessary to protect the resource. While CWRM has never moved toward the declaration of a water shortage in any part of the state, the Hawai'i Administrative Rules

> *"The commission, by rule, may declare a that a water shortage exists within all or part of an area when insufficient water is available to meet the requirements of the permit system or when conditions are such as to require a temporary reduction in total water use within the area to protect water resources from serious harm."*
>
> - HRS §174C-62

[16] HAR § 13-1, Subchapter 7
[17] HRS §174C-13
[18] HRS §174C-10
[19] HAR §13-167-82
[20] HRS §46-11.5

include provisions for emergency rulemaking that can be invoked if CWRM "finds that an imminent peril to public health, safety, or morals requires adoption, amendment, or repeal of a rule upon less than twenty days' notice of hearing."[21]

2.2.5.6 Declaration of Water Emergency

The State Water Code provides CWRM with emergency powers that can be exercised statewide during periods of water emergency, including non-water management areas and despite permitted water use allocations. Thus far, CWRM has never issued a water emergency declaration. CWRM has broad powers to order the "apportioning, rotating, limiting, or prohibiting the use of water resources" in any area if it declares an emergency condition.

Program Issues: Regulatory programs allow CWRM to manage the extent of water resource use and protection through permits and other means. These programs should be refined as needed to meet CWRM objectives as management priorities change. This could involve new or modified statutes, administrative rules, or regulatory programs.

Recommended Projects: Project 1.2, Project 2.3, Project 2.4, Project 2.7, Project 2.8

2.2.6 CWRM Water Use Reporting Program

CWRM collects information on existing water use and projected future water demand through the Water Use Reporting Program and the Water Use and Development Plan process in order to plan for and manage water resources. In particular, water use and demand data are used to foster comprehensive and sustainable resource planning for the development, use, protection, and conservation of water; facilitate integrated water and land use planning and policies; provide a regulatory and internal framework for efficient ground and surface water management; and promote coordination and collaboration among agencies, private entities, and communities.

> *"Any person making use of water from a well or stream diversion works… shall file a declaration of the person's use with the commission…and shall contain information including, but not limited to, the 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."*
>
> - Hawai'i Administrative Rules, §13-168-5

[21] HAR §13-167-45.

2.2.6.1 CWRM Water Use Reporting Requirements

Operators of wells and stream diversion works are required to measure their water use and submit regular monthly reports of their use to CWRM, but salt water wells are exempt from the monthly reporting requirement and may instead report annually. Under the Hawai‘i Well Construction and Pump Installation Standards (HWCPIS 2004), all well owners are required to install flowmeters to measure ground water withdrawals. To facilitate surface water use reporting, CWRM produced a handbook with guidelines for appropriate devices and means of measuring water use that would not be unduly burdensome on water users.[22] Additionally, in 2012, CWRM's Water Resource Management Information System went live, allowing water users to file their reports on-line and monitor their historical use from each source via the internet. This new tool was developed to facilitate reporting by water users and to enable CWRM staff to more efficiently enforce compliance with the reporting requirement. See **Appendix G** for a more detailed discussion of WRIMS and the online reporting features.

2.2.6.2 Water Use Reporting for Ground Water Sources

Table 2-3 below summarizes reported total ground water use during the calendar year of 2016 by ground water use category. Based on reported water use, O‘ahu uses the most ground water, withdrawing over 177 MGD, primarily for municipal purposes. 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.

Table 2-3 Summary of 2016 Reported Ground Water Use

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	9.32	3.00	1.72	4.81	21.22	137.78	177.85
Moloka‘i	0.43	0.00	0.00	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**	**21.48**	**223.23**	**395.96**

Notes: Includes all fresh ground water sources, excluding wells categorized as “other,” saltwater, and caprock sources.

This analysis does not include DHHL ground water reservations

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

2.2.6.3 Water Use Reporting for Surface Water Sources

The number of reporters of large irrigation systems continues to increase. CWRM staff are continuing to improve the accessibility and ease of water use reporting so that more surface water use data can be collected.
Table 2-4 summarizes reported surface water use as of December 2016, by island.

CWRM stores and manages surface water data in WRIMS. At the same time, CWRM is continuing to work with landowners and system operators statewide to get more surface water gaging and water use reporting data into its information management system.[23] To facilitate this, CWRM compiled a handbook to inform users of the various types of methods that are available. Additionally, CWRM contracted 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 to aid current ditch operators and owners in meeting the mandate for surface water use reporting. CWRM continues to work closely with diversion works owners both with reporting water use date and installing of gaging equipment.

Table 2-4 Summary of Reported Surface Water Use (2016)

Island	Total (MGD)[1]
Kauaʻi	186.907
Oʻahu	13.811
Molokaʻi	0.000
Lānaʻi	0.000
Maui[2]	117.508
Hawaiʻi	56.340

1 Total of computed 12-month moving average for January 1, 2016 to December 31, 2016.
2 Includes Wailuku Water Company and Launiupoko Water Company

Stream diversion works declared in the 1990 registration process were not completely field verified. CWRM continues to regularly work with stream diversion works owners, update its stream diversion records, and expand water use reporting.

Program Issues: CWRM must continue to improve its collection of water use reports through a combination of outreach, training, and enforcement actions.

Recommended Projects: Project 1.2, Project 1.4

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

2.2.7 Assessing Existing Water Demands

Existing water demands are recorded and archived to varying degrees by several entities statewide. CWRM relies on reported water use data to quantify both ground water and surface water demands and uses a twelve-month moving average to assess water use.

2.2.7.1 CWRM Assessment of Existing Ground Water Demands

As discussed in **Appendix H: Existing and Future Demands**, 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 2-5 indicates water availability by summarizing existing water demands in relation to the aquifer system area sustainable yields for each of six major Hawai'i Islands. Water use is based on reported pumpage as of December 31, 2016 unless otherwise noted. Because caprock and salt water withdrawals do not count against aquifer sustainable yields, water withdrawn from caprock and salt water sources are excluded from the tables. 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 is also presented.

Table 2-5 Existing Demands and Water Allocations by Island Compared to Sustainable Yield, December 2016

Island	Sustainable Yield (SY) (MGD)	Existing Permit Allocation (MGD)	Unallocated SY (MGD)	Existing Water Use[5] (12 MAV, MGD)	SY minus pumpage (MGD)	Existing Water Use as a Percent of SY
Kauaʻi[1]	328	N/A	N/A	26.009	301.991	7.9%
Oʻahu	393.5	292.351	101.149	177.84	215.66	45.2%
Maui[2]	357	N/A	N/A	86.89	270.11	24.3%
Molokaʻi	79	7.130	71.87	2.46	76.54	3.1%
Lānaʻi[3]	6	N/A	N/A	1.847	4.153	30.8%
Hawaiʻi [4]	2,393	N/A	N/A	114.71	2278.29	4.8%
STATE-WIDE	**3,556.5**	**N/A**	**N/A**	**409.75**	**3,146.75**	**11.5%**

1 Kauaʻi aquifers are not designated ground water management areas; therefore withdrawals do not require water use permits.

2 Only the ʻĪao ASYA is a designated ground water management area; therefore withdrawals from the remaining ASYAs do not require water use permits.

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

4 Hawaiʻi island aquifers are not designated ground water management areas; therefore withdrawals do not require water use permits.

5 Includes DHHL ground water reservations

Table 2-5 shows that at an island-wide scale, total reported pumpage on all islands is within the sustainable yield, although Oʻahu and Maui have a few aquifer system areas where pumpage has exceeded sustainable yield. For more detailed information on aquifer SY, WUP allocations, and existing water use, please see **Appendix H: Existing and Future Demands**.

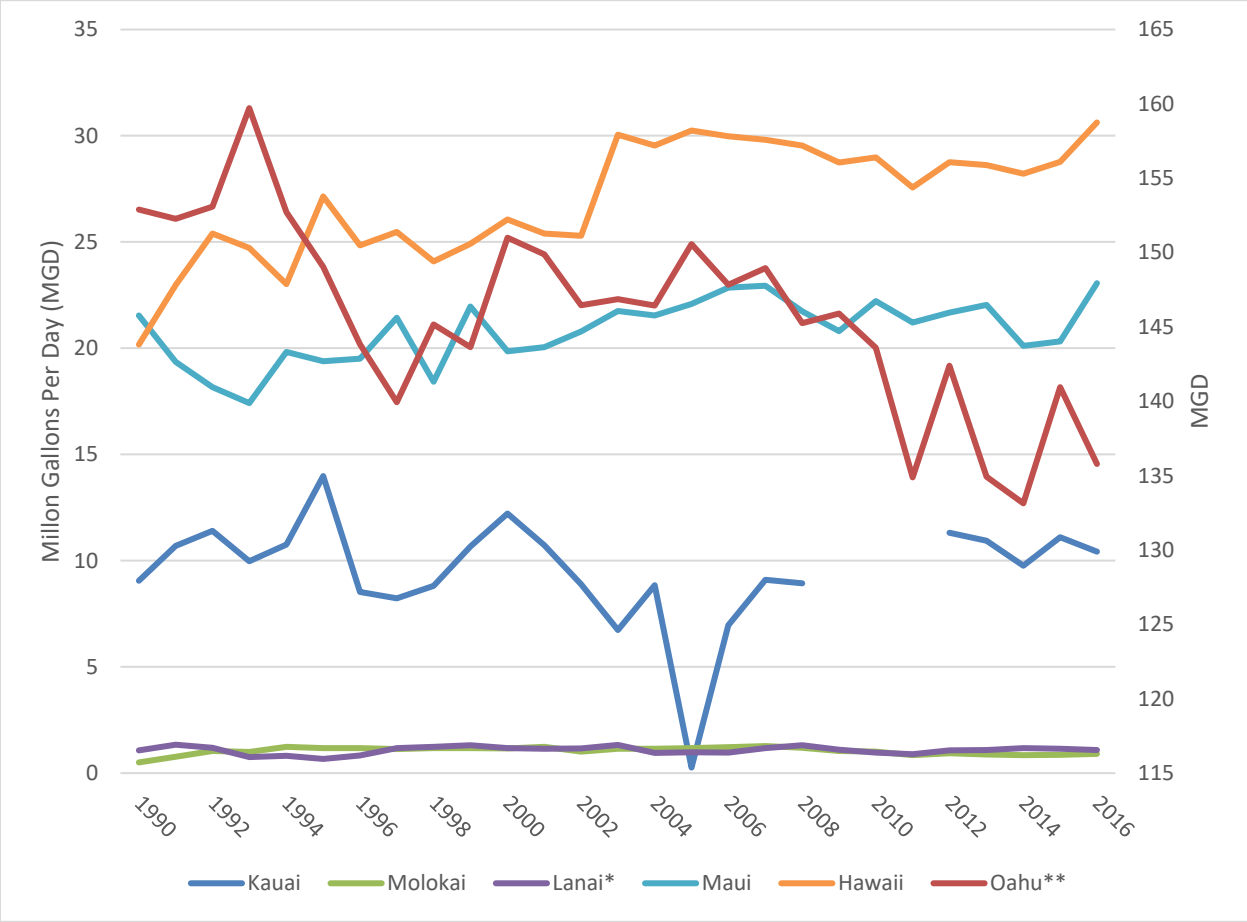
2.2.7.2 CWRM Assessment of Existing Surface Water Demands

CWRM staff is working to improve the understanding and collection of surface water use data with current resources. Efforts have been focused on the large legacy plantation irrigation systems. The current lack of understanding is due to past water use reporting exemptions, little information on stream diversions (field verification information), changes in water use by large-scale agricultural systems, and the difficulties associated with measuring diverted flow. A summary of the 1989 declared surface water use for each Surface Water Hydrologic Unit may be found in **Appendix N,** but it is mostly unverified. Thus, much of the information in **Appendix N** is only included in this document for reference purposes.

2.2.7.3 County Water Department Assessments of Existing Water Demands

With the exception of Lānaʻi, the county water departments provide the majority of the drinking water for each island. They also report their water use to CWRM in accordance with the requirements of the State Water Code. The table below summarizes their reported ground water use to CWRM from 1990 to 2016.

Figure 2-6 Reported County Municipal Water Use 1990-2016



* Data for Lānaʻi from Lānaʻi Water Company

**Data for Oʻahu is shown on right axis

The county water departments also provided municipal water use data to CWRM that characterizes existing water demands in terms of the agency's customer billing categories. This data in **Table 2-6** below 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.

Table 2-6 2012 Water Use by County Water Departments (MGD)

County Water Department Customer Category	Kaua'i[1]	O'ahu[2]	Maui[3]	Hawai'i[4]
Agriculture	0.291	3.40	1.649	2.424
Domestic – Residential	7.326	73.41	21.055	15.206
Domestic – Non-Residential	2.818	34.33	8.14	6.598
Industrial	0.040	2.51	0.884	0.024
Irrigation	0.071	7.59	- - -	0.35
Military	0.020	2.87	- - -	- - -
Municipal	0.917	4.85	- - -	3.927
Other	- - -	0.03	- - -	- - -
Total	11.483	128.99	31.728	28.527

1 Consumption data for Fiscal Year 2011-2012. Source: Kaua'i Department of Water, November 22, 2013 Letter and January 9, 2104 Email.
2 Source: Honolulu Board of Water Supply, May 21, 2014 Email.
3 Source: Maui Department of Water Supply, November 26, 2013 Email.
4 Source: Hawai'i Department of Water Supply, December 13, 2013 Email.

In general, domestic residential water demand represents the highest use category for county municipal water systems, followed by domestic non-residential and agricultural and landscape irrigation. Municipal water demands also use a significant amount of water.

Program Issues: CWRM should continue to work with water use reporters, county water departments, and other large water users to improve water use reporting accuracy and to refine our understanding of water use and water availability.

Recommended Projects: Project 1.2 Project 1.4

2.2.8 Estimating Future Water Demands

The accuracy of future projections in water use 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, including land use-based and population growth-based methods. These projections provide estimates over planning horizon increments of 5, 10, 15, or 20 years. Multiple growth scenarios are usually evaluated for each time increment to provide a range of projected demand. Demand projections can be refined using information contained in other State and county plans, information on federal and private water systems, and historical water use data.

2.2.8.1 Projected Future Department of Hawaiian Home Lands Water Demands

Department of Hawaiian Home Lands (DHHL) water needs are identified as a public trust purpose and are thus given high priority under the Hawai‘i State Constitution and the 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.

As a State agency, the current and future water needs of DHHL are identified in the State Water Projects Plan (SWPP). In 2017, the SWPP was updated to reflect DHHL’s potable and non-potable water needs, broken down by island, to 2031. These projected water demands may be found in **Appendix H: Existing and Future Water Demand**.

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 CWRM action in non-designated areas. These reservations are counted against available sustainable yields 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 components of the Hawai‘i Water Plan. Additional reservations for DHHL are planned based on the 2017 SWPP future demands.

Table 2-7 Current DHHL Water Reservations

Island	Hydrologic Unit	Quantity of Water Reserved (MGD)	Effective Date
Oʻahu	**Waipahu-Waiawa**	1.358[24]	February 18, 1994
Oʻahu	**Waimānalo**	0.124[25]	February 18, 1994
Molokaʻi	**Kualapuʻu**	2.905[26]	June 10, 1995
Hawaiʻi	**Keauhou**	3.398	August 17, 2015
Kauaʻi	**Waimea River**	6.903	June 20, 2017
Kauaʻi	**Wailua**	0.708	September 18, 2018
Kauaʻi	**Anahola**	1.470	September 18, 2018
Kauaʻi	**Kekaha**	0.336	September 18, 2018
Kauaʻi	**Makaweli**	0.405	September 18, 2018
Lānaʻi	**Leeward**	0.067	September 18, 2018
Maui	**Honokōwai**	0.770	September 18, 2018
Maui	**Kamaʻole**	2.547	September 18, 2018
Maui	**Keʻanae**	0.003	September 18, 2018
Maui	**Kawaipapa**	0.118	September 18, 2018
Maui	**Lualaʻilua**	0.063	September 18, 2018
Hawaiʻi	**Hāwī**	0.148	September 18, 2018
Hawaiʻi	**Māhukona**	3.014	September 18, 2018
Hawaiʻi	**Honokaʻa**	0.396	September 18, 2018
Hawaiʻi	**Hakalau**	0.083	September 18, 2018
Hawaiʻi	**Onomea**	0.250	September 18, 2018
Hawaiʻi	**Hilo**	0.492	September 18, 2018
Hawaiʻi	**Keaʻau**	1.336	September 18, 2018
Hawaiʻi	**ʻŌlaʻa**	0.025	September 18, 2018
Hawaiʻi	**Nāʻālehu**	0.185	September 18, 2018
Hawaiʻi	**Pāhoa**	0.660	September 18, 2018

2.2.8.2 Projected Future County Water Demands

According to county water agency projections, by the year 2035, water demands will approach 268 MGD statewide. This translates to an approximate 12% increase in demand from year 2020 to year 2035. Table 2-8 summarizes the water demands projected by the county water agencies through 2035. **Appendix H** also provides a breakdown by water demand categories or billing classes (as designated by the water departments), which is useful in comparing demands associated with potable and non-potable water uses. Demand forecasts were prepared independently by each county; therefore, assumptions and forecast methods vary.

[24] HAR 13-171-61 reserves 1.724 MGD, of which 0.366 MGD has been converted to water use permits.
[25] HAR 13-171-62
[26] HAR 13-171-63

Table 2-8 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)** **Lāna'i (private system)** [4]	39.945	42.913	45.856	48.808[6]
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 Board of Water Supply, June 20, 2018 Email.
3 Source: Maui Department of Water Supply, January 7, 2014 Email.
4 Lāna'i water demand information was not available 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.

2.2.8.3 Water Planning at the County Level

The State Water Code requires each county to prepare and regularly update its County Water Use and Development Plan (WUDP) to address future water demands and to set forth the "allocation of water to land use in that county."[27] County WUDPs (1) assess existing and future land uses and associated municipal water demands; (2) incorporate agriculture, military, private, State, and other non-municipal water demand projections; and (3) evaluate the cost and adequacy of proposed development plans and identify preferred and alternative water development strategies to meet projected demands. It is adopted by CWRM and integrates all other Hawai'i Water Plan components, as emphasized through the adoption of the WUDP as County ordinances. 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, and are summarized in **Appendix H.**

The status of each of the County updates are shown in **Table 2-9**. A summary of the findings of each WUDP, in terms of existing and future water demands, resource options and strategies, and the implications for natural supplies, may be found in **Appendix H**.

[27] HRS §174C-31

Table 2-9 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
Kauaʻi	February 1990	In progress	
Oʻahu			
Central Oʻahu	March 1990	In progress	
East Honolulu	March 1990	In progress	
ʻEwa	March 1990	In progress	
Koʻolau Loa	March 2011	Current	• Ground water development • Water reuse expansion • Conservation
Koʻolau Poko	September 2012	Current	• Ground water development • Water reuse expansion • Surface water for kalo expansion • Conservation
North Shore	December 2016	Current	• Current supplies sufficient
Primary Urban Center	March 1990	In progress	
Waiʻanae	March 2011	Current	• Decrease ground water development • Increase import from Pearl Harbor ASYA • Conservation
Maui			
Maui	March 1990	In progress	
Molokaʻi	March 1990	Awaiting completion of Maui Island WUDP update	
Lānaʻi	August 2012	Current	• Ground water development • Water reuse expansion • Desalination • Conservation
Hawaiʻi	December 2011	Current	• Extend ground water system service areas • Water transfers • Alternative source development • Demand-side management
Keauhou		In progress	

Program Issues: CWRM should continue to work with the counties and others who prepare the Hawaiʻi Water Plan components to refine estimates of future water use. CWRM should also continue to encourage coordination between land-use and water planners.

Recommended Projects: Project 2.3, Project 3.1.

2.2.9 Resource Conservation and Augmentation

As an island state, Hawai‘i has limited access to natural fresh water supplies. Competition for fresh water, increasing population and development pressures, the rising awareness of environmental and cultural water needs, and the impacts of global climate change require that Hawai‘i become as efficient as possible in its uses of limited fresh water supplies, and plan for natural water resource alternatives. In fact, some areas of the State of Hawai‘i are approaching the limits of water resource development: nearly all of O‘ahu and Moloka‘i, and part of Maui have been designated as ground water management areas, where ground water use and development is regulated by CWRM. Additionally, North Central Maui (Nā Wai ‘Ehā) has been designated as a surface water management area, having similar regulations.

The State Water Code mandates that CWRM plan for and coordinate conservation and augmentation programs in cooperation with other federal, State, and county agencies, and private and public entities created for the utilization and conservation of water.[28] CWRM is moving forward in providing leadership and guidance for the establishment, development, and implementation of statewide water conservation and augmentation programs.

2.2.9.1 Water Conservation Programs

CWRM serves as a coordinator, funding source, and clearing house for information on water conservation. It also offers technical assistance and leads by example, but because CWRM is not a water purveyor, it cannot directly implement water efficiency programs. CWRM depends on water purveyors and users in Hawai‘i to participate in and implement the measures outlined in its water conservation plans. State and county agencies and private businesses and organizations have incorporated varying degrees of water conservation within their operations. CWRM water conservation plans and programs are in **Table 2-10** below.

[28] HRS §174C-5(12) and §174C-31(d)(4)

Table 2-10 CWRM Water Conservation Plans and Programs

Program/Report	Purpose
Hawai‘i Water Conservation Plan (CWRM, February 2013) http://files.Hawai‘i .gov/dlnr/cwrm/planning/hwcp2013.pdf	Coordinate various state agencies’ and muncipalities’ individual water conservation programs and provide for collaboration toward a common goal.
Prototype Water Conservation Plan for the Department of Land and Natural Resources (CWRM, February 2005) http://files.Hawai‘i .gov/dlnr/cwrm/planning/pwcp2005.pdf	Provide a framework for water conservation plans for all State agencies, and conservation program options and strategies for water purveyors throughout Hawai‘i.
Conservation Manual for State of Hawai‘i Facilities (CWRM, May 2007) http://files.Hawai‘i .gov/dlnr/cwrm/planning/wcmshf2007.pdf	Facilitate State agency implementation of water conservation programs.
Water Loss Audit Program (2016)	Establishes a water loss audit program for public water systems, including technical assistance. Annual validated audits are required by affected systems.
Water Security Grant Program (2016)	Establishes a two-year pilot program to enable public-private partnerships that increase water security.

In general, the counties practice conservation by reducing system leaks and losses, adopting universal metering, customer water conservation programs, public education programs, adjusting water rates to influence demand, and as a last resort, rationing water use during severe shortages as provided by county rules and ordinances. Counties also practice conservation by protecting watershed areas to realize dependable yields. Each of the counties have independently undertaken water conservation programs and strategies, summarized in **Appendix J: Resource Conservation and Augmentation**.

2.2.9.2 Water-Energy Nexus

In modern society, water is used to produce energy and energy is used to develop and deliver drinking water and to treat wastewater. This water-energy connection is referred to as the water-energy nexus. While water in Hawai‘i is relatively inexpensive, energy is not. The substantial amount of energy used by water and wastewater utilities and the volume of water used for energy production presents opportunities for utilities to find ways for conserving both water and energy by improving efficiencies in their production and delivery processes. High energy prices in Hawai‘i provide powerful incentives to improve water efficiency. Water and wastewater utilities should conduct energy and water audits to inform their decision making.

CWRM's 2016 **Hawai'i Water Energy Nexus Report** found that utilities and agencies often pursue water conservation programs independently with dispersed results, and that greater collaboration between utilities and government agencies is necessary to develop effective and mutually beneficial conservation initiatives and programs, including partnerships and collaboration between energy and water utilities. There are very few programs targeting combined water-energy conservation in Hawai'i. For a short description of the known programs, please refer to **Appendix J**.

2.2.9.3 Developing a Resource Augmentation Program

Resource augmentation, including rainwater/stormwater capture, wastewater reclamation and reuse, and desalination of brackish water and seawater, should also be embraced as an important component of sustainable water resource management. In general, alternative water supplies should be renewable, drought resistant, environmentally sound, and socially responsible. Several county water and wastewater agencies employ reclamation techniques to process surface water and wastewater. However, there is no statewide water resource augmentation program.

It is the State's policy to encourage the development and maximum beneficial use of alternative water resources to augment the water development programs of each county. The State is providing leadership and guidance to counties and private water purveyors in the form of goals and priorities established through an integrated resource augmentation program that ensures that the pursuit and development of alternative-water sources is executed in an efficient and sensible manner, and encourages cooperation, development of implementation incentives, and innovative thinking among State, county, and private entities.

Existing CWRM programs that promote the use of alternative sources include water use regulation, instream flow standard assessment, and long-range planning. In designated water management areas, applicants for water use permits must show that no alternative water sources are available to meet their needs. If an alternative source is available, CWRM will deny requests for use of public trust resources in favor of the available alternative. In setting instream flow standards, the Water Code directs CWRM to consider alternative sources, and other physical solutions, to minimize the impacts of streamflow restoration on existing uses.[29] Finally, CWRM's Statewide Framework for Updating the Hawai'i Water Plan[30] advocates the use of an integrated resource planning (IRP) approach, a comprehensive form of planning that considers direct and indirect costs and benefits of demand-side and supply-side management, in addition to supply augmentation, for updating the County Water Use and Development Plan components of the Hawai'i Water Plan.

[29] HRS §174C-71(1)(E)
[30] Commission on Water Resource Management. (2000). *Statewide Framework for Updating the Hawai'i Water Plan*

2.2.9.4 Water Supply Augmentation

Current and anticipated demands for fresh water are outpacing conventional source development and will likely surpass the volumes of naturally occurring ground and surface water at some point. State and county governments must actively pursue alternative water supplies to sustain Hawai'i's growing population, meet the needs of industry, and help ensure the long-term viability of our ground water aquifers and watershed areas. Common alternative water supplies may be found in **Table 2-11**.

Table 2-11 Alternative Water Supplies

Alternative Water Supply	Potential Uses/Benefits
Gray Water Reuse Definition: wastewater discharged from showers and bathtubs; hand-washing lavatories; wastewater that has not contacted toilet waste; sinks (not used for disposal of hazardous, toxic materials, food preparation, or food disposal); and clothes-washing machines (excluding wash water with human excreta e.g., diapers).[31]	• Landscape irrigation • Toilet and urinal flushing • Freshwater conservation • Increased environmental flows • Reduced wastewater flows • Reduced energy consumption • Landscape enhancement • Nutrient reuse • Ground water recharge
Wastewater Reclamation Definition: The treatment of wastewater such that it may be used for beneficial purposes	• Constructed wetlands • Ground water recharge • Irrigation • Recreational uses • Construction-related uses • Recharge of natural wetlands • In-stream flow restoration • Composting • Toilet and urinal flushing • Industrial uses • Aesthetic uses • Freshwater conservation • Increased environmental flows • Landscape enhancement • Nutrient reuse • Pollution reduction and prevention • Drought-proof supply

[31] Hawai'i Department of Health, June 22, 2009, Guidelines for the Reuse of Gray Water.

Table 2-11 Alternative Water Supplies (continued)

Alternative Water Supply	Potential Uses/Benefits
Stormwater Reclamation (i.e., Rainwater Harvesting) Definition: Runoff water from the impervious surfaces in cities and developed areas, such as streets, sidewalks, roofs, parking lots, and other areas where water cannot percolate into the subsoil.	• Domestic uses (washing bathing, drinking, toilet and urinal flushing, etc) • Ground water recharge • Irrigation • Construction-related uses • Industrial uses • Aesthetic uses (ponds and water features) • Freshwater conservation • Ground water recharge • Landscape enhancement • Pollution reduction and prevention • Erosion reduction • Flood control and containment • Clean Water Act compliance
Desalination Definition: removal of dissolved minerals, including but not limited to salt, from seawater, brackish ground water, or treated wastewater.	• Domestic use • Industrial uses • Freshwater conservation • Drought-proof supply

Note: Water conservation, through the implementation of effective demand- or supply-side measures, may also be viewed as a strategy to meet future water needs.

Major challenges related to successful resource augmentation include reliability, quality, efficiency and economics, technology, and environmental impacts. Further discussion and descriptions of resource augmentation methods, issues, constraints, reports/studies, and programs may be found in **Appendix J: Resource Conservation and Augmentation**.

Program Issues: CWRM should continue to promote water delivery and use efficiency, alternative water supplies where appropriate, and to facilitate planning and discussions among stakeholders who are interested in implementing these practices. Other regulatory agencies should also review their policies and programs to reduce barriers to alternative water supplies

Recommended Projects: Project 2.5, Project 2.6, Project 3.1, Project 3.2

2.2.10 Drought Planning

Drought is a persistent and extended period of below normal precipitation that induces a variety of adverse effects. Direct and indirect impacts of drought manifest as changes in the environment, economy, public health, and long-term water supply and may be exacerbated by climate change. Drought can lead to difficult decisions regarding the allocation of water, stringent water use limitations, water quality problems, and inadequate water supplies for fire suppression. CWRM has assumed the role of lead agency in the development of the State's drought program, which is described in **Appendix K: Drought Planning.**

Drought Response vs. Mitigation

Drought Response:
Emergency actions that are implemented directly in response to drought conditions.

Drought Mitigation
Short- and long-term actions and/or programs that may be implemented prior to, during, and after drought events to reduce the degree of risk to human life, property, and the economy.

According to the U.S. Drought Monitor, Hawai'i has frequently experienced severe drought conditions somewhere in the state since June 2008.[32] The 2012 Pacific Islands Regional Climate Assessment (PIRCA) shows a statewide increase in average air temperature from 1916-2006, a downward trend in rainfall since the beginning of the 20th century, and an even steeper negative rainfall trend since 1980 (**Figure 2-7**). The data also show a decrease in stream base-flow across the state since the early 1900s, which indicate a decrease in ground water recharge and storage, coinciding with the trend of decreasing rainfall. Furthermore, research projections of future rainfall in the Hawaiian Islands suggest that Hawai'i should be prepared for a future with a warmer climate, diminishing rainfall, and declining stream base flows.

In recent years, planning has shifted from responding to drought impacts to proactively reducing its impacts before they occur. Federal legislation and the resultant State and county actions that have contributed to the development of Hawai'i's drought program are listed in **Table 2-12**. Further discussion and descriptions of drought resources, as well as recommendations for drought planning, may be found in **Appendix K**.

[32] National Drought Mitigation Center, U.S. Drought Monitor, accessed February 28, 2014, http://droughtmonitor.unl.edu/MapsAndData/DataTables.aspx

Figure 2-7 Interannual and Interdecadal Rainfall Variations in the Hawaiian Islands[33]

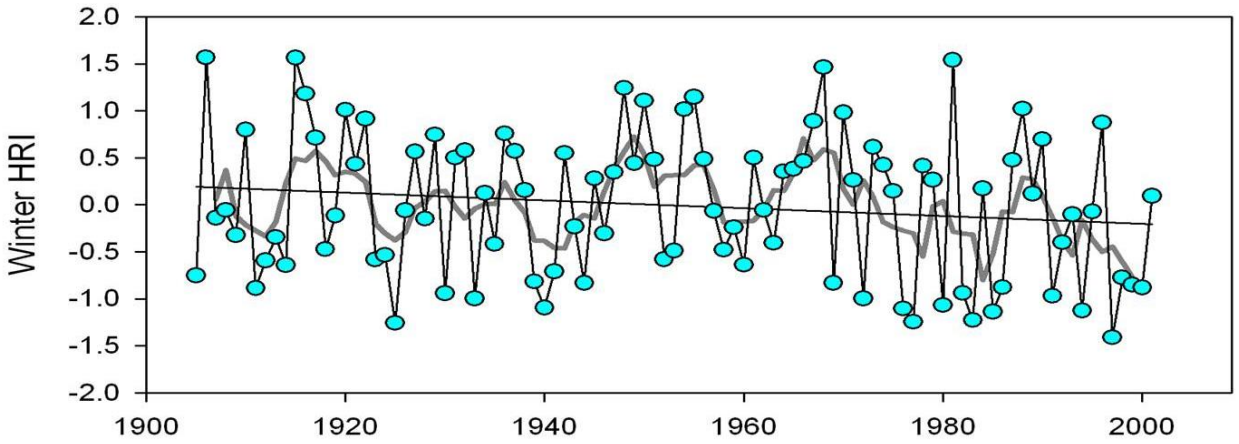


Table 2-12 Drought Planning-Related Federal Legislation and State and County Actions

Action	Need/Purpose
Federal Disaster Management Act of 2000 (FEMA)	Requires each state and territory to conduct hazard mitigation planning and to implement projects to reduce hazard impacts prior to a disaster occurrence
Hawai‘i State Multi-Hazard Mitigation Plan (Hawai‘i Emergency Management Agency, 2013)	Assesses risk and vulnerability to multiple hazards, reviews current mitigation actions and capabilities, and develops a mitigation strategy for each hazard including mitigation projects and actions. Required to receive public assistance subsequent to disasters, additional pre-disaster mitigation funds for state or local mitigation projects, and non-emergency assistance such as Public Assistance restoration of damaged facilities and Hazard Mitigation Grant Program funding.
County Hazard Mitigation Plans • Kaua‘i (August 2015) • Honolulu (September 2017) • Hawai‘i (October 2015) • Maui (October 2015)	Required for a county to be eligible for post-disaster federal funding. The counties prepare multi-hazard plans and have a five-year update cycle
Hawai‘i Drought Plan (CWRM, 2017)	Develops coordinated emergency response mechanisms, while outlining steps toward mitigating the effects of future drought occurrences at a statewide level.

[33] Chu, P.-S., and Chen, H. 2005. Interannual and interdecadal rainfall variations in the Hawaiian Islands. Journal of Climate 18: 4796-4813.

Table 2-12 Drought Planning-Related Federal Legislation and State and County Actions (continued)

Action	Need/Purpose
Drought Risk and Vulnerability Assessment and Geographic Information System (GIS) Mapping Project (CWRM, 2003)	Illustrates the extent and severity of drought risk for different impact sectors throughout the islands and facilitates the development of drought response and mitigation strategies.
County Drought Mitigation Strategies	Coordinates government agency and stakeholder actions and identifies projects for integration within the *County Hazard Mitigation Plans*. Implementation of these projects is championed by County/Local Drought Committees.

Program Issues: CWRM should continue to coordinate drought mitigation and planning activities among impacted stakeholder sectors, conduct regular updates of the Hawai‘i Drought Plan and develop water shortage plans for priority water management areas.

Recommended Project: Project 2.8

2.2.11 Watershed Protection

The USGS simply defines a watershed as the divide separating one drainage basin from another.[34] However, healthy watersheds provide Hawai‘i communities with valuable water-related services such as flood mitigation, streamflow, healthy nearshore waters, and healthy ground water supplies. Watershed management seeks to maintain and restore the continuing functioning of these and other ecosystem services. CWRM’s goals toward watershed protection encourage integrated efforts, good data, and collaboration across all levels of government, communities, and the private sector. Further discussion may be found in **Appendix L: Watershed Protection**.

> *“(DLNR) shall ‘devise ways and means of protecting, extending, increasing, and utilizing the forests and forest reserves, more particularly for protecting and developing the springs, streams, and sources of water supply to increase and make that water supply available for use.’”*
>
> -Hawai‘i Revised Statutes § 183-31

[34] USGS Water Science Center http://water.usgs.gov/wsc/glossary.html#W

The State of Hawai‘i has a long history of watershed protection and management programs, which were initiated to ensure a sustainable water supply. Additionally, many modern watershed protection and management programs have sprung from the requirements of the Clean Water Act of 1977, subsequent supporting legislation, a resurgence in Hawaiian culture, and a newfound appreciation for traditional land and water management principles. In the face of a changing climate, these programs and principles have become even more critical as a means to ensure the sustainability of clean and plentiful water resources for our island communities. Initiatives in Hawai‘i that engage in and support watershed protection, include public/private Watershed Partnerships and the Hawai‘i Association of Watershed Partnerships, various State DLNR Division of Forestry and Wildlife (DOFAW) watershed protection initiatives, Honolulu Board of Water Supply’s watershed prioritization, the County of Maui Department of Water Supply’s grant program, the Hawai‘i Coastal Zone Management Program, the Department of Health water quality programs, and other State watershed protection programs. Additional information on each of these programs and initiatives may be found in **Appendix L: Watershed Protection**.

Although current watershed management efforts favor a comprehensive approach, watershed management in Hawai‘i tends to have either a water quality (DOH, Environmental Protection Agency (EPA), and the Coastal Zone Management Program) or water quantity (Honolulu BWS, Maui DWS, the Watershed Partnerships, and DOFAW) improvement focus. The Natural Resources Conservation Service (NRCS) and the Soil and Water Conservation Districts address both water quality and quantity, and entities such as the State Office of Conservation and Coastal Lands (OCCL), the Land Use Commission (LUC), and U.S. Army Corps of Engineers (USACE) address water as part of a system, but do not have water resource protection as a main focus. Further discussion of watershed issues, programs, and recommendations may be found in **Appendix L**.

Fencing protects vegetation (left side of photo) from feral ungulates.

Program Issues: CWRM should continue to collaborate with watershed partnerships, county water departments, and large landowners to support watershed studies, protection and restoration.

Recommended Projects: Project 1.7, Project 3.2, Project 3.3

2.2.12 Water Quality

The State Water Code provides that the Department of Health shall have primary jurisdiction and responsibility for administration of the state's water quality control programs.[35] The *Hawai'i Administrative Rules, Title 11, Chapter 20, Rules Relating to Public Water Systems*, identifies the maximum contaminant levels for various chemicals, as well as other parameters for drinking water quality. Water quality standards for state waters are found under HAR §11-54. CWRM defers to DOH on most water quality related matters. DOH plans and strategies for ensuring water quality are listed below and described in **Appendix M: Water Quality**.

- **DOH Strategic Plan: The Five Foundations for Healthy Generations**

  Examines DOH's core environmental protection programs and discusses their history, organization, mission, goals, strategies, and performance measures, and sets forth targets to measure the effectiveness of programs in meeting community needs.

- **Environmental Health Management Report**

  Provides an overview of all of the activities of the Environmental Health Administration, not just those involved in water quality, and clarifies the environmental goals and objectives of the DOH.

- **Water Quality Plan (WQP)**

  The DOH is responsible for formulating and updating the State Water Quality Plan, a component of the Hawai'i Water Plan, for all existing and potential sources of drinking water.[36] The major objective of the WQP is to protect public health and ecological systems by preserving, protecting, restoring, and enhancing the quality of ground and surface waters throughout the State of Hawai'i.

The Safe Drinking Water, Clean Water and Wastewater programs provide input and guidance to the WQP. Major initiatives are listed below and described in **Appendix M**.

- Surface Water Quality Management Program
- Source Water Assessment and Protection Program
- Comprehensive State Groundwater Protection Program Strategy/Plan
- Underground Injection Control (UIC) Program
- Groundwater Contamination Maps
- Wastewater Recycling Program

Program Issues: CWRM should continue to work with DOH and other stakeholders to monitor, protect and improve water quality.

Recommended Projects: Project 2.2, Project 2.6, Project 2.7, Project 3.2

[35] HRS §174C-66
[36] HRS §174C-68 and HAR §13-170-50.

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3 Priority Recommendations and the Action Plan

3.1 Planning for the Future

CWRM underwent a multi-part process to identify issues and needs, projects and tasks to address those issues and needs, and priorities for near-term action. This section briefly describes that process.

3.1.1 Goals for the WRPP Update

From the information received through the stakeholder input process and the analysis of current water resource information and management tools, three broad goals were developed to focus the actions that would be put into a near-term Action Plan. Goals are ideal future end-states that reflect the values of a community or institution. The following goals will guide CWRM in its actions to further the protection and management of the water resources trust.

Goal 1: A solid and up-to-date foundation of data on Hawai‘i water resources, water use, and water dynamics is used to make water resource management decisions.

Goal 2: Water resources, public trust uses, and water rights are protected and balanced against reasonable beneficial uses.

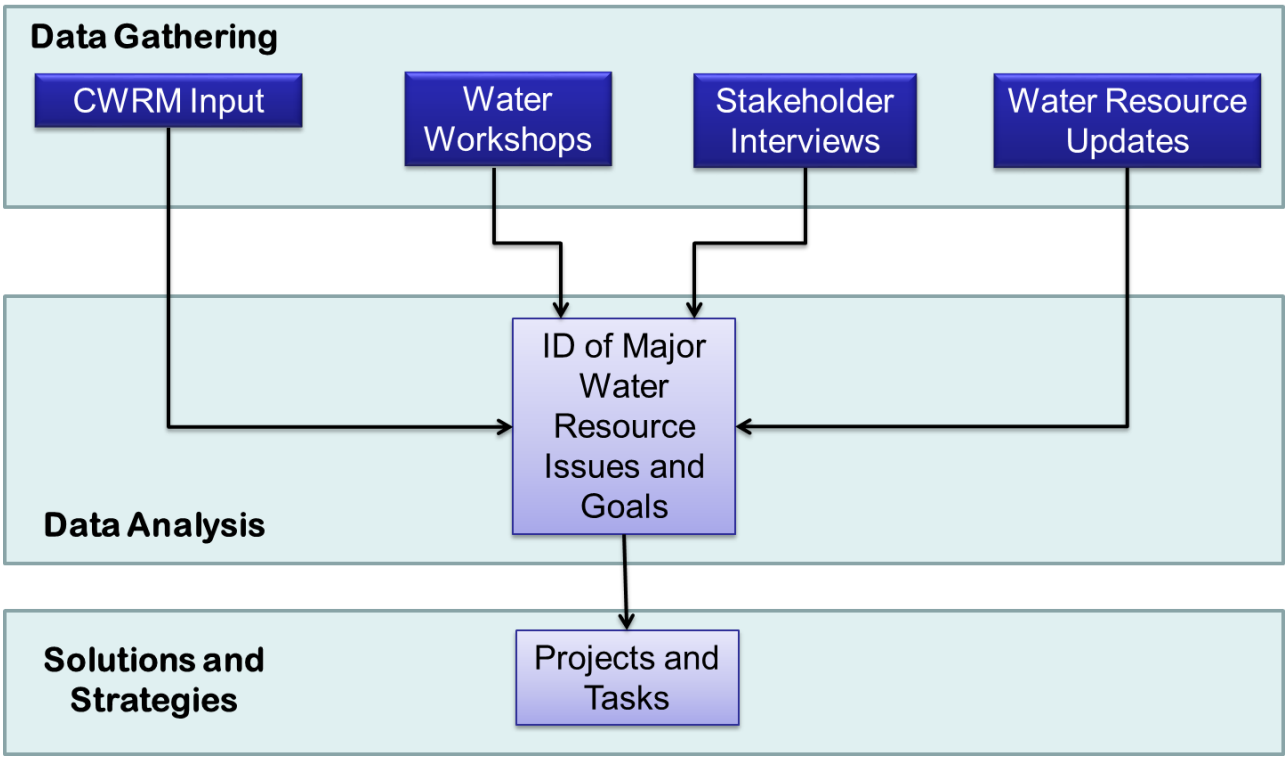
Goal 3: Partnerships, education, and awareness increase collaborative water resource management among government, private, and community entities and the citizens of Hawai‘i.

3.1.2 Identification of Issues, Tasks, and Projects

This update of the WRPP began with a thorough evaluation of the implementation of the 2008 WRPP - what actions and programs were implemented, what issues or management needs remain outstanding, what new information was generated through monitoring or studies to better inform management going forward? The next step involved a series of meetings, interviews, and workshops to gather additional input. Initially, the input of CWRM staff was sought. This was followed by a series of interviews and small group meetings with stakeholders having a special interest in water resource management or use, such as federal, state, and county agencies; non-governmental organizations; cultural practitioners; large landowners; and professional hydrologists. CWRM then conducted a series of workshops statewide to gather input from the general public (see **Appendix E** for the stakeholder input process and summary). In addition, actions, directives and policies established by CWRM at its monthly meeting and decisions of the Supreme Court in its review of contested case hearing decisions were also compiled.

Through the update process, several hundred possible tasks were identified to address various issues. These tasks were then refined by CWRM and grouped into broader categories resulting in a total of 20 projects to achieve the three goals listed above. The following diagram outlines the planning process.

Figure 3-1 Process for Identifying WRPP Projects and Tasks



3.1.3 Prioritization of Projects and Tasks

Each of the 20 projects are included in an Action Plan, but tasks needed to be prioritized to provide guidance to CWRM on what to focus on in the near-term. In order to determine which tasks CWRM will actively seek to initiate and/or implement within the next five years, tasks were put through a two-tier prioritization process where they were scored against a set of seven prioritization criteria, listed below.

PRIORITIZATION CRITERIA

1. Task is a required service or product that, (a) is mandated by the State Water Code, Administrative Rule, or Court Decision; (b) impacts core foundational CWRM services or products; and/or (c) is depended on by other projects, programs, or services.

2. Task is in strategic alignment with CWRM's Vision, Mission, Goals, and Policies.

3. Task reduces or mitigates risk or negative impact on water resources and/or the public.

4. Task has value to the public.

5. Task addresses an existing or foreseeable conflict.

6. Task can be leveraged by other users or partners, adds value for external partners, increases positive collaborative efforts, or strengthens relationships with stakeholders.

7. Task costs can be shared among other government agencies, academic institutions, private individuals / entities, non-profit organizations, and / or community groups / individuals.

The 20 projects and respective priority tasks are the basis of this Action Plan. This ensures that all major issues identified during the research, update, and stakeholder outreach process were addressed in some fashion. Tasks that were not included in the near-term Action Plan are still considered important and are compiled in **Appendix O,** to be implemented as opportunities and funding sources arise.

3.2 Action Plan

Table 3-1 Table 3-1 lists those tasks that CWRM will seek to initiate or implement within the next five years as a part of its Action Plan. Included in the Action Plan table are the project title, lead CWRM Branch and partnering agency or entity, estimated cost range, and status to enable CWRM to track the progress and performance of its Action Plan. Tasks listed in the table are presented as they correspond to the three goals of CWRM and not necessarily how they ranked during the prioritization process. The cost ranges for each task are estimations of the cost for CWRM. Total project costs would be determined through detailed scoping and development of the activity.

The Action Plan Table shall be treated as a living document to allow CWRM to track the progress of meeting the goals identified in the Action Plan. The "Task Status" column will be populated with the information needed to determine the status, progress, and/or results for the corresponding task.

Table 3-1 Action Plan

	DESCRIPTION	LEAD CWRM BRANCH AND PARTNERS	COST RANGE	TASK STATUS**
GOAL 1:	**A solid and up-to-date foundation of data on Hawai'i water resources, water use, and water dynamics is used to make water resource management decisions**			
Project 1.1	**Collect and analyze climatic data to determine trends in water resource health and anticipate future issues and problems.**			
Task 1.1.1	Identify the adequate level of hydrologic and climatic data collection needed statewide to enable effective decision-making about water security.	CWRM/ University of Hawai'i (UH)/ USGS/ Counties	$155,000	In progress
Task 1.1.2	Develop implementation plan based on recommendations from Task 1.1.1	CWRM/ USGS/UH/ Counties	$100,000*	
Task 1.1.3	Coordinate climate data sharing by establishing a common data portal or shared public data resource.	Ike Wai CWRM/NWS/ USGS	Internal	In progress
Project 1.2	**Improve the reporting and analysis of ground and surface water use.**			
Task 1.2.1	Maintain and improve the ease of use and utility of CWRM's WRIMS database on a continuous basis.	CWRM	$375,000*	In progress
Task 1.2.2	Increase participation of stream diversion and well owners in online reporting through outreach, education, and ultimately, enforcement.	Ground Water/Stream Branches	$250,000/ Internal	In progress
Task 1.2.3	Develop standards for surface water use reporting to improve consistent reporting.	Stream Branch	Internal	In progress

*May require additional recurring costs for operation and maintenance

**This column will be populated as CWRM implements tasks listed with "in progress" or "completed"

Internal: CWRM staff will accomplish task with existing resources

Table 3-1 Action Plan (continued)

	DESCRIPTION	LEAD CWRM BRANCH AND PARTNERS	COST RANGE	TASK STATUS**
Goal 1	**A solid and up-to-date foundation of data on Hawai'i water resources, water use, and water dynamics is used to make water resource management decisions**			
Project 1.3	**Update estimates of aquifer sustainable yields with new and best information available using the 2008 precautionary approach.**			
Task 1.3.1	Improve recharge estimates to include the best available information on climate change impacts.	Ground Water Branch/USGS	$250,000	
Project 1.4	**Develop and implement a strategic surface water monitoring plan.**			
Task 1.4.1	Improve estimates of stream flow characteristics, particularly during low-flow conditions (USGS StreamStats).	Stream Branch	$1,500,000	In progress
Task 1.4.2	Verify diversion use and amounts for large/legacy irrigation systems	Stream Branch	Internal	In progress

*May require additional recurring costs for operation and maintenance

**This column will be populated as CWRM implements tasks listed with "in progress" or "completed"

Internal: CWRM staff will accomplish task with existing resources

Table 3-1 Action Plan (continued)

	DESCRIPTION	LEAD CWRM BRANCH AND PARTNERS	COST RANGE	TASK STATUS**
Goal 1	**A solid and up-to-date foundation of data on Hawai'i water resources, water use, and water dynamics is used to make water resource management decisions**			
Project 1.5	**Understand how climate change will impact water resources.**			
Task 1.5.1	Partner and coordinate with other entities who are researching the potential impacts of climate change.	Planning Branch	Internal	
Task 1.5.2	Integrate the best available information on the impacts of climate change on long-range water resources planning.	Planning Branch/Counties/DOA/DLNR/DOH	Internal	
Task 1.5.3	Encourage long-range planning at the Federal/State/County levels to include climate change adaptation plans.	Planning Branch /Counties/ Federal	Internal	
Project 1.6	**Improve the understanding of appurtenant water rights.**			
Task 1.6.1	Develop an efficient process to determine and quantify appurtenant water rights to guide CWRM staff and the public.	CWRM	Internal	In progress
Task 1.6.2	Develop and implement a process to catalog and inventory appurtenant water rights. Incorporate known and anticipated appurtenant claims into instream flow standards and surface water permitting.	CWRM	$100,000	

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**This column will be populated as CWRM implements tasks listed with "in progress" or "completed"

Internal: CWRM staff will accomplish task with existing resources

Table 3-1 Action Plan (continued)

	DESCRIPTION	LEAD CWRM BRANCH AND PARTNERS	COST RANGE	TASK STATUS**
Goal 1	**A solid and up-to-date foundation of data on Hawai'i water resources, water use, and water dynamics is used to make water resource management decisions**			
Project 1.7	**Understand the impacts of land use on hydrology, ecosystem function, and water resources needed for human consumption.**			
Task 1.7.1	Understand the impacts of native vs. nonnative plant species on water resources and watersheds by supporting research and long-term hydrologic monitoring programs.	CWRM/USGS/ UH/DLNR/ Counties	$100,000*	In progress
Task 1.7.2	Develop a pilot adaptive management plan for protecting ground water dependent ecosystems	CWRM/USGS/ UH/National Park Service (NPS)/ Cultural Practitioners	$175,000 *	In progress
Project 1.8	**Develop and implement a comprehensive statewide ground water monitoring plan.**			
Task 1.8.1	Construct new deep monitoring wells in critical aquifers to gather and utilize data to identify impacts from pumpage and climate and land use changes, verify fresh water sustainable yields, and monitor recharge trends.	Ground Water Branch	$5,000,000/ 1 Full-Time or Equivalent staff (FTE)	In progress
Task 1.8.2	Resurvey geodetic-control benchmarks in the State for deep monitor wells and water –level observation wells to ensure consistent and accurate water level measurements.	USGS	TBD	

*May require additional recurring costs for operation and maintenance

**This column will be populated as CWRM implements tasks listed with "in progress" or "completed"

Internal: CWRM staff will accomplish task with existing resources

Table 3-1 Action Plan (continued)

	DESCRIPTION	LEAD CWRM BRANCH AND PARTNERS	COST RANGE	TASK STATUS**
Goal 1	**A solid and up-to-date foundation of data on Hawai'i water resources, water use, and water dynamics is used to make water resource management decisions**			
Project 1.9	**Establish Sustainable Funding sources.**			
Task 1.9.1	Increase permit fees to amounts sufficient to defray administrative costs of permit systems	CWRM	Internal	In progress
Task 1.9.2	Establish and implement water source registration fees for the purpose of supporting CWRM core activities and programs.	CWRM	1 FTE	
GOAL 2:	**Water resources, public trust uses, and water rights are protected and balanced against reasonable beneficial uses.**			
Project 2.1	**Manage instream and non-instream uses to provide for reasonable beneficial use while protecting public trust uses.**			
Task 2.1.1	Prioritize streams for developing measurable IFS.	Stream Branch	Internal	In progress
Task 2.1.2	Continue to develop measurable instream flow standards by reviewing instream needs and current non-instream uses.	Stream Branch	Internal	In progress
Task 2.1.3	Implement and enforce measurable instream flow standards.	Stream Branch	Internal	In progress

*May require additional recurring costs for operation and maintenance

**This column will be populated as CWRM implements tasks listed with "in progress" or "completed"

Internal: CWRM staff will accomplish task with existing resources

Table 3-1 Action Plan (continued)

	DESCRIPTION	LEAD CWRM BRANCH AND PARTNERS	COST RANGE	TASK STATUS**
GOAL 2	**Water resources, public trust uses, and water rights are protected and balanced against reasonable beneficial uses.**			
Project 2.2	**Protect water quality from land use impacts.**			
Task 2.2.1	Implement source water protection programs.	DOH/Office of Planning/CZM/ Counties	TBD	
Task 2.2.2	Develop standards and guidelines for stormwater reclamation and reuse.	DOH/EPA	TBD	
Task 2.2.3	Address the impacts of leaking underground storage tanks on water quality.	DOH/EPA	TBD	
Task 2.2.4	Address impacts of byproducts of desalination process injected below the UIC line.	DOH/EPA	TBD	
Task 2.2.5	Develop guidelines and incentives for on-site water reclamation and reuse.	DOH/EPA/ Counties	TBD	

*May require additional recurring costs for operation and maintenance

**This column will be populated as CWRM implements tasks listed with “in progress” or “completed”

Internal: CWRM staff will accomplish task with existing resources

Table 3-1 Action Plan (continued)

	DESCRIPTION	LEAD CWRM BRANCH AND PARTNERS	COST RANGE	TASK STATUS**
GOAL 2	**Water resources, public trust uses, and water rights are protected and balanced against reasonable beneficial uses.**			
Project 2.3	**Provide clear guidance on criteria used to make water resource management decisions, including, but not limited to, the precautionary principle, the protection of public trust purposes, including traditional and customary practices, and economic considerations.**			
Task 2.3.1	Develop a process and policy for regulatory and planning purposes, for identifying the presence of traditional and customary practices in a particular area and the water needs associated with those practices.	CWRM/AMAC	Internal	In progress
Task 2.3.2	Continue to refine the application of the precautionary principle and public trust doctrine to water resource management.	CWRM	Internal	In progress
Task 2.3.3	Update model/methodology for estimating irrigation water demands to ensure the most efficient use of water.	Ground Water/ Stream Branches	$100,000	
Task 2.3.4	Establish additional water reservations for DHHL	Planning Branch	Internal	In progress

*May require additional recurring costs for operation and maintenance

**This column will be populated as CWRM implements tasks listed with “in progress” or “completed”

Internal: CWRM staff will accomplish task with existing resources

Table 3-1 Action Plan (continued)

	DESCRIPTION	LEAD CWRM BRANCH AND PARTNERS	COST RANGE	TASK STATUS**
GOAL 2	**Water resources, public trust uses, and water rights are protected and balanced against reasonable beneficial uses.**			
Project 2.4	**Update CWRM's policies on enforcement and penalties, and modernize and streamline the regulatory process.**			
Task 2.4.1	Develop formal enforcement policies.	Ground Water/ Stream Branches	Internal	
Task 2.4.2	Implement the Civil Resource Violation System already being utilized by other DLNR divisions.	Ground Water/ Stream Branches	Internal	
Task 2.4.3	Update CWRM's Administrative Rules to reflect updated penalties and streamline the regulatory process.	Ground Water /Stream Branches	Internal	In progress
Project 2.5	**Develop, update, and implement water conservation tools, techniques, and plans.**			
Task 2.5.1	Study how energy conservation can be used as an incentive for, and complement to, water conservation.	Planning Branch	$200,000	
Task 2.5.2	Conduct water audits of public water systems to verify use and aid water providers in identifying water losses.	Planning Branch/ DOH/EPA	$700,000 0.5 FTE	In progress
Task 2.5.3	Seek funding for a water conservation rebate program	Planning Branch	$500,000 0.5 FTE	
Project 2.6	**Plan for and provide guidance on the use of alternative water sources.**			
Task 2.6.1	Appraise opportunities for aquifer storage and recharge/recovery in Hawai'i.	Planning Branch/ DOH/Counties	$500,000	
Task 2.6.2	Inventory current and planned resource augmentation projects and efforts in the State.	Planning Branch/DOH	$300,000	
Task 2.6.3	Undertake a statewide stormwater recharge study	Planning Branch/ DOH/EPA/OP/ CZM/ Counties	$300,000	

Table 3-1 Action Plan (continued)

	DESCRIPTION	LEAD CWRM BRANCH AND PARTNERS	COST RANGE	TASK STATUS**
GOAL 2	**Water resources, public trust uses, and water rights are protected and balanced against reasonable beneficial uses.**			
Project 2.7	**Protect ground water sources by updating well standards and sealing abandoned wells.**			
Task 2.7.1	Develop an abandoned well sealing program in coordination with DOH and the Counties, including staff and funding resources, in order to eliminate potential conduits for ground water contamination.	Ground Water Branch/DOH/ Counties	2 FTE	
Task 2.7.2	Identify and prioritize abandoned and unused wells for sealing.	Ground Water Branch/DOH/ Counties	Internal	In progress
Task 2.7.3	Update the Hawai‘i well construction and pump installation standards to address free-flowing tunnels and artesian wells.	Ground Water Branch	Internal	
Project 2.8	**Prepare for water shortages and drought.**			
Task 2.8.1	Coordinate statewide drought planning efforts and resources through regular meetings of the County drought committees and Hawai‘i Drought Council.	Planning Branch	Internal	In progress
Task 2.8.2	Complete regular updates to the Hawai‘i Drought Plan. Evaluate and revise Plan recommendations and drought communication protocol as necessary and appropriate.	Planning Branch	$75,000	Completed
Task 2.8.3	Develop water shortage plans for priority water management areas.	Planning Branch	$200,000	

*May require additional recurring costs for operation and maintenance

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Internal: CWRM staff will accomplish task with existing resources

Table 3-1 Action Plan (continued)

	DESCRIPTION	LEAD CWRM BRANCH AND PARTNERS	COST RANGE	TASK STATUS**
GOAL 3:	**Partnerships, education, and awareness increase collaborative water resource management among government, private, and community entities and the citizens of Hawai‘i.**			
Project 3.1	**Update the Hawai‘i Water Plan.**			
Task 3.1.1	Update the Statewide Framework for Updating the Hawai‘i Water Plan to reflect new issues and data, improved methodologies, and current priorities.	Planning Branch/DOA/ DLNR/ Counties/DOH/ Stakeholders	$300,000	
Task 3.1.2	Ensure incorporation of recent issues and insights, e.g., climate change, reuse, DHHL needs, and traditional and customary practices, into Hawai‘i Water Plan components.	Planning Branch	Internal	In progress
Task 3.1.3	Promote coordination and collaboration among agencies, private entities, and water users when developing Hawai‘i Water Plan components	Planning Branch/ Counties/ DLNR/DOA/ DOH/ Stakeholders	Internal	In progress
Task 3.1.4	Conduct regular updates of the WRPP	Planning Branch	$300,000	
Project 3.2	**Support multi-sectoral based management of water resources.**			
Task 3.2.1	Collaborate with the State Department of Health to protect water resources by the further integration of water quality and water quantity programs.	Planning Branch/DOH	Internal	In progress
Task 3.2.2	Engage and collaborate with other agencies having an interest in water resources to address inter-agency issues and increase coordination.	CWRM/DOH/ CZM/LUC/ Counties/ Federal Partners	Internal	

*May require additional recurring costs for operation and maintenance

**This column will be populated as CWRM implements tasks listed with “in progress” or “completed”

Internal: CWRM staff will accomplish task with existing resources

Table 3-1 Action Plan (continued)

	DESCRIPTION	LEAD CWRM BRANCH AND PARTNERS	COST RANGE	TASK STATUS**
GOAL 3	**Partnerships, education, and awareness increase collaborative water resource management among government, private, and community entities and the citizens of Hawai‘i.**			
Project 3.3	**Increase CWRM community involvement, participation, outreach, and education.**			
Task 3.3.1	Hold regular CWRM meetings on the neighbor islands to allow CWRM members and staff to learn about and understand issues throughout the State and to increase opportunities for neighbor island communities to participate in CWRM processes.	CWRM	Internal	In progress
Task 3.3.2	Publish water use and monitoring data on CWRM’s website.	Ground Water/Stream Branch	Internal	In progress
Task 3.3.3	Assess the development of a pilot community-based surface water data collection program.	Stream Branch	Internal	

*May require additional recurring costs for operation and maintenance

**This column will be populated as CWRM implements tasks listed with “in progress” or “completed”

Internal: CWRM staff will accomplish task with existing resources

3.3 Long-Term Projects

All of the projects, programs, and associated tasks that were identified as a result of this WRPP update process are considered important to managing the use and protection of water resources. Following the task prioritization process, those tasks that were found to be of lower priority are captured in this WRPP as tasks that should be revisited in future planning and updates to the WRPP or those that may be initiated should funds become available or should priorities change. As with any plan, the Water Resource Protection Plan should be regarded as a guide for future and immediate action and should not be so rigid as to not be adaptable to future conditions, new information, or opportunities. A complete list of the long-term tasks may be found in **Appendix O**.

3.4 Implementation and Next Steps

In the past five years during this plan update process, CWRM initiated and/or completed five of the fifty-six tasks in the Action Plan requiring funding. Many of the tasks that will be accomplished using existing staff resources have already been initiated and are ongoing. All tasks are retained in the Action Plan to show the full panoply of tasks that address the issues raised through the stakeholder outreach process.

To complete the remaining tasks in the next five years, it is estimated that an additional $5,000,000 and five full-time staff positions will be required. This $5,000,000 shortfall is equivalent to Capital Improvement Projects (CIP) funds needed for new deep monitor well construction (**Task 1.8.1**). CIP funds are not part of the Commission's operating expenses but will be requested as part of the Department's CIP request during the annual legislative budgeting process.

Should the CIP requests be denied or should a shortfall in the budget occur due to unanticipated executive, judicial, or legislative directives that supersede the priorities outlined in this WRPP, some of these tasks may need to proceed in phases, allowing the actual cost to be spread out beyond the five-year planning period. Phasing will be determined based on available funding at the time and subject to contract negotiations. While some tasks are a critical path and must be implemented before others, in general, any of the tasks in the Action Plan may be selected for implementation in any given year given the needs and grant and partnership opportunities available at that time. Where CWRM is identified as lead agency, it is CWRM's goal to initiate or implement each task in the Action Plan within the next five years.

Currently, CWRM's main source of funding is through annual legislative appropriations. CWRM seeks opportunities to leverage these funds with federal matching funds, other cost-sharing opportunities, and grants. Unfortunately, obtaining cost-share commitments in advance is difficult. The federal agencies that CWRM partners with are also subject to annual budgets, and so commitments for cost-sharing cannot be made in advance of the start of each federal fiscal year. Non-profit organizations occasionally express interest in investing in water resource management, but they often have their own specific interests that may not align with the priorities of CWRM. Finally, executive, judicial, and legislative mandates have in the past and will in the future require CWRM to deviate from its pre-determined priorities. Lack of inclusion in the current Action Plan should not preclude undertaking these new tasks, should the need and opportunity arise. Therefore, some flexibility is needed in plan implementation. CWRM staff will use the Action Plan as a guide for identifying priority tasks, and the Action Plan will be implemented through internal workplans developed by CWRM staff and annual budget requests.

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