



Hawai'i Division of Aquatic Resources

HE WAI E OLA

WATER QUALITY STRATEGY FOR AQUATIC RESOURCES

2026-2030

The background of the entire page is a photograph of a tropical coastline. In the foreground, there is a calm body of water reflecting the sky. In the middle ground, a small boat is visible on the water. In the background, there are dark, forested mountains under a cloudy sky.

PREPARED FOR:
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“‘ELO‘ELO I KA WAI O KŪLANIHĀKO‘I.”
DRENCHED BY THE WATERS OF KŪLANIHĀKO‘I,
THE MYTHICAL POND IN THE SKY.
SYMBOLIZING THE BESTOWMENT OF KNOWLEDGE.

EXECUTIVE SUMMARY

(KA HŌ'ULU'ULU)

Wai (water) is one of the most important and unifying natural resources in Hawai'i, reflected through the traditional Native Hawaiian management of watersheds through the ahupua'a (land division) system. However, in a siloed western government framework based on subject-matter expertise, which does not reflect the values of traditional Native Hawaiian water management, it is difficult to effectively and sustainably manage wai as a resource that transcends modern jurisdictional boundaries. This is especially challenging when looking at the effects of water quality and quantity on the condition of the organisms living in aquatic ecosystems, exemplifying the need for greater watershed and water quality connectivity and inclusivity into management of aquatic organisms. In response to this need, the Division of Aquatic Resources (DAR) developed He Wai e Ola, a water quality strategy for aquatic resources, which identifies how DAR can collaborate across the state to support and uplift ongoing efforts as well as fill in gaps in the understanding of how aquatic life is affected by water quality.

The primary statewide issues identified by this Water Quality Strategy are as follows:

- A. Water quality is an uka (upland) to kai (ocean) issue, but the agencies that manage and work to improve it are siloed;
- B. Statewide monitoring efforts are not currently structured to identify effects of water quality on aquatic ecosystems;
- C. There is a lack of published literature of how water quality parameters are affecting aquatic species specific to Hawai'i, and;
- D. There is a need for both continued data collection and active solutions to improve water quality at the same time, which can be challenging due to a lack of capacity and funding.

To respond to this need, DAR has identified the following internal goals for the duration of this Water Quality Strategy from 2026-2030:

- 1. Build internal DAR capacity to implement projects and partnerships to improve water quality for aquatic resources;
- 2. Facilitate regular communication and collaboration between state, federal, and county agencies managing water quality, water quantity, and watersheds;
- 3. Support the collection of biological data and water quality data in the same locations to facilitate better understanding of water quality effects on aquatic resources;
- 4. Support research on the effects of various water quality parameters on culturally and commercially important reef fishes and other aquatic organisms, and;
- 5. Build community partnerships to support restoration efforts to improve water quality.

Following the completion of this Water Quality Strategy, DAR will begin working on achieving these goals through a Water Quality Coordinator as well as organizing internal watershed-related projects and continued collaboration with other state agencies and organizations that were initiated through the creation of this strategy. This strategy provides a comprehensive guide to sustaining and strengthening the connection between water and aquatic resources and improving water quality through collaborative efforts for positive outcomes for our kahawai (streams), muliwai (estuaries), and kai.

OUTLINE

(PAPA KUHIKUHI)

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Hawaiian Vocabulary (Papa ‘Ōlelo)

Ahupua‘a – social-ecological land division extending from the uplands to the sea
Konohiki – headman of an ahupua‘a under the chief; land or fishing rights under their control
Kuleana – responsibility
Kilo – to observe/examine/watch closely
Uka – inland/upland
Wai – water
Kahawai – stream/river
Muliwai – estuary/river mouth
Lepo pohō – marsh/wetland
Kai – sea/ocean/lowland
Loko i‘a – fishpond
Limu – seaweed
‘Āina – land
Pae‘āina – archipelago
Kuleana – responsibility

Contributors

Below is a list of participants in the **Mauka to Makai Water Quality Working Group** as well as the DAR internal water quality team. The Mauka to Makai Water Quality Working Group was formed to provide community, stakeholder, and expert guidance to DAR during the creation of this Water Quality Strategy. The DAR internal water quality team was formed to gather DAR employees who work on water quality-adjacent projects in streams, estuaries, and reef environments that we could build on to write this plan. We would like to extend our gratitude as well to everyone who helped edit and review this document along the way.

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Acronyms

ASU - Arizona State University
CBM - Community Based Monitoring
CECs - Contaminants of Emerging Concern
CNMI - Commonwealth of the Northern Mariana Islands
CRCP - Coral Reef Conservation Program
CWA - Clean Water Act
CWRM - Commission on Water Resource Management
CZM - Coastal Zone Management
DAR - Division of Aquatic Resources
DLNR - Department of Land and Natural Resources
DAB - Department of Agriculture and Biosecurity
DOCARE - Division of Conservation and Resources Enforcement
DOFAW - Division of Forestry and Wildlife
DOH - Department of Health
ESA - Endangered Species Act
EPA - Environmental Protection Agency
FIB - Fecal Indicator Bacteria
HCRS - Hawai'i Coral Reef Strategy
HIMB - Hawai'i Institute of Marine Biology
HOKWO - Hui O Ka Wai Ola
HWO - Hawai'i Wai Ola
HWP - Hawai'i Water Plan
HRS - Hawai'i Revised Statutes
IR - Integrated Report
KUA - Kua'āina Ulu 'Auamo
MMA - Marine Managed Area
MMWQWG - Mauka to Makai Water Quality Working Group
MNMRC - Maui Nui Marine Resource Council
NOAA - National Oceanic and Atmospheric Administration
NPDES - National Pollutant Discharge Elimination System
NRCS - Natural Resources Conservation Service
OCM - Office of Coastal Management
OPSD - Office of Planning and Sustainable Development
PacIOOS - Pacific Integrated Ocean Observing System
SGD - Submarine Groundwater Discharge
SOPs - Standard Operating Procedures
TMDLs - Total Maximum Daily Loads
TNC - The Nature Conservancy
TSS - Total Suspended Sediment
UH - University of Hawai'i
USCRTF - United States Coral Reef Task Force
USDA - United States Department of Agriculture
USGS - United States Geological Survey
USFWS - United States Fish and Wildlife Service
WQS - Water Quality Standards

HE MELE NO KĀNE

He ui, he nīnau, e ui aku ana au iā 'oe:

Aia i hea ka wai a Kāne?

Aia i ka hikina a ka lā, puka i Ha‘eha‘e,

Aia i laila ka wai a Kāne.

E ui aku ana au iā 'oe:

Aia i hea ka wai a Kāne?

Aia i kaulana a ka lā,

I ka pae ‘ōpua i ke kai,

Ea mai ana ma Nīhoa,

Ma ka mole mai ‘o Lehua,

Aia i laila ka wai a Kāne.

E ui aku ana au iā 'oe:

Aia i hea ka wai a Kāne?

Aia i ke kuahiwi, i ke kualono,

I ke awāwa, i ke kahawai,

Aia i laila ka wai Kāne.

E ui aku ana au iā 'oe:

Aia i hea ka wai a Kāne?

Aia i kai, i ka moana,

I ke Kualau, i ke ānuenue,

I ka pūnohu, i ka uakoko,

I ka ‘ālewalewa,

Aia i laila ka wai a Kāne.

E ui aku ana au iā 'oe:

Aia i hea ka wai a Kāne?

Aia i luna ka wai a Kāne,

I ke ao uli, i ke ao ‘ele‘ele,

I ke ao panopano,

I ke ao pōpolohua mea a Kāne lā ē,

Aia i laila ka wai a Kāne.

E ui aku ana au iā 'oe:

Aia i hea ka wai a Kāne?

Aia i lalo, i ka honua, i ka wai hū,

I ka wai kau a Kāne me Kanaloa,

He waipuna, he wai e inu,

He wai e mana, he wai e ola!

E ola nō a!

A query, a question, I put to you:

Where are the waters of Kāne?

In the east, where the sun rises at Ha‘eha‘e,

There are the waters of Kāne.

A question, I ask of you:

Where are the waters of Kāne?

Out there, in the west, with the floating sun,

Where cloud forms rest on ocean’s breast,

Raising their forms at Nīhoa,

This side of the base of Lehua,

There are the waters of Kāne.

A question, I ask of you:

Where are the waters of Kāne?

Yonder on mountain peak, on the ridges steep,

In the valleys deep, where the rivers sweep,

There are the waters of Kāne.

A question, I ask of you:

Where are the waters of Kāne?

Yonder, at sea, on the ocean,

In the driving shower, in the heavenly rainbow,

In the piled-up mist, in the blood-red rainfall,

In the ghost-pale cloud-form,

There are the waters of Kāne.

A question, I ask of you:

Where are the waters of Kāne?

Up on high are the waters of Kāne,

In the heavenly blue sky, in the black piled cloud,

In the darkest of clouds,

In the dark sacred cloud of the gods,

There are the waters of Kāne.

A question, I ask of you:

Where are the waters of Kāne?

Deep in the ground, in the gushing spring,

In the ducts of Kāne and Kanaloa,

A wellspring of water, water to quaff,

A water of magic power, the water of life!

Life! Long may it live!

From a traditional Hawaiian perspective, wai is sacred, symbolizing life, prosperity, and spiritual connection. Wai is considered the predominant kinolau or physical embodiment of the god Kāne. “He Mele no Kāne” is a traditional Hawaiian mele (chant) that describes the many different water forms that are associated with this deity and where water is located and can be found throughout the water cycle. According to this chant, wai is found in the east where the sun rises, in the west with the floating sun, on the mountain peak, on the ridges steep, in the valleys deep, where the rivers sweep, at sea, on the ocean, in the heavenly rainbow, in the piled-up mist, in the heavenly blue sky, in the darkest of clouds, deep in the ground, and in the gushing spring. The end of this mele states “He wai e mana, he wai e ola,” which translates to “A water of magic power, the water of life.” The Hawaiian cultural perspective defines the physical characteristics of this resource, as well as the spiritual aspect of wai as the element that supports life and moves energy through our natural systems.

The Hawaiian people attained true sustainability through the ahupua‘a system, or watershed divisions stretching from the mountain to the sea. These ensured everyone had access to vital resources, including freshwater. This system of resource management provided all the things needed for survival from a single ahupua‘a and was managed traditionally through stewardship for community well-being and sustenance. The health of watersheds were vital for all life and cultural continuity and connected the ‘āina (land) and kai. Therefore kānāwai (laws), derived from the concept of “equal sharing of water”, were created and rooted in sharing and responsibility, where water was managed judiciously, taking only what was needed and ensuring water continued to flow to support all life. Most importantly, the land uses were organized in a way that would provide for human needs without unnecessary impacts to the natural environment. Hawaiians’ connection to sacred natural spaces plays an integral part to the understanding of the natural world and the design of sustainable systems.

It is the role of kānaka (humans) to understand and activate the elemental forces of nature as well as the deep sense of responsibility within them to care for water resources to support future generations. With development, commercialization, and diversion of water, the cultural function of sacred natural spaces is progressively altered while traditional systems are severely disrupted, impacting communities and ecosystems. These distractions and changes in the spiritual landscape make it hard for kānaka to interact with the elements and understand their role and how to live sustainably on this Earth. Access to water shapes community structures and defines cultural identity, so current movements seek to restore water flows mai uka a i kai (from the uplands to the sea) and uphold public trust principles, reclaiming water as a community right rather than a private commodity. The word waiwai, literally “water-water,” is defined as wealth, prosperity, and abundance and exemplifies wai’s central role in societal health and richness. The following Water Quality Strategy, developed by the Division of Aquatic Resources, will incorporate traditional Native Hawaiian understanding of wai into management of aquatic organisms to model values of responsibility and stewardship ingrained in Hawai‘i and its people.

INTRODUCTION AND BACKGROUND

(KA HO'OKAHUA)

55 “Aia ka wai i ka maka o ka ‘ōpua.”

Water is in the face of the ‘ōpua clouds.

- Mary Kawena Pukui, ‘Ōlelo No‘eau

Water is one of the most important and unifying natural resources, spanning multiple ecosystems in Hawai‘i. Both the quality and quantity of water affect entire ahupua‘a as water flows from ridge to reef. A deep understanding of how wai in all its forms is connected and gives life to the pae‘āina (archipelago) is pivotal in understanding how Native Hawaiians managed their resources through these ahupua‘a systems. However, in a western government framework that is based on systematic compartmentalizing of jurisdiction based on subject-matter expertise, it has been difficult to effectively and holistically manage wai as a resource that transcends modern jurisdictional boundaries. As such, we recognize the need to move towards comprehensive management of wai that aligns with traditional Native Hawaiian water resource management through inter-agency collaboration to understand the consequential effect of wai on the health and abundance of our nearshore resources.

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Currently, our state government is still siloed regarding water issues. Changes in water quality within different ecosystems in an ahupua‘a, such as streams, estuaries, anchialine pools, and ultimately the ocean, impact aquatic resources that fall under DAR’s purview. However, managing water quality and quantity falls under the jurisdiction of other state agencies: primarily, the Department of Health (DOH) and secondarily, the Commission on Water Resource Management (CWRM) via the allocation and use of water as stated in the State Water Code (§174C-5). DOH is primarily responsible for monitoring and regulating water quality, while CWRM is primarily responsible for allocating allowable uses of freshwater quantity. As such,

issues pertaining to water quality have historically primarily been managed with respect to human health and use. This contributes to a lack of both understanding and action to improve water quality for positive aquatic resource outcomes.

The mission of the State of Hawai‘i Department of Land and Natural Resources (DLNR) Division of Aquatic Resources (DAR) is to work with the people of Hawai‘i to manage, conserve and restore the state’s unique aquatic resources. Water quality, or more specifically the biogeochemical parameters of the aquatic habitat, greatly affects aquatic species, reefs, and fisheries, and influences whether reefs are resilient to disturbance events. However, DAR did not have a strategy prior for how to utilize water quality data to inform management, or how to collaborate with other organizations to monitor or improve water quality for the health of aquatic resources. This strategy provides DAR with an outline for managing aquatic resources with water quality and biogeochemical water characteristics in mind. The purpose of this Water Quality Strategy is to guide DAR in incorporating water quality and quantity information into our management of aquatic resources, as well as collaborating with other state agencies and organizations to improve water quality for aquatic ecosystems through comprehensive ahupua‘a management.

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To better understand the effects of water quality on the whole system, including aquatic biota, we must focus management efforts on thorough ahupua‘a management from the uplands to the sea. Beginning this work will take a concerted effort among state agencies to define each agency’s kuleana (responsibility) and clarify pathways for collaboration across jurisdictions. In this strategy, we outline a vision to move towards collaborative management of ahupua‘a through the lens of water quality and its effect on aquatic organisms from ridge to reef. We achieve setting this vision through:

- (1) Outlining water governance and state agency jurisdiction in order to define DAR’s role in monitoring and managing how water quality impacts the marine landscape in Hawai‘i
- (2) Identifying key issues pertaining to the understanding and improvement of water quality for aquatic resources
- (3) Offering solutions through defined actions and projects, as well as descriptions of priority water quality parameters and priority places to guide focused actions

This Water Quality Strategy will guide how DAR addresses water quality in our management of aquatic resources from 2026-2030. Within that time, this strategy will be revisited in 2028 and revised as necessary based on lessons learned from the first two years of project implementation. This strategy serves as a starting point for statewide conversations around key gaps and opportunities in water quality management and improvement, and will guide DAR's partnership with other water management agencies, community organizations, and individuals interested in seeing clean water for aquatic resources throughout Hawai'i.

DAR's Role in Assessing and Addressing Water Quality

As the agency managing the aquatic life affected by the quality and quantity of water throughout its uka to kai journey, DAR is uniquely positioned to fill the current gap in understanding between water quality and aquatic resource condition. DAR has the ability to:

- A. Collaborate with DOH and other state and local agencies to ensure actions taken to manage water quality are protective of stream, estuarine, anchialine pool, and coral reef biota and fisheries as well as human health;
- B. Coordinate among organizations and individuals working at the intersection of managing water quality and aquatic ecosystems in Hawai'i to support projects that improve water quality and increase our understanding of water quality effects on fish, corals, limu (seaweed), invertebrates, and other aquatic species; and
- C. Monitor biology of aquatic ecosystems in concert with water quality and quantity monitoring to better understand how the marine environment responds to changes in water quality.

Through this Water Quality Strategy, DAR will outline key issues, potential solutions, and needs from communities, fishers, partner organizations and agencies, and within DAR to further actions to improve water quality for aquatic resources. This strategy also includes appendices with potential projects and actions to support efforts around the state to collaborate to improve water quality. This will ensure that while jurisdiction over the management of water quality lies within DOH and CWRM, DAR will be equipped to respond to the effects of water quality on the aquatic resources DAR is mandated to manage.

Overview of Agency Jurisdictions

To define DAR's role in assessing and addressing water quality, we first had to define each agency's kuleana throughout the state and clarify pathways for collaboration across jurisdictions. Insights and background on individual agency jurisdictions can be found below. The following are meant to be a general overview of agency jurisdictions as they relate to water quality, not an

extensive literature review. For more detailed information, please refer to the individual documents and laws cited in each section.

Agency Jurisdiction: State Offices

The primary agency in Hawai‘i that manages water quality is the Department of Health, which does so under the authority of the Environmental Protection Agency.

In the State Water Code, which is found in Title 12, Subtitle 2 of the Hawai‘i Revised Statutes, jurisdiction over water quality is given to the **Department of Health** to exercise the powers and duties vested for the administration of the State’s water quality control program (State Water Code, §174C-66). In the Hawai‘i Administrative Rules, DOH is also mandated to control water pollution, manage wastewater systems, and administer water quality standards (HAR §11). The State Water Code mandates that DOH develops the Hawai‘i Water Quality Plan, which is included in the four-part Hawai‘i Water Plan (State Water Code, §174C-31). The Water Quality Plan details DOH’s duties and water protection goals, which include but are not limited to: developing science-based and federally-approved water quality standards, developing Total Maximum Daily Loads (TMDLs) to improve water quality, regulating point source discharges through National Pollutant Discharge Elimination System (NPDES) permitting and enforcement, educating the public on nonpoint source water pollution, coordinating groundwater protection activities, and upgrading and replacing cesspools (Water Quality Plan, 2019). In the Water Quality Plan, branch-specific goals are also defined. Clean Water Branch goals are defined as amending current water quality standards, engaging in new water quality monitoring initiatives to apply data for watershed prioritization and pollutant source identification, collaborating with counties and state agencies to restore watersheds and support stakeholder stewardship of watershed resources, and obtaining federal approval of the new Coastal Nonpoint Pollution Control Program Management Plan. Wastewater Branch goals are defined as supporting the implementation of recommendations provided by the Water Reuse Task Force and continuing to work with stakeholders to develop a long-range plan for cesspool conversion.

The Department of Land and Natural Resources houses three agencies that play a part in water’s journey through an ahupua‘a: the Commission on Water Resource Management, the Division of Forestry and Wildlife, and the Division of Aquatic Resources.

In the State Water Code, general administration of the code is given to the **Commission on Water Resource Management**. This responsibility includes designating water management areas for regulation, carrying out surveys and research into all aspects of water use and water quality, protecting instream uses of water, establishing interim instream flow standards, publishing bulletins for information dissemination to the public, identifying areas where saltwater intrusion threatens freshwater sources, maintaining and inventory of water uses and water resources, and planning programs for the development and regulation of water resources

based on the best available information (State Water Code, §174C-5). Key to this DAR Water Quality Strategy is the responsibility that is given to CWRM in the State Water Code to “provide coordination, cooperation, or approval necessary to the effectuation of any plan or project of the federal government in connection with or concerning the waters of the State” (State Water Code, §174C-5(12)). Additionally, CWRM is mandated to cooperate with other government agencies with duties related to utilizing or conserving waters of the state, and to participate in the exchange of ideas, knowledge, and data (State Water Code, §174C-5(6)).

In the Hawai‘i Revised Statutes, Title 12, Subtitle 4, Chapter 183, duties for the **Division of Forestry and Wildlife** regarding water are defined as devising ways and means of protecting, extending, and utilizing forests and reserves for the protection and development of springs, streams, and sources of water supply (HRS §183-1.5(4)). DOFAW is also given jurisdiction over determining watershed areas (HRS §183-31) and managing permits for repairs and maintenance of loko i‘a (fishponds) (HRS §183-44). DOFAW also houses the Watersheds Partnership Program, which provides technical and financial support for the implementation of watershed management plans. These partnerships are critical to supporting restoration and management work of watersheds from upland forests to coastal ecosystems.

In the Hawai‘i Revised Statutes, Title 12, Subtitle 5, Chapter 187A, the **Division of Aquatic Resources** is mandated to manage and administer aquatic life in the state (which is defined as any species of mammal, fish, amphibian, reptile, invertebrate, coral that inhabits marine or freshwater, and marine plants or seaweed,) as well as gathering and compiling information and statistics concerning the habitat and character of, and increase or decrease in, aquatic resources in the state (HRS §187A-2). DAR is given rulemaking authority regarding the conservation and allocation of natural supply of aquatic life in an area, but not regulatory jurisdiction regarding the water the aquatic organisms live in (HRS §187A-5). Similar to CWRM’s mandate of cooperation with other agencies, DAR is mandated to secure the cooperation and assistance of and to assist appropriate government agencies having an interest in aquatic resource management (HRS §187A-8).

In addition to DOH and DLNR, two state agencies exist that help promote coordination, planning, and best practices for water quality and water use: the Coastal Zone Management Program and the Department of Agriculture and Biosecurity.

The **Coastal Zone Management (CZM)** program resides within the Office of Planning and Sustainable Development (OPSD,) which is part of Economic Development and Tourism in the Department of Business. In the Hawai‘i Revised Statutes, Title 13, Chapter 205A, the CZM program is mandated to protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems. Furthermore, this chapter states that CZM is mandated to protect, and where feasible, restore recreational value of coastal waters through

collaboration with DOH to set water quality standards and regulate point and nonpoint sources of pollution. CZM is also mandated to preserve valuable coastal ecosystems through promoting water quantity and quality planning and management practices which reflect the tolerance of fresh water and marine ecosystems and prohibit land and water uses which violate state water quality standards (§205A-2). These mandates set CZM up to be an integral link between federal, state, and county governments in Hawai‘i to achieve these goals.

The **Department of Agriculture and Biosecurity (DAB)**, similarly to CZM, does not regulate water quality or quantity directly but promotes practices that encourage good water quality such as erosion control through Best Management Practices (BMPs) for land use and oversight on the sale and use of pesticides, herbicides, and fertilizers.

Table 1. Overview of state agency jurisdictions relating to watersheds, water quality, and water quantity.

STATE AGENCY JURISDICTION OVERVIEW			
Agency	How can this agency influence water quality?	How can this agency influence water quantity?	Primary Tools / Mechanisms
DOH	Monitoring and regulation of point and nonpoint sources of pollution, wastewater management	Indirectly through water source protection efforts through the Hawai‘i Water Plans	State Water Code, Hawai‘i Water Plans, CWA implementation and enforcement with TMDLs and NPDES
DLNR-DAR	Monitoring effects of water quality on aquatic organisms	Monitoring effects of water quantity on aquatic organisms	Collaborations with other agencies, aquatic biota expertise
DLNR-CWRM	Indirectly through management of quantity	Managing water use and water quantity in streams	State Water Code, Hawai‘i Water Plans
DLNR-DOFAW	Managing wetlands and upper watersheds	Watershed management near stream sources	Watershed Partnership Program
CZM	Defining recreational value of coastal waters	Linking water quantity to coastal ecosystems	Statewide planning and coordination
DAB	Controlling erosion and chemical use in land management	Promoting irrigation efficiency and water-saving practices	Best Management Practices for land use

Agency Jurisdiction: Federal Offices

The **Environmental Protection Agency (EPA)** implements and enforces federal water laws in Hawai‘i under the Clean Water Act (CWA). EPA houses the majority of legal framework necessary for DOH to implement their programs and water quality regulations. EPA oversees the work of DOH and provides water quality standards through the CWA 303. These water quality standards are used to determine whether waterways are impaired and subsequently, whether TMDLs or NPDES permits need to be set to regulate water quality. EPA also reviews and approves methodologies for water quality monitoring.

The **National Oceanic and Atmospheric Administration (NOAA)** houses the Office of Coastal Management (OCM), which works closely with the Hawai‘i CZM program to influence planning, habitat control, and nonpoint source pollution. NOAA also houses the Coral Reef Conservation Program (CRCP), which strategizes and administers funds to support projects to reduce land-based source pollution.

The **United States Fish and Wildlife Service (USFWS)** does not directly regulate water quality or water withdrawal in Hawai‘i, but they do provide professional and technical advice on water quality and quantity as they relate to federally protected and managed species and habitats through the Endangered Species Act (ESA).

The **United States Geological Survey (USGS)** does not directly regulate water quality or water withdrawal in Hawai‘i, but they do conduct studies to monitor both water quality and quantity, providing essential data to inform management decisions. The USGS Pacific Islands Water Science Center specifically conducts hydrologic surveys relevant to water resource management. In the Hawai‘i State DOH Nonpoint Source Management Plan (2021-2025,) opportunities for collaboration with USGS are mentioned to study pesticides, herbicides, pharmaceuticals, hormones, and other chemicals in state waters.

The **United States Department of Agriculture (USDA)** does not directly regulate water quality or water withdrawal in Hawai‘i, but they do work with landowners to improve land use practices to mitigate agricultural impacts on water quality and quantity. Through their Natural Resources Conservation Program (NRCS), they provide technical assistance and encourage landowners to partake in voluntary programs to conserve, protect and improve soil, water, air, plants and animals on their land.

Table 2. Overview of state agency jurisdictions relating to watersheds, water quality, and water quantity.

FEDERAL AGENCY JURISDICTION OVERVIEW			
Agency	How can this agency influence water quality?	How can this agency influence water quantity?	Primary Tools / Mechanisms
EPA	Setting water quality standards and providing guidelines for permits	Indirect effects via water quality standards	CWA implementation and enforcement
NOAA	Protecting water through coastal habitat programs	Investigating coastal hydrology and sea level	CZM partnerships and coastal data
USFWS	Protecting species and habitats that intersect water resources	Considering water flow through habitats	ESA consultation, water rights expertise
USGS	Monitoring and collecting scientific data	Measuring and analyzing data on water flow	Water data research and assessment expertise
USDA	Encouraging best management practices for agricultural runoff and conservation	Influencing land use affecting water flows	Conservation programs and technical assistance

Agency Roles

Given the jurisdictions listed above, it is recommended that DOH and DLNR first work together to define specific roles of each agency in regards to ahupua'a management of water quality and quantity. It is also recommended that other relevant county and local government agencies be included in these conversations to ensure a well-rounded and place-based approach to viewing water governance in the state. Some questions that have arisen during the drafting of this Water Quality Strategy regarding agency roles include:

- A. How can agencies collaboratively prioritize actions to restore watersheds and improve water quality for aquatic resources?
 - a. What are potential mechanisms for these partnerships?
- B. What are appropriate protocols for reporting and responding to water quality-related episodes in aquatic environments, for both community members and agencies?
- C. Which agencies are responsible for enforcement of water quality infractions?

- D. What capacity needs to be built across agencies managing various aspects of water quality to address key issues identified in this Water Quality Strategy?

These questions will be addressed starting in 2026 through regular meetings of DOH and DLNR, as outlined in the *Goals and Objectives* section.

Overview of Primary Water Quality and Quantity Concerns and their Effects on Aquatic Resources

In this introduction, we outline current knowledge on the effects of the following parameters identified as priorities by the DAR-facilitated Mauka to Makai Water Quality Working Group: 1) [nutrients](#), 2) [sediments](#), 3) [fecal indicator bacteria](#), 4) [contaminants of emerging concern](#), and 5) [freshwater quantity](#).

Coral reef condition declines when water quality is reduced (Nalley et al., 2021). Water quality and reef condition can be improved through local-scale management actions, so it is vital to understand the effects of water quality on these resources in order to improve them (Tuttle & Donahue, 2022). When water quality is degraded, individual parameters can negatively impact reefs, but effects can also be synergistic. Often, water quality parameters act in concert with other reef stressors such as coral bleaching from warmer waters or reduced numbers of herbivores to lead to declining reef condition (Szmant, 2002). In response, our best course of action as managers is to have a strategy to address all types of impacts on a broad scale while being attuned to local and regional scales where one or a subset of parameters are the primary drivers of water quality impairment. This is particularly important in Hawai‘i, as all land in the state is considered to be in the “coastal zone” and any activity on land disproportionately impacts inland, coastal, and ocean water quality (Mezzacapo et al., 2021). In this Water Quality Strategy, we outline how various agencies can work together at the intersection of managing water quality and utilizing data to move towards adaptive management for positive aquatic ecosystems outcomes.

Nutrients

Global models estimate that around 22% of reefs worldwide are threatened from land-based pollution of excess nutrients and soil erosion (Fabricius, 2005). Recent research shows that land-based source pollution in particular decreases reef resiliency, and can amplify negative effects of climate change on reefs (Gove et al., 2023; Hondula et al., 2025). Nutrients are not inherently bad for aquatic ecosystems; in fact, inorganic macronutrients, along with light, are two crucial ingredients to fuel primary productivity, which in turn elevate food web dynamics and positively impact reef health. Natural nutrient inputs to coral reefs are critical for biological function. The issue arises due to nutrient loading, where excess nutrients from land-based source pollution,

runoff, or other sources lead to eutrophication, excess algal growth, and other negative reactions in the aquatic environment.

Some specific nutrients like ammonium or nitrate have been shown to make pH more variable, making reefs more vulnerable to global climate change (Silbiger et al., 2018). Reefs that are adjacent to disturbed watersheds with human presence and/or development show higher nutrient concentrations (Comeros-Raynal et al., 2021; Houk et al., 2020). Excess nutrients can lead to non-native macroalgal blooms, which in concert with declining levels of herbivorous reef fishes in Hawai‘i, can lead to algal overgrowth on coral reefs (Amato et al., 2016; Gove et al., 2023). This is a concerning issue in Hawai‘i, where reports have estimated that along West Hawai‘i, sewage-contaminated groundwater reaches at least 42% of reefs through submarine groundwater discharge (Hondula et al., 2025). However, submarine groundwater discharge is not all sewage contaminated. In fact, most SGD input into coastal areas or nearshore reefs are from deep groundwater that has not been contaminated by sewage, and they provide very important sources of nutrients to fuel productivity on the reefs. (Dulai et al. 2016).

Sediments

Sedimentation and land-based runoff are large issues impacting reefs in Hawai‘i, where erosion is ubiquitous due to poor historical plantation and ranching land management as well as overgrazing and habitat degradation by invasive ungulates. Sedimentation is a tricky rate to capture, as reef exposure to sediment is driven not only by its proximity to terrestrial sources of sediment but also coastal current dynamics that might resuspend sediments once they are in the marine environment (Teneva et al., 2016). Turbidity or Total Suspended Sediment (TSS) can be used as a proxy to measure the amount of particles in the water column at any one given moment or to measure the flow of water, but it does not capture the rate at which sediment is entering that environment from the adjacent watershed. Sedimentation has been found to reduce recruitment, growth, and survival of corals, largely due to smothering by said sediment or sediment-trapping macroalgae and the light limitations of coral symbionts (Fabricius, 2005).

Fecal Indicator Bacteria

Hawai‘i has over 83,000 cesspools that discharge 52 million gallons of untreated sewage into the groundwater every day (DOH, 2021). Sewage discharge can lead to decreased species diversity, increased nutrients leading to eutrophication, and reduction in coral cover (Mezzacapo et al., 2021). In areas with well-documented sources of wastewater and excess nutrients associated with sewage, such as South Kohala in West Hawai‘i and Mā‘alaea in central Maui, average relative coral cover loss was about 64-84% (Couch et al., 2014; Walsh et al., 2018). These effects on reefs are frequent, as sewage has been shown to travel quickly from land to sea; in some instances, sewage will reach shoreline waters within a range of nine hours to three days (Abaya et al., 2018). These findings show how imperative it is to manage wastewater contamination to aquatic ecosystems in Hawai‘i.

Various agencies and organizations measure fecal indicator bacteria (FIB) in Hawai‘i as a proxy for sewage input to the marine environment. These include Surfrider’s Blue Water Task Force, the Department of Health Clean Water Branch, and Hawai‘i Wai Ola, among others. Fecal indicator bacteria include fecal coliform (which includes *E.coli*) and *Enterococcus*. Fecal indicator bacteria data can be difficult to interpret, as they are found in both human and animal feces. *Enterococcus* specifically occurs naturally in tropical soils. That being said, there are established federal standards under the EPA to use FIB to characterize water quality conditions (although it is important to note these water quality standards are recreational criteria meant to protect swimmers’ and other water recreators’ health.) Additionally, research in Hawai‘i streams has shown that *Enterococcus* presence is positively associated with bacterial pathogens found in those same streams, indicating that enterococci is indicative of land-based runoff in streams (Viau et al., 2011). Once sewage reaches the ocean, it generally gets diluted due to water movement over nearshore reefs, but reefs near benthic seeps with sewage exhibit coral colony growth anomalies and other algal overgrowth (Aguilar et al., 2023).

Contaminants of Emerging Concern

Contaminants of emerging concern (CECs) are pollutants that have been increasingly detected in the environment, but a limited understanding of their impacts has left them largely unmanaged in current monitoring and regulatory frameworks. These can include pharmaceuticals, chemicals from personal care products, herbicides and pesticides, per- and poly-fluoroalkyl substances (PFAS,) industrial chemicals, and more (De Guise et al., 2022). Many CECs are considered endocrine-disrupting compounds (EDCs) that interfere with natural hormone systems, contributing to a wide range of chronic health effects such as reproductive issues, developmental impairments, carcinogenicity, and metabolic disorders (Li et al., 2024; You & Song, 2021). These pollutants are challenging to monitor and manage. Due to their relatively new emergence in the environment, they are understudied and many do not have regulations set by the EPA for monitoring and management.

In parallel with this Water Quality Strategy, a needs assessment for addressing CECs in Hawai‘i and the Pacific is being developed by the current Grau Fellow Lauryn Hansen through Sea Grant. This ongoing assessment implicates wastewater disposal systems and landfills, agriculture, and military and industrial activities as primary sources of CECs in the Pacific. Due to the high prevalence of cesspools, legacy agriculture, and military activities in Hawai‘i, it is likely there are CECs in the waters of Hawai‘i. Wastewater can lead to integration of pharmaceuticals and personal care products into the water, as most wastewater systems are unequipped to remove CECs in processing (Mezzacapo et al., 2021). Agriculture contributes to heavy metal, pesticide, and herbicide levels in water due to legacy and ongoing use of various industrial agriculture chemicals (Zhou et al., 2025). Military and industrial activities are major sources of contamination from heavy metals, petroleum products, and other industrial chemicals due to

dumping, chemical storage, and manufacturing (Broomandi et al., 2020). These compounds are often found at low concentrations, but even in small amounts, many persistent compounds are known to cause negative health impacts. The state of Hawai‘i is in need of a plan for prioritizing and measuring these compounds to better understand their environmental concentrations and exposure pathways. This will aid a fuller understanding of their impacts on human and ecosystem health.

Freshwater Quantity

DAR is committed to better understanding the connection between freshwater quantity and marine resources. Stream flow in Hawai‘i is regulated by the Commission on Water Resource Management. Freshwater quantity, especially stream flow, plays a critical role in the health of Hawai‘i’s marine ecosystems. Streams deliver not only water but also nutrients, sediment, and organic material to estuaries and nearshore reefs, helping to sustain native fishes, invertebrates, and algae (Wilmot et al., 2022). Adequate flow maintains the natural salinity balance in estuaries, supports the migration and life cycles of native amphidromous species such as ‘o‘opu (Hawaiian freshwater goby species), ‘ōpae kala‘ole (endemic freshwater shrimp, *Atyoida bisulcata*), and hīhīwai (freshwater snail, *Neritina granosa*), and flushes pollutants from watersheds (Peyton et al., 2021). When stream flow is reduced or diverted, salinity can rise, water temperatures increase, and sediment delivery patterns shift, leading to stress on coral reefs and seagrass beds (Bahr et al., 2015; Oki, 2003). In some instances, freshwater can help maintain desirable temperature and salinity levels for coral reef health, balancing the effects of climate change (Sahwell & Solo-Gabriele, 2025). Over time, diminished freshwater inputs can reduce reef resilience to climate change, degrade traditional fisheries, and threaten the cultural practices that depend on this resource as well as healthy uka to kai connections (HI-EMA Hazard Mitigation Plan, 2023).

An additional factor to include in the discussion of freshwater quantity is groundwater and submarine groundwater discharge (SGD.) Groundwater inputs to coastal ecosystems have both fresh and saline components, and have the potential to impact biogeochemical processes in nearshore marine environments (Richardson et al., 2017). Nutrient addition to marine ecosystems through SGD has been shown to enhance reef production and respiration (Silbiger et al., 2025). However, SGD has the potential to transport excess nutrients from wastewater and other pollutants from land to nearshore marine ecosystems (Amato et al., 2016). Therefore, in any discussion surrounding water quantity and inputs of freshwater into marine ecosystems, it is important to balance inputs that are beneficial to reef function with polluting or excessive inputs that might be harmful.

Overview of Water Quality Laws and Regulations in Hawai‘i

Water quality in Hawai‘i is regulated through a series of federal and state laws that mandate monitoring, management, permitting, and protection. A full list of these regulations can be found in the appendices, but the following summarizes key agency interactions to manage water quality in Hawai‘i. The federal Clean Water Act (CWA) through the Environmental Protection Agency (EPA) sets the framework (standards, permits, and enforcement) for water quality management. The Department of Health (DOH) administers most CWA programs through state statutes and administrative rules. Additionally, the Coastal Zone Management (CZM) program integrates land-use controls with water quality protection. The State Water Plans outline how DAR and CWRM work to manage water quality and quantity.

Water laws specific to Native Hawaiian Law can be found in the text *Native Hawaiian Law, a Treatise*. It states that waters in Hawai‘i are held in public trust for all of the state’s citizens. The public trust doctrine holds that determining water use and condition must favor public use, access, and enjoyment over private use. This priority of public use of water provides “support for the protection and restoration of traditional and customary Native Hawaiian practices” (Native Hawaiian Law, 2015). This is a generalization of a large body of knowledge, and more information can be found in chapters 9, 13, and 14 of this text (regarding water law in Hawai‘i, shorelines, and traditional and customary access and gathering rights, respectively.)

KEY ISSUES AND POTENTIAL SOLUTIONS (NĀ HIIHA A ME KA HO‘OPONOPONO)

1238 “Inā e lepo ke kumu wai, e hō‘ea ana ka lepo i kai.”

If the source of water is dirty, the muddy water will travel on.

- Mary Kawena Pukui, ‘Ōlelo No‘eau

One of the primary goals of this Water Quality Strategy is to determine where DAR can fit into work currently being conducted in Hawai‘i to improve water quality for nearshore resources. In order to do this, we first identified key issues or gaps within work currently being done statewide to improve water quality, and then identified potential solutions that DAR can fit into. The primary issues we identified, in no particular order, are:

- E. Water quality is an uka to kai issue, but the agencies that manage and work to improve it are siloed;
- F. Statewide monitoring efforts are not currently structured to identify effects of water quality on nearshore ecosystems;
- G. There is a lack of published literature of how water quality parameters are affecting aquatic species specific to Hawai‘i, and;
- H. There is a need for both continued data collection and active solutions to improve water quality at the same time, which can be challenging due to a lack of capacity and funding.

In the remainder of this section, we will outline each key issue and general solutions suggested for each, including how DAR can support these solutions.

Need for Interagency Connections

Assessments for water quality across multiple ecosystems in Hawai‘i are important as water flows from the mountains down streams and valleys, into wetlands, and ultimately to the ocean. Traditionally, land in Hawai‘i was managed through ahupua‘a, which were typically divided along watersheds, ensuring each land division could be self-sufficient by encompassing all essential resources for life (Kamehameha Schools, 1987). This system enabled the konohiki (headman of an ahupua‘a) to understand how all the associated ecosystems within an ahupua‘a were connected and influenced each other. This comprehensive understanding of this natural system allowed the konohiki to enforce kapu (prohibitions or sacred laws) within their specific ahupua‘a to prevent overharvesting and allow resources to replenish, ultimately ensuring long-lasting sustainability and management of the land and sea. Through detailed and extensive kilo

(observation), the konohiki adaptively managed to achieve sustainable productivity in the ahupua'a for the ultimate goal of resilience. However, when the state government of Hawai'i was formed, agencies were given jurisdiction over individual ecosystems, disrupting the ahupua'a system of management. In regard to water quality, the Department of Health (DOH) is mandated to manage the quality of the state's water, along with the Commission of Water Resource Management (CWRM). This is entrenched in DOH's Environmental Management Division, which includes the Clean Water Branch, Safe Drinking Water Branch, Surface Water Protection Branch, and Wastewater Branch.

The Department of Land and Natural Resources (DLNR) manages the ecosystems within the ahupua'a influenced by water quality. Streams are generally managed by the Commission on Water Resource Management (CWRM), wetlands and shorelines by the Division of Forestry and Wildlife (DOFAW), and biota within both freshwater and marine ecosystems by the Division of Aquatic Resources (DAR). Ecosystems that DAR is mandated to monitor and manage include coral reefs, anchialine pools, streams, and estuaries (HRS §187A).

This siloed nature of the state government agencies that have a hand in water quality, as well as the lack of capacity and resources within each agency, has led to a disjointed form of management in the state that fails to wholly understand the impacts of changing water quality on multiple ecosystems and aquatic resource health. To remedy this disjointed structure of governance, we must shift perspectives towards holistic watershed management based on the ahupua'a system, extending from the uplands to the sea. Beginning this work will take a concerted effort among state agencies to define each agency's kuleana and clarify pathways for collaboration across jurisdictions. As the agency managing the ecosystems throughout each ahupua'a, where the effects of all other associated ecosystems merge, DAR is in a unique position to convene these agencies to work towards more interconnected management where the agencies communicate regularly and work together to accomplish shared goals.

To begin this work, DAR has convened quarterly sharing sessions between DOH and DLNR to encourage regular communication and collaboration. At these meetings, agency staff share

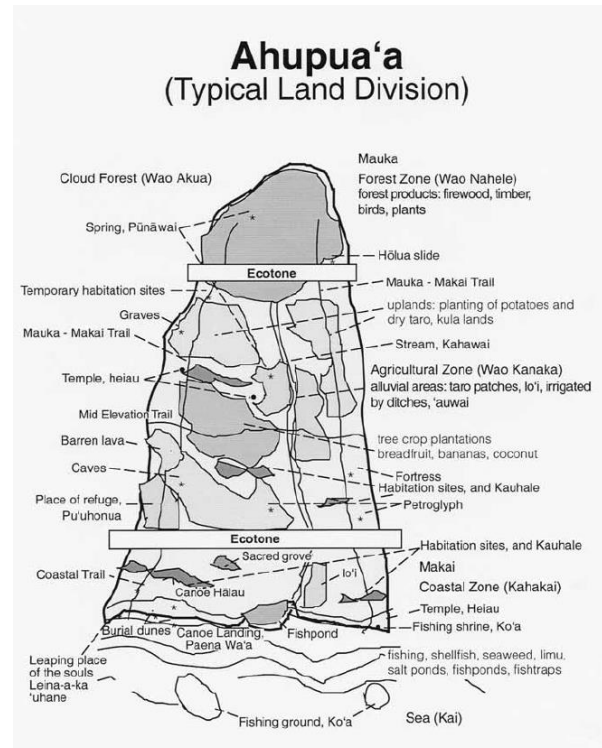


Figure 1. Ahupua'a model after Luciano Minerbi (1999), from *The Hawaiian ahupua'a land use system: its biological resource zones and challenge for silvicultural restoration*.

information, discuss projects to collaborate on, and talk about needs of any of the agencies that are necessary to maintain, sustain, or improve water quality. Staff from the EPA and the CZM program have also joined these sharing sessions, which are the beginnings of more consistent and fruitful collaboration to improve water quality mai uka a i kai. Moving forward, it would be advantageous to include more branches of DOH in these meetings, as so far the primary branches that have been involved in these conversations are the Clean Water Branch and the Surface Water Protection Branch. It would also be advantageous to include representatives from county governments to support conversations about specific actions to improve water quality. Additional topics of conversation for these collaborative meetings include, but are not limited to: (1) Clarifying the role each agency has in enforcement of water quality regulations, (2) Inviting researchers, community members, indigenous land managers, and fishers to discuss the most up-to-date knowledge and understanding of how various water quality parameters impact aquatic ecosystems, and (3) Inviting the Hawai‘i Hazard Emergency and Emergency Response office to discuss contaminants of emerging concern and how we can begin to address them.

To remedy this disjointed structure of governance, we must shift perspectives towards holistic watershed management based on the ahupua‘a system, extending from the uplands to the sea.

Additional potential areas of collaboration have been identified through the creation of this Water Quality Strategy. The following represent priority action items that have been identified for collaborative projects:

- Collection of biological data at agreed locations of mutual interest to provide information on aquatic life condition to water quality and quantity management agencies
- Collection of water quality and biological data at locations where management, restoration, and mitigation actions are taking place to determine effects of changes in water quality and quantity on aquatic resources
- Increased capacity in water quality monitoring to collect a full suite of parameters and monitoring during brown water events
- Training between agencies to assist staff in water quality and quantity data collection and assessment

Need for Co-located Data

One of the primary water quality documents that is regularly produced in Hawai‘i is the Integrated Report (IR) that is compiled by DOH every two years for the Environmental Protection Agency (EPA.) This document is mandated by the EPA Clean Water Act (CWA)



Figure 2. Panel on water quality and marine monitoring at the U.S. Coral Reef Task Force Meeting in Saipan, CNMI in November 2024.

Sections 303(d) and 305(b). The IR provides information on the overall health of surface waters statewide in Hawai‘i, as well as providing a list of impaired waters. Subsequently, this list of impaired waters is used to determine which waters DOH needs to set Total Maximum Daily Loads (TMDLs) for. To determine whether waters are impaired, the IR makes use of Water Quality Standards (WQS,) which are set by the EPA for each region. DOH measures various water quality parameters at locations statewide, compares the measurements to WQS, and if any exceed

the threshold set by WQS for that site, they are considered impaired and a TMDL is put in place to remedy the impairment. The EPA *How’s My Waterway* online tool, which categorizes data from Integrated Reports, shows that 200 coastal waters in Hawai‘i that support aquatic life were characterized as impaired in the 2024 DOH Integrated Report.

Currently, water quality standards are set through consideration of human health criteria and aquatic life criteria (EPA, 2025). For some places, numerical biological criteria can be set that take biological health into account when assessing water quality, such as having a designated use set by the EPA for the Propagation of Aquatic Life. However, the State of Hawai‘i currently does not incorporate biological criteria into their IR. Biological criteria are not the only way to incorporate information on aquatic biota into assessment of water quality condition; biological data can supplement water quality assessments in IRs to show how organisms living in aquatic environments respond to changes in water quality. To find an example of where this occurs, DAR staff facilitated a panel discussion at the 49th meeting of the United States Coral Reef Task Force (USCRTF) in Saipan in the Commonwealth of the Northern Marianas Islands (CNMI). Panelists included employees from the Division of Environmental Quality (DEQ), the Bureau of Environmental and Coastal Quality (BECQ), and the EPA. The goal of the panel was to discuss how the agencies work together to integrate water quality and biological data in their IR. In Saipan, the BECQ Marine Monitoring Team (MMT) supplements water chemistry monitoring by evaluating ecological conditions through long-term surveys of benthic communities. They measure changes in benthic substrate, coral diversity, and seagrass trends. Subsequently, the CNMI WQS incorporates marine biological monitoring data to assess habitat health and resiliency in their IR.

Key takeaways from the panel at the USCRTF were:

- (1) It is important to have co-located water quality and biological data
- (2) Consistent communication between agencies is key
- (3) Collaborative efforts need to be written into plans to encourage agency commitment

The panelists noted that when you have co-located water quality and biological data, it helps connect management actions to the health of the watershed as a whole and show ecosystem response to various regulations. With this information in hand, DAR staff returned to Hawai'i to share with DOH and begin creating plans on how the two agencies can work together more efficiently and effectively to collect data in the same places, providing information on water quality near critical DAR reef monitoring sites as well as providing biological information to DOH near water quality management sites. To start, these efforts would consider only supplemental biological data, not the creation of biological criteria, though that can stand as a goal to work towards in the future. Initial plans for these partnerships are listed in the *Potential Projects* appendix of this Water Quality Strategy.

Data Management

As conversations surrounding water quality and biological data collection within DAR begin, it is important to address data management. Key goals of data management for this Water Quality Strategy are as follows:

- A. *Quality assurance*: Data collection methodologies used by DAR (for assessing either water quality or biology) align with EPA-approved methodologies utilized by DOH and include quality assurance plans
- B. *Transparency*: Data is stored in such a way that it will be easily sharable with partners, and data analysis is regularly communicated to the public
- C. *Standardization*: Data collection methodologies are transferable across DAR districts for ease of information sharing and analysis

Within this Water Quality Strategy, DAR intends to create internal capacity and expertise to respond to distinct water quality questions and events related to the health and condition of aquatic resources through restoration and monitoring planning efforts. DAR is planning to expand biological data collection efforts to investigate areas where management, restoration, and mitigation actions are occurring. These data will be shared with partner agencies, organizations, and community groups to inform understanding of how water quality and water quantity affect aquatic resources. Additionally, DAR plans to collect water quality data to respond to community requests for water quality information and supplement ongoing monitoring projects for priority areas where water quality is not currently being measured.

Need for Research on Water Quality Effects on Aquatic Life

At the time of this strategy's completion, the EPA is conducting a project to determine whether water quality standards are protective of coral reefs. As most water quality standards were initially set with only human health in mind, there is not much data on how various water quality parameters affect fishes, corals, limu, and invertebrates. It is imperative that water quality standards set for Hawai'i are relevant to Hawaiian organisms and backed by scientific understanding of their effects on those organisms. At the conclusion of this Water Quality Strategy in December 2025, this EPA project was still ongoing but will continue to be tracked by DAR staff for relevant information that could help inform water quality efforts at DAR.

In Hawai'i, the field of research on effects of degraded water quality on corals, fishes, limu, and invertebrates is still emerging. There is a body of literature in some areas looking at how water quality impairments affect corals and plankton, but effects on fishes, limu, and invertebrates are much less understood. Through this Water Quality Strategy, DAR hopes to partner with researchers in Hawai'i to support research on how priority water quality parameters outlined in this Water Quality Strategy affect key aquatic species, particularly food fishes due to their importance to subsistence, culture, and economy in Hawai'i and herbivorous fishes due to their importance in maintaining algal presence on reefs. Initial plans for these studies are listed in the *Potential Projects* appendix of this Water Quality Strategy.

Additionally, more specific research is needed on the prevalence of Contaminants of Emerging Concern (CECs) in Hawai'i waters and their effects on fishes and other aquatic biota. Sea Grant is currently developing a needs assessment document for Hawai'i that will outline best practices for CEC management and identify priority contaminants for targeted monitoring and research. The assessment has already identified the need for regular, coordinated monitoring to inform baseline contamination levels across media and ecosystems in Hawai'i. This assessment is expected to be completed by Fall 2026. Prior to its completion, the DAR Water Quality Coordinator will work with the Sea Grant Grau Fellow who is developing the needs assessment to determine which CECs to prioritize and determine relevant monitoring and research methodologies for DAR and partners to incorporate into water quality monitoring. One potential action to gather necessary information on CECs in Hawai'i is to conduct a pilot contaminant study to gather baseline data for detection and probability of impact. Such a study will require project-specific funding as well as a position to coordinate the study, so DAR will work together with UH Sea Grant and potentially DOH to determine appropriate funding sources and determine which agency or organization would be best to coordinate this study.

Simultaneous Need for Data and Solutions

A challenge of working with a complex, multidimensional issue such as degraded water quality is that a real need exists for additional data and studies to fully understand the subject at hand,

while at the same time, solutions and action are needed to mitigate and resolve the damage to Hawai‘i’s natural ecosystems from poor water quality before any further harm can be done. Indeed, data is necessary to inform effective solutions. Many stakeholders involved in this conversation have differing views on whether it is more important to gather data and monitor or to restore and act. As a managing agency that also collects regular monitoring data, it is DAR’s responsibility to take steps towards both avenues simultaneously.



Figure 3. DAR staff partner with community organizations on land-based restoration projects in Maui.

One way DAR can advance both data collection and restoration action together is by partnering with community organizations and agencies that are conducting restoration projects on land, employing expertise from each group to accomplish common goals. DAR can coordinate with these organizations to collect nearshore biological data adjacent to restoration efforts to understand the biological response. Such collaborations will clarify whether mitigation actions have a measurable impact on the marine environment. This kind of data is also incredibly helpful to DOH, who have requested that DAR help collect data on biological response to water quality management regulations and restoration actions.

Multi-jurisdictional engagement and collaboration *mai uka a i kai* is essential to moving restoration and monitoring work towards effective *ahupua‘a* management. Leveraging each agency’s expertise and capacity will be key to accomplishing shared goals. In addition to project-based, episodic monitoring, it is vital to establish a baseline understanding of water quality conditions throughout aquatic environments. Projects like this are listed in the *Potential Projects* appendix later in this plan.

To fill the gap in understanding of the effects of water quality and quantity on the condition of aquatic resources, DAR will reach out to existing community organizations conducting restoration efforts that improve water quality who do not currently have capacity to measure or monitor the effects of their efforts on aquatic ecosystems. Through DAR’s Community Based Monitoring (CBM) program, DAR will create a guidebook based on water quality Standard Operating Procedures (SOPs) that are developed as a result of this Water Quality Strategy to aid in providing capacity and resources to communities who are interested in addressing water quality for their place.

DAR WATER QUALITY NEEDS (NĀ PONO)

1506 “Ka nui e pa‘a ai i ka hue wai.”

The size that enables one to carry a water gourd.

- Mary Kawena Pukui, ‘Ōlelo No‘eau

DAR identified gaps and needs of both our statewide and district (island) offices to better connect water quality and aquatic resource condition. These needed improvements are listed below, along with descriptions of current and past projects that are being or have been conducted regarding water quality. The information below was gathered and transcribed from individual meetings with each of the DAR district lead biologists and their teams. Common needs identified by all five districts (Kaua‘i, O‘ahu, Maui Nui, West Hawai‘i, and East Hawai‘i) are highlighted as Statewide shared needs, while all other needs mentioned only in individual district meetings are discussed subsequently as district-specific needs.

Statewide

Shared needs:

- Capacity and expertise to lead, coordinate, and conduct water quality management, restoration, monitoring, research, and partnerships
- Statewide Standard Operating Procedures (SOPs) for water quality and biological data collection, as well as data management protocols
- Research as well as a literature review on the effects of sedimentation and wastewater on reefs and fish
- Updated field equipment for water quality monitoring and funding to support water quality positions and programs

Capacity is the biggest need for DAR statewide to support the work to improve water quality discussed in this Water Quality Strategy. Many districts have limited numbers of field staff to conduct restoration, monitoring, and research. Additional positions with a focus on water quality and watershed work can fulfill an internal need for immediate water quality source detection and other needs from DAR teams who are interested in understanding the condition of water quality in a specific area. More capacity to test water quality in order to inform our management actions was specifically requested by DAR’s Aquatic Invasive Species team and coral restoration teams. Dedicated water quality staff have proved critical in the Maui Nui district, where DOH shared that the primary reason they have been able to conduct so many restoration projects successfully

in Maui is due to the presence of the Ridge to Reef Coordinator position for West Maui on the DAR Maui team, who acts as a liaison between DAR and DOH. Staff from CWRM and DOFAW in DLNR agreed that having a similar position for each district within DAR to prioritize a watershed perspective would be incredibly beneficial for continued communication between agencies and the successful implementation of projects to improve water quality for aquatic resources.

Each district office also mentioned the need for development of statewide protocol for water quality data collection, biological data collection to determine water quality effects, and data management. Staff training was also mentioned as a potential avenue for partnering with DOH to ensure monitoring methodologies are EPA-approved. Most districts were interested in more research on the effects of sedimentation and wastewater on nearshore ecosystems, as these have been identified as priority water quality concerns. A literature review was also requested, as effects of sediment and wastewater on reefs and fishes is a relatively data-poor field of study but having a resource with compiled information would help DAR guide management decisions until more research is conducted. Lastly, all districts mentioned the need for both updated field equipment and consistent funding pools for water quality-related projects, staff, and programs.

Other statewide needs respond directly to the key issues and potential solutions outlined in the previous section of this Strategy. The first need is regular communication and collaboration with other agencies, which can be fulfilled through the addition of a watershed-focused position for the DAR districts that do not already have one (Kaua'i, O'ahu, West Hawai'i, and East Hawai'i*.) A need for co-located data can also be fulfilled through both internal DAR capacity (ex. taking water quality samples alongside regular marine monitoring) and partnerships (ex. taking water quality samples near areas where DOH or CWRM are conducting management or restoration projects.) The need for more understanding of how sedimentation and nutrients affect fish populations can be fulfilled through partnerships with local research universities or nonprofits. Lastly, the importance of focusing on restoration efforts alongside monitoring projects is consistently highlighted in order to work towards actually improving water quality for aquatic resources while working to better understand its effects on those organisms.

**It was decided internally that due to the Moloka'i DAR office and team still being in construction, a watershed-focused position will not be pursued for Moloka'i until the infrastructure to support them is established.*

Kaua'i District

Specific needs:

- Position to provide capacity for on-the-ground work and guide collaborations for water quality on Kaua'i
- Clarity on agency responsibilities surrounding water quality

On Kaua‘i, a few community organizations are working on standing up water quality monitoring projects, namely Reef Guardians (which is also supported by Wastewater Alternatives and Innovations). Surfrider Blue Water Task Force collects fecal indicator bacteria measurements focused on human health. Waipā Foundation conducts water quality monitoring as part of their broader restoration and stewardship work. The Kaua‘i DAR team is interested in being able to have capacity to join these efforts, primarily to identify metrics associated with reef degradation.

Specific needs mentioned in order to move towards a better understanding of impacts on reefs coming from the uplands are coordination and technician capacity, funding, equipment, and laboratory analysis capacity. In particular, the Kaua‘i team would like one person to act as a coordinator between various agencies and organizations working on water quality who would also have capacity and expertise to engage in restoration actions and take water quality measurements as needed by the Kaua‘i team. These water quality measurements would ideally be paired with reef data, particularly on priority reefs, but could also extend up estuaries and streams to better detect sources of water quality degradation. The Kaua‘i team also mentioned a need for a better understanding of agency responsibility, so when community members ask water quality regulation-related questions, they can know who to refer to and coordinate with to fix the issue. They mentioned this position could also play a role in gathering the information needed to create this reference of responsibilities. For equipment, the Kaua‘i team specifically mentioned more sophisticated YSI devices than the simple handheld YSI devices currently held by the district. They were also interested in sediment traps to determine change in sedimentation and erosion following restoration efforts ma uka, and mentioned the need to look into OCCL permits to place instruments like these out on the reefs.

The Kaua‘i team’s primary concern was with gathering more information to better communicate with the local community and respond to community concerns and needs surrounding water quality. They mentioned examples of community concern around how sedimentation in Waimea is affecting fishing, how waste entering the ocean from streams affects popular dive sites, and how streams showing degraded water quality from Surfrider’s measurements empty into beaches where people recreate.

O‘ahu District

Specific needs:

- Facilitation and collaboration with O‘ahu agency, organization, and community counterparts to support coordination of restoration and monitoring
- Standard operating procedures for how DAR responds to reports from community on fish kills, as well as SOPs for how communities can accurately report fish kill events

The O‘ahu DAR district currently has a handful of staff members working on watershed restoration projects and estuary monitoring. Due to this capacity, there are an array of projects at

various stages of support. These include, but are not limited to: statewide estuary monitoring, regular monitoring of anchialine pools in Wai‘anae, and mangrove restoration projects in He‘eia.

The primary water quality needs for the O‘ahu district pertain to protocols for data collection and management, as well as increased partnerships to support restoration. The O‘ahu district office is in need of standard operating procedures (SOPs) for utilizing handheld water quality monitoring meters to measure basic physical water quality parameters to tack this onto routine marine monitoring protocols, as well as SOPs for conducting more in-depth water quality testing for other parameters such as nutrients, sedimentation, or other contaminants of emerging concern that are of interest by area. The O‘ahu district office has a fair amount of field staff, but they would need training for the new SOPs and data analysis. O‘ahu district office staff suggested this could be a potential point of collaboration with DOH, if their offices would be willing to hold trainings for DAR staff for water quality data collection. Additionally, plans for where the new data would be stored and how it could be shared with other DAR district offices and partners are needed. Finally, in order to complete this work, the O‘ahu office would need more handheld water quality monitoring meters as well as any supplies and equipment necessary to collect additional water quality parameters outside of general physical parameters that can be assessed with the handheld sensors.

The O‘ahu district office was also interested in facilitation of regular conversations with other agency partners on O‘ahu to support coordination of monitoring activities near areas where other agencies such as DOH, CWRM, and DOFAW are conducting restoration projects. This would help the O‘ahu office prioritize where to place new monitoring efforts. This could also apply to collaborations with community organizations looking for additional support with restoration or monitoring activities. In terms of more specific community input, it was also mentioned that having SOPs for how communities can report fish kills to DAR to facilitate faster and more comprehensive responses would be helpful.

Maui Nui District

Specific needs:

- Water quality funding pool to use for immediate water quality source detection needs
- Water quality data from FAHU and CRAMP sites to establish baseline trends for water quality values compared to fish and benthic data

The Maui Nui DAR district is the most involved with water quality work out of all DAR districts, with projects conducting stream surveys in collaboration with the Commission on Water Resource Management (CWRM,) surveys of plankton, chlorophyll, and limu composition in estuaries and loko i‘a, and shoreline seine net surveys to pair with water quality surveys collected by the community organization Hui O Ka Wai Ola (HOKWO.) In addition, the DAR Maui team is involved with several projects from our partners, such as assessing contaminants in

water, sediment, and biota off the burn area near Lahaina with USGS, UH Sea Grant, and DOH, studying impacts of nearshore sedimentation and injection wells on coral biology with UH Mānoa and TNC, and testing nitrogen isotopes in limu to evaluate nutrient sources with Maui Nui Marine Resource Council (MNMRC). In 2026, the Maui Nui DAR team will also be starting water quality monitoring on Molokaʻi. It has been noted the amount of restoration, monitoring, and water quality studies that have been conducted by the DAR Maui team is made possible by the presence of a Ridge 2 Reef Coordinator position for West Maui as well as two stream and estuary biologists in the Maui office.

As the DAR Maui team already has capacity for water quality projects in their Ridge 2 Reef Coordinator and stream biologists, they are mostly interested in securing funding to support their ongoing and planned projects. One of their newest projects on estuary monitoring to pair seine net samples with water quality samples is on a single year grant, so they are interested in securing sustained funding for this project. Additionally, they are interested in continuing to support capacity on the island of Maui to collect regular water quality data through the community organization Hui O Ka Wai Ola and the UH Maui Water Quality Laboratory. In general, they noted that it would be useful to have a pool of funds for water quality projects to respond to immediate water quality source detection needs.

The DAR Maui team noted that these water quality studies are essential for both fishing and tourism in Maui, where heavy sedimentation events often prevent people from being able to get in the water. They are interested specifically in research that looks at the effects of this sedimentation on local fish populations, and suggested adding water quality testing to their regular marine monitoring team's Fish and Habitat Utilization (FAHU) and Coral Reef Assessment and Monitoring Program (CRAMP) surveys to compare fish assemblage and benthic data to water quality data, establishing a baseline and then identifying trends.

West Hawaiʻi District

Specific needs:

- Better mapping of submarine groundwater discharge plumes and effects on reef health
- Better understanding of water circulation with oceanographic modeling

The DAR Kona office is interested in building water quality expertise within their office to better study and understand water quality on the west side of Hawaiʻi Island. They are currently working with the DAR Hilo office on biological surveys at Waiʻulaʻula alongside CWRM to determine the biological condition and response before, during, and after stream flow restoration. They also noted a few studies in West Hawaiʻi by UH Hilo and Arizona State University (ASU) to research wastewater and pharmaceuticals in the ocean, particularly near high tourism areas and potential sites for coral restoration projects.

The DAR Kona team is interested in better understanding the effects of wastewater on reef environments and whether conversion of cesspools leads to a measurable change in nutrients and fecal indicator bacteria in the water. They are also interested in understanding the effects of sedimentation on key reef fishes. In general, they mentioned a need for setting standardized water quality methods at the statewide scale for DAR that can be implemented within all districts along with dedicated staff time towards doing the work.

East Hawai‘i District

Specific needs:

- Research on changes or impacts from wastewater management systems and impacts of pesticides and other chemical pollutants in streams

The Hilo team is working towards integrating water quality into their stream and anchialine pools programs, particularly with partnerships with researchers with water quality buoys and the new Kahawai Watch program, which is still in its planning phase (see more information on this program in the *Potential Projects* appendix of this document.) However, they are also interested in growing their water quality expertise through extra capacity and statewide water quality monitoring protocols, similar to the DAR Kona team.

DAR Hilo is particularly interested in better understanding the impacts of wastewater on reefs, especially in Keaukaha where an aging suspect sewer system is of major concern for community members. They would like to see research on the impacts of pesticides and other chemical pollutants that violators pour into the streams to harvest aquatic resources such as prawns, as well as the impacts of sedimentation on reef systems. They have had many concerns from the local community on stream health, so the formation of the Kahawai Watch program could help them better collaborate and communicate with the community.

GOALS AND OBJECTIVES (NĀ PAHUHOPU)

2178 “Mōhala i ka wai ka maka o ka pua.”

Unfolded by the water are the faces of the flowers.

- Mary Kawena Pukui, ‘Ōlelo No‘eau

The following goals and objectives outline specific actions for DAR to address the key issues identified in this Water Quality Strategy from 2026-2030. In 2028, this strategy will be reviewed and revised as necessary based on lessons learned from project implementation in the first two years. In 2030, success will be measured and the strategy will be updated.

Implementation of these goals and objectives will be primarily led by the Water Quality Coordinator, who will begin work in January 2026. In addition to fulfilling the below goals and objectives in a timely manner, the Coordinator will organize and facilitate regular meetings among agency, community, and organizational partners to continue the conversations started in the creation of this strategy; conduct field work to develop water quality and biological protocols for DAR in collaboration with DOH, CWRM, DOFAW, and other interested parties; apply for funding sources to support pilot projects; and any other tasks that support the actions outlined in this strategy to improve water quality for aquatic resources. Other potential projects that will be led by the Coordinator to fulfill goals of this strategy are listed in the *Potential Projects* appendix.

These goals and objectives represent a starting point for DAR to develop methods and grow capacity to help answer questions relating to the effect of water quality on aquatic resources, as well as continuing collaboration with other agencies to support ongoing efforts. Additional goals and objectives will be developed as needed during the 2028 review of this strategy to continue building on momentum from strategy implementation in 2026-2027.

DAR WATER QUALITY STRATEGY

NEEDS, GOALS AND OBJECTIVES

DAR NEED	GOAL	OBJECTIVES
Capacity for water quality projects and partnerships	1. Build internal DAR capacity to implement projects and partnerships to improve water quality for aquatic resources	1. Hire a Water Quality Coordinator to implement the actions listed in this Water Quality Strategy by January 2026 2. Hire a watershed-focused position for Kaua‘i and Hawai‘i Island by January 2028 3. Explore pathways for increasing capacity to analyze additional water quality samples in the state with DOH, UH, and other regional laboratories
Regular agency collaboration	2. Facilitate regular communication and collaboration between state, federal, and county agencies managing water quality, water quantity, and watersheds	1. Continue hosting quarterly interagency meetings through December 2030 2. Partner on at least one restoration project with each of the agencies DOH, CWRM, and DOFAW (where each agency has some level of involvement,) or additional interested parties, by December 2030
Co-located water quality and biological data	3. Support the collection of biological data and water quality data in the same locations to facilitate better understanding of water quality effects on aquatic resources	1. Develop methods for collecting biological data alongside management and restoration efforts ma uka by December 2026 2. Pilot water quality testing alongside DAR marine monitoring locations in at least one DAR district by January 2027 3. Partner with DOH to have DAR biological data incorporated into the DOH Integrated Report to the EPA by Fall 2029
Water quality effects on reef fishes	4. Support research on the effects of various water quality parameters on culturally and commercially important reef fishes and other aquatic organisms	1. Secure funding for DAR estuary seine net and water quality data collection to supplement understanding of how water quality affects aquatic biota by 2028 2. Support at least one graduate student research project on watersheds and fisheries by Fall 2026 3. Partner with at least two researchers to investigate the effects of water quality and quantity on fishes and reef habitats by Fall 2027 4. Develop a list of management-relevant questions for researcher use based on DAR information needs by Spring 2027, to be updated regularly
Simultaneous restoration and monitoring efforts	5. Build community partnerships to support restoration efforts to improve water quality	1. Identify at least one new community partnership per DAR district and start a restoration or monitoring project with them by January 2027 2. Develop, with the DAR Community Based Monitoring program, general water quality sampling protocols that can be tailored to site-specific restoration areas ma uka by December 2026

PRIORITY WATER QUALITY PARAMETERS (NĀ KŪLANA WAI)

1323 “Ka i‘a a ka wai nui i lawe mai ai.”

The fish borne along by the flood.

- Mary Kawena Pukui, ‘Ōlelo No‘eau

To identify priority water quality parameters for this Water Quality Strategy, we utilized a series of guiding questions developed by the Mauka to Makai Water Quality Working Group (MMWQWG). Identifying priority parameters allows us to narrow down which aspects of water quality we are going to focus the Division of Aquatic Resources’ efforts and resources on. Priority parameters were identified by counting the number of times each parameter was mentioned by a participant of the MMWQWG during the parameter prioritization process. Priority water quality parameters are listed in Table 3, along with the number of instances (votes) they were mentioned as an answer to the guiding questions (see below). This activity represents a quantitative method to gather information on which water quality parameters are of high importance to DAR’s partners and stakeholders.

Table 3. Priority water quality parameters.

Water Quality Parameter	Prioritization Votes
Sedimentation rate, TSS, and/or turbidity	24
Nutrients (nitrogen and phosphorus)	22
Fecal Indicator Bacteria (FIB)	10
Contaminants of Emerging Concern (CECs)*	5*
Stream flow rate (water quantity)	4
Salinity	4
Wastewater/cesspool contamination	4
Temperature	3
Heavy Metals	3
Chlorophyll a	2
pH	1
Conductivity	1

*CECs were prioritized specifically as a need for more research and monitoring.

Guiding questions used in this parameter prioritization discussion are listed below:

- I. Which parameters are of most concern to communities and participants involved in the Mauka to Makai Water Quality Working Group?
- II. Which parameters are directly applicable to local management action?
- III. Which parameters can be addressed through local policy?
- IV. Which parameters can be most immediately addressed by restoration action?
- V. Which parameters, based on currently available evidence, have the greatest effect on coral reefs, fisheries, and reef-associated organisms?
- VI. Which parameters do we currently have accessible monitoring data for?

Parameters with 5 or more “votes” were considered priorities. These are highlighted in Table 3. It was noted that contaminants of emerging concern (CECs) were prioritized particularly for more research, as we currently do not have enough research or monitoring data on CECs to know whether each specific contaminant has a negative effect on aquatic organisms, or where they are found in the aquatic environment in Hawai‘i. It was also noted that metals should be prioritized for research, particularly with regard to fishes. Water quantity was highlighted as something that could be studied by measuring salinity, nutrients, and sediments.

In addition to gathering information on priority water quality parameters from partners and stakeholders involved in the MMWQWG, DAR convened researchers from the University of Hawai‘i, the Hawai‘i Institute of Marine Biology, UH Sea Grant, UH Water Resources Research Center, and The Nature Conservancy to discuss evidence available for effects of various water quality parameters on aquatic resources. Participants in this workshop identified the following parameters have strong evidence to suggest they have a negative effect on coral reef ecosystems and fisheries: **high levels of nitrogen, low pH, low salinity, high temperature, and high sediment loads**. These parameters will be used to frame questions about necessary actions to improve water quality for aquatic resources. For each parameter, we will ask whether we need to gather more information about the parameter in aquatic environments through monitoring, whether we need to learn more about the effects of the parameter on aquatic resources through research, or whether have enough monitoring and research data to know where the parameter is showing up most consistently, the effects it has on the environment, and how it can be remedied to support restoration projects. This conversation will be ongoing, as new information is revealed through research.



Figure 4. DAR staff leading a workshop at the University of Hawai‘i to determine which parameters we have sufficient evidence for having a negative effect on aquatic organisms.

PRIORITY PLACES (NĀ WAHI)

1137 “Huli ka lau o ka ‘ama‘u i uka, nui ka wai o kahawai.”

When the leaves of the ‘ama‘u turn to the upland, it is a sign of a flood.

- Mary Kawena Pukui, ‘Ōlelo No‘eau

Part of the difficulty of coordinating various agency and organization efforts is prioritizing which places to initiate projects in. To organize which areas, watersheds, and reefs were top priorities to the agencies and organizations involved in creating this Water Quality Strategy, we asked participants in the planning process the following questions:

- I. Which areas do you believe have some of the most pressing issues related to water quality?
- II. Where do you currently have projects or initiatives where you would like to see increased or additional water quality improvements?
- III. Where would you be interested in seeing projects to improve water quality where there currently are none?

Responses were compiled and prioritized into Table 4, along with the five “focal moku” identified in the ongoing Sea Grant Pili Nā Moku project (*see* Potential Projects *appendix*): Kona (Kaua‘i), Wai‘anae (O‘ahu), Kona (Moloka‘i), Pū‘ali Komohana (Maui), Kohala (Hawai‘i). Top priority areas, or those which two to four agencies or organizations identified as priorities, are listed in descending order from highest to lowest priority in the numbered lists per island below. Priority areas are color-coded based on what guiding question they were mentioned in response to: areas with pressing water quality issues, areas where ongoing projects exist but we still need to see improved water quality, and areas where there are currently few projects but we would like to see more. All other areas, which were mentioned only once by any single agency or organization, are listed in bullet points in no particular order below the numbered lists. Priority places listed in the table below will be utilized in guiding creation of potential project ideas for DAR along with partner organizations. This activity represents a semi-quantitative method to gather information on which water quality parameters are of high importance to DAR’s partners and stakeholders.

Table 4. Identified by DAR, DOH CWB, DOH SWPB, CWRM, MMWQWG, and the Pili Nā Moku Partnership with Hawai‘i Sea Grant, DLNR, and KUA.

PRIORITY AREAS BY ISLAND	
Kaua‘i	
<i>Top Priority Areas on Kaua‘i</i>	<i>Other Mentioned Areas on Kaua‘i</i>
1. Waimea 2. Kalapakī	• ‘Anini • Hanalei
O‘ahu	
<i>Top Priority Areas on O‘ahu</i>	<i>Other Mentioned Areas on O‘ahu</i>
1. Wai‘anae / Kaupuni 2. Hale‘iwa / Kaiaka 3. He‘eia / Kahalu‘u 4. Maunalua Bay 5. Pu‘uloa	• Pūpūkea / Waimea • Kahana Bay • Waiāhole • Waikāne • Māmala Bay • Ke‘ehi • Kāne‘ohe Bay • Hau‘ula
Moloka‘i	
<i>Top Priority Areas on Moloka‘i</i>	<i>Other Mentioned Areas on Moloka‘i</i>
1. South Moloka‘i / Moku ‘o Kona	• n/a
Maui	
<i>Top Priority Areas in Maui</i>	<i>Other Mentioned Areas in Maui</i>
1. Olowalu 2. Ukumehame 3. Central Maui / Keālia / Nā Wai ‘Ehā 4. Lahaina 5. North Kīhei	• Ka‘a Point • Kanahā Beach Park • West Maui • Makapipi to Ha‘ikū (East Maui)
Hawai‘i	
<i>Top Priority Areas on Hawai‘i</i>	<i>Other Mentioned Areas on Hawai‘i</i>
1. Kohala / Puakō / Waikoloa / Pelekane 2. Hilo Bay 3. Miloli‘i 4. Kahalu‘u / Keauhou	• Kona • Nāpo‘opo‘o • Hōnaunau • Kealakekua • Keaukaha

In addition to the above compilation of priority areas based on multiple stakeholders, two key DAR agency partners have lists of priority areas for their projects. The Department of Health has priority areas listed for Total Maximum Daily Load (TMDL) creation in their Integrated Report (the 303(d) list). Total Maximum Daily Loads are a calculation of the maximum amount of a certain pollutant that a water body can receive and still meet water quality standards. High priority water bodies on the 303(d) list are set for TMDL creation within the next two years. Water bodies listed as high priority in the latest DOH Integrated Report from 2024 are, in no particular order: Ka‘elepulu stream, Ka‘elepulu estuary, Ka‘elepulu nearshore, Kalihi stream, Kaupuni stream, Moanalua stream, Ke‘ehi lagoon, Ke‘ehi lagoon beach, and Pōka‘i Bay. It is interesting to note that in this latest report, all water bodies listed as high priority for creation of a TMDL are found on O‘ahu. This may be because priority is often given to watersheds with high numbers of NPDES permits, where TMDLs can be most effectively implemented.

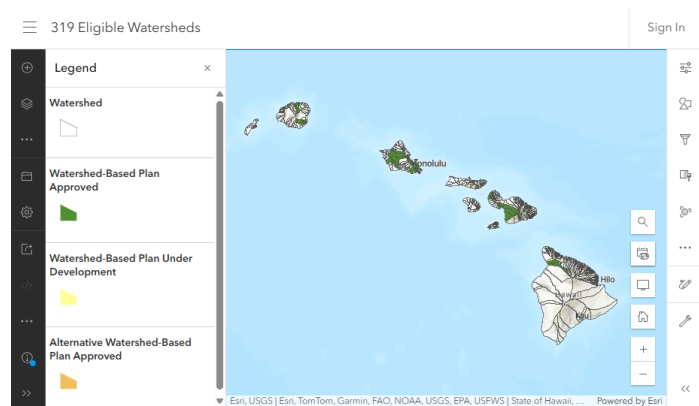


Figure 5. DOH 319 Priority Watersheds GIS layer.

The Department of Health also prioritizes watersheds through the 319 program. This program, established by the Clean Water Act and administered through the EPA, provides grants to manage nonpoint source pollution in priority watersheds. This program is administered in Hawai‘i through DOH’s Polluted Runoff Control Program. In order to qualify for 319 grants, watersheds must have a DOH-approved watershed-based

plan or alternative plan. As of now, watersheds with approved watershed or alternative plans under this program are, in no particular order: **Kaua‘i:** Hanalei Bay and Nāwiliwili Bay; **O‘ahu:** Ala Wai, Honouliuli, Kaiaka Bay, Kapakahi, Ko‘olaupoko, Mā‘ili‘ili, Waikele, and Wailupe; **Moloka‘i:** Kawela; **Maui:** West Maui, Southwest Maui, Mā‘alaea Bay, and Pāhākea; **Kaho‘olawe:** Hakioawa, Kaulana, and Kamōhio; **Hawai‘i:** Kawaihae and Waikoloa.

Additionally, the Division of Forestry and Wildlife prioritizes areas for uka restoration and fencing projects to control ungulates and mitigate erosion through the Hawai‘i Association of Watershed Partnerships (HAWP), pictured to the right.

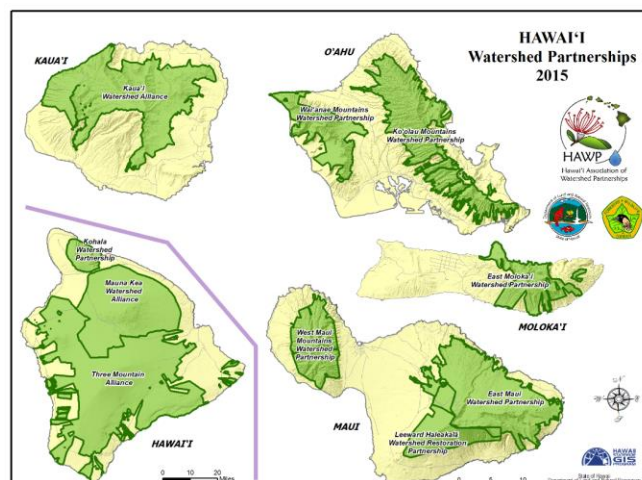


Figure 6. Map of watersheds included in the Hawai‘i Association of Watershed Partnerships.

LOOKING FORWARD (KA HOLOMUA)

1102 “Ho‘omoe wai kahi ke kāo‘o.”

Let all travel together like water flowing in one direction.

- Mary Kawena Pukui, ‘Ōlelo No‘eau

To support implementation of actions listed in this Water Quality Strategy, DAR has hired a Water Quality Coordinator position starting in January 2026. Additionally, DAR is internally organizing our watershed-based staff and projects into a Watershed Program as part of the Mitigation, Aquaculture, Restoration and Resilience (MARR) Program. This organized Watershed Program will create more focus and capacity in each district office to conduct on-the-ground restoration work, coordinate between agencies and organizations, and collect water quality data. The purpose of organizing this program is to shift DAR’s focus to include more management of freshwater ecosystems that historically have not gotten as much attention in the division as our marine ecosystems.

This Water Quality Strategy has identified key water quality-related issues in Hawai‘i and proposed specific, measurable solutions as well as potential projects. These potential projects, found in the appendices, focus on management, restoration, monitoring, and research. Restoration efforts will aim to partner with community organizations to improve wetland and estuary health. Monitoring will address gaps in data collection by collaborating with existing organizations in Hawai‘i collecting water quality data. Research projects will target management-relevant questions with local universities and nonprofits. Since DAR is unable to regulate water quality directly, management efforts will rely on building partnerships, particularly with the Department of Health (DOH), to enhance the connection between water quality and aquatic resource health and promote best management practices to improve aquatic ecosystem health.

The outcome of the first year of the Water Quality Coordinator position is to use the completed Water Quality Strategy to evaluate DAR’s present capacity and needs while beginning to implement projects that will improve water quality for nearshore resources. In year two, the Water Quality Coordinator is expected to have implemented at least one pilot project in each of the four categories of potential projects (management, restoration, monitoring, and research) through partnerships and/or increased internal capacity. The Coordinator will also be expected to maintain and facilitate collaborative discussions that began with the creation of this strategy.

APPENDICES (NĀ KĀKO'O)

2903 “Wai ‘apu lau kī.”

Water in a ti-leaf cup.

- Mary Kawena Pukui, ‘Ōlelo No‘eau

- I. Purpose and Supporting Plans
- II. Potential Projects
- III. Map of Current Water Quality Monitoring Sites
- IV. Water Quality Laws and Regulations
- V. Literature Cited

APPENDIX I:

PURPOSE AND SUPPORTING PLANS

The purpose of the Division of Aquatic Resources' Nearshore Water Quality Strategy is to guide DAR in incorporating water quality and quantity information into our management of nearshore resources, as well as collaborating with partners to complete projects that improve water quality for nearshore ecosystems.

This plan came about through requests from various stakeholders, particularly subsistence fishers and local commercial fishers, who were interested in seeing DAR more actively investigate and address the role that water quality plays in the health of nearshore fisheries and reefs in Hawai'i. This has been a long-standing conversation, but the catalyst came from a fisher in 2022 who encouraged DAR to convene with other state agencies and organizations managing water quality. After that initial meeting, DAR designated the National Coral Reef Management Fellow for 2024-2025 to focus on identifying how DAR can support work to improve water quality in Hawai'i. Development of this Water Quality Strategy subsequently began in January 2024.

In addition to addressing concerns from fishers and other stakeholders, this Water Quality Strategy addresses multiple objectives in other state and national plans and projects. These are outlined below, along with the priorities and objectives in each plan or project that are addressed within this Water Quality Strategy. These various plans, strategies, and community concerns provide justification and purpose behind this Water Quality Strategy.

DAR: Hawai'i Coral Reef Strategy 2030

The Water Quality Strategy addresses objectives within the Hawai'i Coral Reef Strategy (HCRS) 2030, which was developed by DAR in 2020.

HCRS 2030 Priorities Addressed:

- Mauka Intervention Pillar
 - Objective 1: Develop the foundations of a Watershed Restoration Program within DAR to support water quality management from ridge to reef
 - Objective 2: Strengthen and expand existing water quality restoration in West Maui and South Kohala

NOAA CRCP: National Coral Reef Resilience Strategy

The Water Quality Strategy addresses priorities of the National Coral Reef Resilience Strategy, which is currently under review by NOAA's Coral Reef Conservation Program and will be released by the end of 2026.

National Coral Reef Resilience Strategy (IN DRAFT) Priorities Addressed:

- Pollution Pillar
 - Strategy L1: Develop, coordinate, and implement watershed management plans
 - Strategy L2: Build and sustain watershed management capacity at the local level

DAR: Maui Management Plan

The Water Quality Strategy addresses community concerns that came up during the initial Holomua Marine Initiative process on Maui. Water quality was mentioned consistently as a pressing issue from the Holomua Navigation Team, outlining the necessity of supporting restoration efforts ma uka to improve water quality as well as incorporating water quality into regular monitoring.

Maui Management Plan (IN DRAFT) Priorities Addressed:

Restoration Pillar

- Goal: Work to lessen environmental and human impacts mai uka a i kai that affect the nearshore ecosystems
- Objectives:
 - Collaborate with partners to improve water quality and support efforts to minimize volume of effluent from injection wells by expanding the use of nature-based solutions and distributing the R-1 water across the land through greenways, green infrastructure and fire breaks
 - Collaborate with DOFAW and other partners to support and expand ungulate fencing, especially in lower elevations and in areas uka of active coral restoration projects
 - Collaborate with communities and CWRM to conduct ecological monitoring of streams and estuaries, before, during and after freshwater stream restoration actions to better understand and highlight the benefits of returning freshwater to the nearshore

Monitoring Pillar

- Goal: Develop a Maui monitoring plan that evaluates the effectiveness of implemented management measures and builds on existing monitoring to ensure that methods and data analyses are aligned both spatially and in scope with the management measures
 - Objective: Incorporate water quality and stream flow monitoring into the nearshore monitoring plan to better understand the impacts of water quality and quantity on the health of corals and nearshore fish

DAR: Reef Habitat Plan

The Water Quality Strategy addresses community concerns raised in a survey sent out to fishers statewide in Fall 2024 for the Reef Habitat Plan. Survey responses noted that fixes to freshwater

runoff was one of the primary actions DAR could take to improve fish habitat (67.4% of 1,094 respondents voted that this would be a highly effective management action.) After the survey was closed, DAR held a series of meetings with fishers to review and discuss in more detail the results of the survey. Based on these meetings, the following ideas for how to address water quality were outlined.

Reef Habitat Plan Ideas:

- Monitoring & Testing
 - Support community-led water quality testing efforts, particularly in areas with known issues, and track spatial extent of impact
 - Prioritize water sampling near high-risk areas, such as agricultural zones/chemical runoff areas, stream mouths and freshwater springs, and other drainage outlets
- Jurisdiction, Accountability & Coordination
 - Bridge gaps and clarify jurisdictional responsibilities around freshwater quality and quantity
 - Collaborate with County and DOH to ensure accountability and enforcement around permitting and land-based pollution
 - Identify landowners responsible for erosion hotspots and promote cooperative land management with CWRM, DOFAW and community organizations
- Watershed Protection & Restoration
 - Support uka-to-kai restoration projects, including but not limited to reforestation, wetland protection, sediment control
 - Incorporate traditional ecological knowledge and community kilo in identifying degraded or vulnerable watersheds

DAR: Strategic Plan

Lastly, water quality is addressed in the Ecosystems Branch planning for DAR's recent internal Strategic Planning process, which will be completed in 2025.

DAR Strategic Plan (IN DRAFT) Priorities Addressed:

- Ecosystems Branch
 - Objective 1: Increase water quality and quantity monitoring for aquatic resources through partnerships and agency collaborations

For a complete list of plans, strategies, and resources relating to water quality in the state of Hawai'i, please contact DAR's Water Quality Coordinator at ellen.s.jones.nss@hawaii.edu.

APPENDIX II:

POTENTIAL PROJECTS

This appendix provides a list of project ideas and plans that have been discussed within DAR during the development of this Water Quality Strategy to address identified water quality needs. A corresponding spreadsheet for this section is held internally in the Division of Aquatic Resources SharePoint. This spreadsheet is intended to be a living version of this section where projects can be planned, tracked, and updated as necessary. Progress on these projects will be reported on a quarterly basis on the DAR public website beginning in Spring 2026 for transparent communication of ongoing work to improve water quality for aquatic resources.

Following are a list of potential projects as of December 2025, at the time of this plan's completion. Projects are split into the following four categories: management, restoration, monitoring, and research. All projects listed are identified as being ongoing or in a planning or idea phase as of the completion of this strategy. Projects in the planning phase are currently being socialized and funding is being pursued. Projects in the idea phase have been discussed but not yet pursued further. This list is meant to serve as a guide for DAR of projects within DAR's kuleana or in partnership with agency partners that can work towards the ultimate goal of improving water quality for aquatic resources.

Management

Project: Map of Water Quality Organizations in Hawai'i

Project Leads: Division of Aquatic Resources

Status: Funded, ongoing project

Details: As part of the efforts to develop a Water Quality Strategy for DAR, a need was identified for better statewide collaboration of water quality improvements for aquatic resources. A project began in 2024 to survey organizations working to improve and individuals interested in water quality to create a social network map of these groups and use it to identify key gaps and opportunities to improve water quality for aquatic resources. This project will likely be completed in early 2026.

Project: Kahawai Watch

Project Leads: Division of Aquatic Resources, Commission on Water Resource Management

Status: Unfunded, project in planning phase

Details: This project is modeled off the successful Makai Watch program, which enables community members to learn marine management regulations and be able to report them to DLNR's Division of Conservation and Resources Enforcement (DOCARE.) Through this

project, DAR plans to involve landowners from the community in a program to monitor changes to streams running through their properties.

Project: Statewide Watershed Monitoring Plan

Project Leads: Department of Health (Clean Water Branch)

Status: Funded, ongoing project

Details: DAR is providing support to the DOH CWB project to write a new statewide watershed monitoring plan. This plan will support DOH efforts to monitor water quality in streams as well as on the coasts, and will incorporate narrative biological criteria that DAR will help set.

Project: Structured Decision Making

Project Leads: Division of Aquatic Resources

Status: Funded, ongoing project

Details: DAR is funding a graduate student in the University of Hawai'i Natural Resources and Environmental Management (NREM) program to develop a structured decision-making framework to investigate connectivity between estuarine and marine ecosystems.

Project: Environmental Review and Project Comment Guidance

Project Leads: Division of Aquatic Resources

Status: Unfunded, project in idea phase

Details: DAR biologists regularly review permit applications and project plans that may affect water quality and aquatic species, but lacks a standardized approach. Furthermore, each biologist may have their own specific expertise or specialized knowledge. A more collaborative approach and ability for multiple biologists to review an application or project would be beneficial and better standardize the review process. Integration with water quality data access or tools and/or a checklist and other reference tools would greatly support consistency and scientific defensibility. Could develop an internal review guide for DAR staff to use across projects.

Project: Fish Kill Response Protocol

Project Leads: Division of Aquatic Resources

Status: Partially funded, project in planning phase

Details: DAR sometimes responds to reports of fish mortality events. There is a need to have clear procedures, field tools and water quality measuring devices, agency coordination for rapid response. This would support real-time data collection and improve our ability to identify causes and recommend solutions. Integration with DOH for fish tissue analysis or water sample analysis for testing and development of a rapid response kit and reporting template or protocol in partnership with DOH or other agencies are needed.

Restoration

Project: Pili Nā Moku

Project Leads: University of Hawai‘i Sea Grant, Kua‘āina Ulu ‘Auamo, Department of Land and Natural Resources

Status: Funded, ongoing project

Details: Restoration projects will be completed by DAR’s partners in the grant, including the Division of Forestry and Wildlife and community groups working with KUA. DAR is a part of this grant to detect changes in water quality based on land-based restoration efforts such as wetland restoration, fencing to control ungulate populations, and planting native plants to reduce erosion.

Monitoring

Project: Decision Tool for Monitoring Parameters

Project Leads: Division of Aquatic Resources, University of Hawai‘i

Status: Funded, ongoing project

Details: As part of the efforts to develop a Water Quality Strategy for DAR, a need was identified for expert input on water quality parameter prioritization. A project was started in 2025 to gather researchers who focus on water quality as it is related to aquatic resources in Hawai‘i and gather their thoughts on which parameters are most important to focus monitoring efforts on through an expert elicitation process. Using the information gathered from these conversations, DAR will develop a decision support tool to guide monitoring priorities, which will likely be completed in 2026.

Project: Community Water Quality Monitoring Toolkit

Project Leads: Division of Aquatic Resources

Status: Funded, project in planning phase

Details: As part of the efforts to develop a Water Quality Strategy for DAR, a need was identified by DAR’s Community Based Subsistence Fishing Area liaison and Kōkua Community Based Monitoring coordinator for DAR to develop a toolkit for communities interested in monitoring water quality. DAR will develop this toolkit alongside methods for DAR districts to collect water quality data, and will ensure that all methodologies align with DOH and EPA-approved methods. DAR is also investigating the possibility of aligning this community water quality monitoring toolkit with DOH quality assurance requirements to lower the barrier to communities interested in investigating water quality for their place.

Project: Water quality monitoring at CRAMP sites

Project Leads: Division of Aquatic Resources, Department of Health

Status: Unfunded, project in idea phase

Details: DAR plans to integrate water quality monitoring at long-term reef habitat monitoring sites that DAR has recently inherited from the Coral Reef Ecology Lab at HIMB. These sites, part of the Hawai'i Coral Reef Assessment and Monitoring Program (CRAMP,) were passed to DAR after the principal investigator of the lab, Ku'ulei Rogers, retired. These sites have a long-term dataset that already exists and adding water quality measurements to these sites would allow DAR to determine how reef health is influenced by various water quality parameters.

Project: Invasive Species Information

Project Leads: Division of Aquatic Resources

Status: Unfunded, project in idea phase

Details: DAR's Aquatic Invasive Species team has a need for more information on water quality in an area with potential eutrophication (*Sarcothelia* sp., *Eucheuma* sp., Majano anemone, *Avrainvillia* sp., and *Lyngbia* sp. have been showing up and covering coral in the past two years.) There is a specific interest in examining nutrient concentrations for water.

Project: Indicator Species

Project Leads: Division of Aquatic Resources, Department of Health, Commission on Water Resources Management

Status: Funded, project in planning phase

Details: DAR staff have been asked recently to provide expertise on indicator species relating to water quantity (CWRM) and water quality (DOH) for various state projects. To provide consistent advice on how to holistically monitor the effect of changes in water quality and quantity on aquatic resources, DAR is planning to organize an internal meeting to discuss the utility of indicator species.

Research

Project: Thresholds for sedimentation effects on fishes

Project Leads: Division of Aquatic Resources

Status: Unfunded, project in idea phase

Details: DAR will provide information to researchers on priority fish species to study to determine how sedimentation and turbidity impact nearshore herbivorous fish populations. This information will subsequently be shared with DOH to show how water quality is affecting fish assemblages on nearshore reefs.

Project: Water quality in MMAs

Project Leads: Division of Aquatic Resources

Status: Unfunded, project in idea phase

Details: DAR will support nutrient testing in Marine Managed Areas (MMAs) around the state to determine the quality of the water for the health of reef and fish communities. Additionally,

many MMAs are areas that see high levels of tourism, so testing of water quality will inform better management of human use of these unique areas.

Project: Aquatic Biota and Habitat Sensitivity

Project Leads: Division of Aquatic Resources

Status: Unfunded, project in idea phase

Details: Fills a gap by linking water quality/quantity impairments to specific effects on native aquatic species. Could determine thresholds or range tolerances for sensitive native species. Species sensitivities could help justify and prioritize future restoration and compliance actions, and strengthen internal and external communications. Develop summary of native aquatic species specific sensitivities and integrate or share with DOH or other regulatory agencies.

Project: Restoration (Mangrove) Water Quality Study

Project Leads: Division of Aquatic Resources

Status: Unfunded, project in idea phase

Details: Baseline, removal, and post-removal water quality monitoring to understand impact of wetland restoration activity increasingly popular in state wetlands. It is important to understand what kind of mitigation may be necessary for maximizing ecological benefits in wetlands uka of kai habitats.

Project: Contaminants of Emerging Concern baseline study

Project Leads: TBD

Status: Unfunded, project in idea phase

Details: In order to determine which CECs to prioritize for monitoring, the state of Hawai'i needs a pilot contaminant study to gather baseline data for detection and probability of impact. A case study for a similar action taken in California by the San Francisco Estuarine Institute (SFEI) is detailed in the UH Sea Grant CECs Needs Assessment, which will be completed in 2026. Such a study will require project-specific funding as well as a position to coordinate the study, so DAR will work together with UH Sea Grant and potentially DOH to procure funding and determine who would be best to coordinate this study.

APPENDIX III:

MAP OF CURRENT WATER QUALITY MONITORING SITES

As part of the development of this Water Quality Strategy, a need was identified for better understanding of where water quality data is currently being collected around Hawai‘i, which organizations are collecting it, and where it can be accessed. In response, DAR worked with the Pacific Integrated Ocean Observation System (PacIOOS) at the University of Hawai‘i (UH) along with UH Sea Grant and Wastewater Alternatives and Innovations (WAI) to develop an interactive map on ArcGIS Experiences that showcases current monitoring program sites. This interactive map is free and open and can be accessed at the following link: [DAR Water Quality Monitoring for Nearshore Resources](#). The map includes monitoring sites from the Department of Health, the Surfrider Foundation Blue Water Task Force, Hui O Ka Wai Ola on Maui, Hawai‘i Wai Ola on Hawai‘i, PacIOOS, University of Hawai‘i, Wastewater Alternatives and Innovations, and the National Oceanic and Atmospheric Administration. It also includes layers such as coral and fish surveys, cesspool locations, streams, Marine Managed Areas (MMAs,) and more.

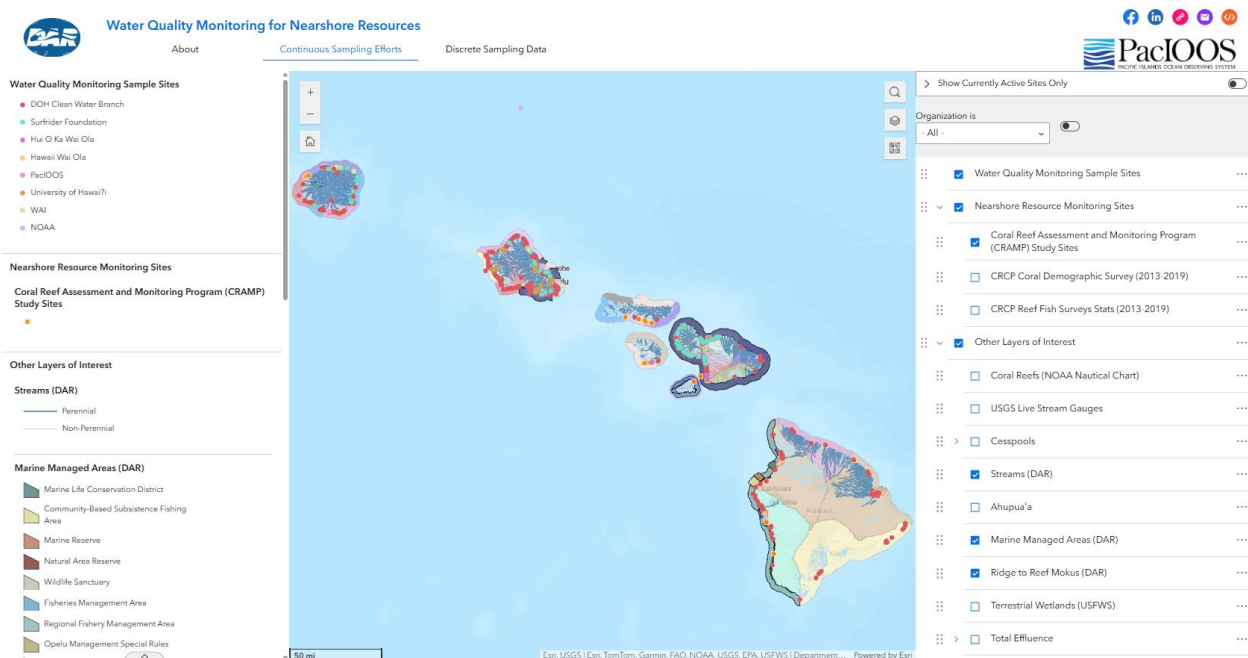


Figure 7. Static image of the interactive GIS map of current water quality monitoring sites around the Main Hawaiian Islands created in partnership with DAR, PacIOOS, UH Sea Grant, and WAI.

APPENDIX IV:

WATER QUALITY LAWS AND REGULATIONS

This appendix is intended to be a companion to the *Agency Jurisdictions* and *Key Issues and Potential Solutions* sections where agency jurisdictions and roles are discussed. The following summary of federal, state, and local laws can be referenced when discussing water quality governance relating to aquatic resources.

Federal Framework

Clean Water Act (CWA) 33 U.S.C. §1251 et seq.

- Primary federal law governing surface water quality in the United States
- Key CWA programs delegated to the Hawai‘i Department of Health (DOH):
 - **Section 303** — Water Quality Standards: States must adopt and enforce water quality standards (implemented in Hawai‘i via HAR 11-54)
 - **Section 402** — National Pollutant Discharge Elimination System (NPDES): Requires permits for point-source discharges (implemented in Hawai‘i via HAR 11-55)
 - **Section 401** — Water Quality Certification: States certify federally permitted activities will comply with water quality standards (Implemented in Hawai‘i via HAR 11-53)
 - **Section 319** — Nonpoint Source Pollution: States develop programs to reduce pollution from runoff and diffuse sources (Implemented in Hawai‘i via HAR 11-56)
- EPA retains oversight authority, and can review/approve permits and state programs. Can also enforce the CWA directly if state enforcement is inadequate

Constitutional Foundation

Hawai‘i Constitution, Article XI, Section 7

- Declares that natural resources are held in trust for the people and requires the State to conserve, protect, and regulate water resources

Hawai‘i Revised Statutes (HRS)

HRS Chapter 342D — Water Pollution

- Prohibits unpermitted discharges into state waters
- Establishes DOH authority over water pollution control and permitting
- Includes penalties, variances, and enforcement
- Contains the statewide cesspool conversion mandate: All cesspools must be upgraded or connected to sewer by 2050 (HRS 342D-72)

HRS Chapter 340E — Safe Drinking Water

- Implements the federal Safe Drinking Water Act

- Establishes state drinking water standards
- Requires monitoring, reporting, and notification of contamination

HRS Chapter 205A — Coastal Zone Management (CZM) Act

- Protects coastal and marine water quality
- Requires county Special Management Area (SMA) permits for development near the shoreline that must ensure compliance with water quality standards

Hawai‘i Administrative Rules (HAR) - Administered by DOH

HAR 11-54 — Water Quality Standards

- Designated uses for all waters (e.g., recreation, aquatic life, drinking water supply)
- Narrative and numeric criteria
- Antidegradation policy to protect existing water quality

HAR 11-55 — Water Pollution Control (NPDES)

- Implements Hawai‘i’s NPDES permitting program
- Applies to point-source discharges, including industrial and municipal stormwater, construction runoff, and wastewater discharges

HAR 11-53 — Water Quality Certifications

- Procedures for Section 401 certifications
- Required for activities needing federal permits (e.g., dredge and fill under CWA Section 404)

HAR 11-56 — Nonpoint Source Pollution Control

- Establishes Hawai‘i’s nonpoint source pollution program
- Provides a framework for best management practices and watershed management plans

HAR 11-20 — Public Water Systems

- Implements drinking water standards for public systems
- Includes monitoring, treatment, and public notification requirements

HAR 11-23 — Underground Injection Control (UIC)

- Protects underground sources of drinking water from injection wells
- Regulates siting, construction, and operation of wells

HAR 11-62 — Wastewater Systems

- Standards for septic systems, wastewater treatment plants, and reuse systems
- Central to cesspool conversion and wastewater permitting

Implementation and Enforcement

- **DOH Clean Water Branch (CWB):** Oversees surface water quality, NPDES permits, 401 certifications, and nonpoint source programs
- **DOH Safe Drinking Water Branch (SDWB):** Oversees drinking water protection, UIC permits, and groundwater quality
- **Counties:** Implement SMA permits under the Coastal Zone Management program, often adding water-quality protective conditions
- **EPA:** Maintains oversight of Clean Water Act implementation, retains direct enforcement authority
- **Hawai‘i Environmental Court:** Handles water quality, drinking water, and pollution cases arising under state law

APPENDIX V:

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