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DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
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STAFF SUBMITTAL

COMMISSION ON WATER RESOURCE MANAGEMENT

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Honolulu, Hawai‘i

Reservation of Non-potable Water for the Department of Hawaiian Home Lands From East Maui Streams in the Nāhiku, Ke‘anae and Honomanū Regions and Amend Interim Instream Flow Standards For the Surface Water Hydrologic Units of Waikamoi (6047), Honomanū (6051), Nua‘ailua (6052), West Wailuaiki (6057), Waiohue (6060), East Maui

SUMMARY OF REQUEST

Staff is requesting that the Commission on Water Resource Management (Commission) consider approving the request for a surface water reservation of 15.24 cubic feet per second (cfs) (9.85 million gallons per day, mgd) for the Department of Hawaiian Home Lands (DHHL) to meet their foreseeable future non-potable water needs in areas of Central Maui serviced by the East Maui Irrigation System from streams in the Nahiki, Ke‘anae and Honomanū region; and amend the interim instream flow standards (interim IFS) for streams contained within the following surface water hydrologic units in the region of East Maui (See Figure 1).

WAIKAMOI (6047): Waikamoi Stream
HONOMANŪ (6051): Honomanū Stream
NUA‘AILUA (6052): Nua‘ailua Stream
WEST WAILUAIKI (6057): West Wailuaiki Stream
WAIOHUE (6060): Waiohue Stream

LOCATION MAP: See Figure 1

LEGAL AUTHORITY

The State Water Code provides for reservations of water in both designated and non-designated water management areas. In designated areas, water reservations may be made pursuant to §174C-49(d), Hawaii Revised Statutes (HRS), which states:

> *The commission, by rule, may reserve water in such locations and quantities and for such seasons of the year as in its judgment may be necessary. Such reservations shall be subject to periodic review and revision in the light of changed conditions; provided that all presently existing legal uses of water shall be protected.*

Hawaii Administrative Rules (HAR) Subchapter 6 (Reservation of Water) includes §13-171-60 (Reservations of water) that provides further guidance for water reservations in water management areas:

> *(a) As provided in HRS §174C-49(d), the commission, by rule, may reserve water in such locations and quantities and for such seasons of the year as in its judgment may be necessary.*
>
> *(b) The commission shall adopt within this subchapter specific reservations of water in water management areas in such quantities as are deemed necessary for purposes which are consistent with the public interest, including the provision of water for current and foreseeable development and use of Hawaiian home lands pursuant to section 221 of the Hawaiian Homes Commission Act and HRS §174C-101(a).*
>
> *(c) Proceedings for the establishment of a reservation of water resources within a designated water management area by the commission may be initiated:*
> *(1) Upon recommendation by the chairperson; or*
> *(2) Upon written petition to the commission by any interested person with proper standing.*
>
> *(d) Reserved water shall not be allocated from water management areas by the commission except upon application for a water use permit by the party, or parties, for whom the water was reserved.*
>
> *(e) All reservations shall be subject to periodic review and revision in light of changed conditions.*

HRS §174C-101(a) also authorizes water reservations for DHHL, whether or not the area has been designated a water management area:

> *Decisions of the commission on water resource management relating to the planning for, regulation, management, and conservation of water resources in the State shall, to the extent applicable and consistent with other legal requirements and authority, incorporate and protect adequate reserves of water for current and foreseeable development and use*

> *of Hawaiian home lands as set forth in section 221 of the Hawaiian Homes Commission Act.*

In non-water management areas, the reservation of surface water for DHHL should be coordinated with the establishment of interim IFS.

The Code provides that the Commission may adopt interim IFS on a stream-by-stream basis or a general IFS applicable to all streams within a specified area. In the 2000 appellate ruling on the first Waiāhole Ditch Contested Case Hearing Decision and Order ("*Waiāhole* I"), the Hawai‘i Supreme Court emphasized that "instream flow standards serve as the primary mechanism by which the Commission is to discharge its duty to protect and promote the entire range of public trust purposes dependent upon instream flows." 94 Haw. 97, 148, 9 P.3d 409, 460. This submittal is proposing to address interim IFS on five streams in East Maui.

The initial interim IFS for the streams being considered were established by way of Hawai‘i Administrative Rules (HAR) §13-169-48, which, in pertinent part, reads as follows:

> Interim instream flow standard for East Maui. The Interim Instream Flow Standard for all streams on East Maui, as adopted by the commission on water resource management on June 15, 1988, shall be that amount of water flowing in each stream on the effective date of this standard, and as that flow may naturally vary throughout the year and from year to year without further amounts of water being diverted offstream through new or expanded diversions, and under the stream conditions existing on the effective date of the standard…

The effective date was October 8, 1988, and in effect, grandfathered all then-existing diversions that were registered with the Commission by May 31, 1989. Following the initial registration of stream diversion works, any new or substantially modified stream diversion works required a permit for construction as well as an amendment to the interim IFS.

From 1988 to 2010, the status quo interim IFS was in effect.

The current interim IFS for the streams being considered were established June 20, 2018 by the final Decision and Order (2018 Decision & Order) following a contested case hearing from 2010-2017 (CCH-MA13-01).

The Code defines an instream flow standard as a "quantity or flow of water or depth of water which is required to be present at a specific location in a stream system at certain specified times of the year to protect fishery, wildlife, recreational, aesthetic, scenic, and other beneficial instream uses." *See* HRS § 174C-3 ("Definitions").

"Instream use" means beneficial uses of stream water for significant purposes which are located in the stream and which are achieved by leaving the water in the stream. Instream uses include, but are not limited to:

1) Maintenance of fish and wildlife habitats;
2) Outdoor recreational activities;

3) Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation;
4) Aesthetic values such as waterfalls and scenic waterways;
5) Navigation;
6) Instream hydropower generation;
7) Maintenance of water quality;
8) The conveyance of irrigation and domestic water supplies to downstream points of diversion; and
9) The protection of traditional and customary Hawaiian rights.

In considering a petition to amend an interim instream flow standard, the Code directs the Commission to "weigh the importance of the present or potential instream values with the importance of the present or potential uses of water for noninstream purposes, including the economic impact of restricting such uses." HRS § 174C-71(2)(D).

"Noninstream use" means the use of stream water that is diverted or removed from its stream channel and includes the use of stream water outside of the channel for domestic, agricultural, and industrial purposes.

Since the establishment of the Stream Protection and Management Branch in July 2002, the Commission has developed a framework for setting measurable instream flow standards statewide. This framework involves an assessment of natural flow conditions for the current climate period, an analysis of the instream uses protected by the State Water Code, the existing and planned uses of water, and the availability of water from multiple sources. The analysis for establishing interim IFS incorporates a balancing of the public trust uses with reasonable and beneficial uses. In some streams, reductions in downstream flow may affect the availability of surface water for other non-instream riparian uses, instream recreational uses, and aesthetic values. Reductions in streamflow have also limited the availability of habitat for native aquatic biota including amphidromous species and the protection of habitat for endemic damselflies, some of which are threatened or endangered. In *McBryde Sugar Co v. Robinson*, the Hawai'i Supreme Court identified riparian rights as "the right to use water flowing without prejudicing the riparian rights of others and the right to the natural flow of the stream without substantial diminution in the shape and size given it by nature". 54 Haw. at 198, 504 P.2d at 1344. 54 Haw. 174, 504 P.2d 1330. Further, the Hawai'i Supreme Court affirmed the unity of the hydrological cycle such that surface and groundwater represent an integrated source of water, and "where surface and groundwater can be demonstrated to be interrelated as parts of a single system, established surface water rights may be protected against diversions that injure those rights whether the diversion is of surface water or groundwater." *Reppun v. Board of Water Supply,* 65 Haw. at 531, 656 P.2d 57 at 79.

The public trust is a state constitutional doctrine which "continues to inform the Code's interpretation, define its permissible 'outer limits,' and justify its existence…(T)he Code does not supplant the protections of the public trust doctrine." *Waiāhole I*, 94 Hawai'i at 133, 9 P.3d at 445. The State Supreme Court has described "the public trust relating to water resources as the authority and duty 'to maintain the purity and flow of our waters for future generations and to assure that the waters of our land are put to reasonable and beneficial uses (*emphases in original)*." *Waiāhole I,* 94 Hawai'i at 138, 9 P.3d at 450. "'Reasonable-beneficial use' means the

use of water in such a quantity as is necessary for economic and efficient utilization, for a purpose, and in a manner which is both reasonable and consistent with the state and county land use plans and the public interest." HRS § 174C-3.

The Hawai`i Constitution requires the Commission both to protect natural resources and to promote their use and development. "The state water resources trust thus embodies a dual mandate of 1) protection and 2) maximum reasonable and beneficial use." *Waiāhole I*, 94 Hawai'i at 139, 9 P.3d at 451. The purposes or protected uses of the water resources trust are: 1) maintenance of waters in their natural state, 2) domestic water use of the general public, in particular, protecting an adequate supply of drinking water, 3) the use of water in the exercise of Native Hawaiian traditional and customary rights, and 4) the reservation of water enumerated by the State Water Code. *Waiāhole I*, 94 Hawai'i at 136-37, 9 P.3d at 448-58; *In re Wai'ola o Moloka'i, Inc.* ("*Wai'ola*"), 103 Hawai'i 401, 431, 83 P.3d 664, 694 (2004).

"In this jurisdiction, the water resources trust also encompasses a duty to promote the reasonable and beneficial use of water resources in order to maximize their social and economic benefits to the people of the state…(We) have indicated a preference for accommodating both instream and offstream uses where feasible..(and) reason and necessity dictate that the public trust may have to accommodate offstream diversions inconsistent with the mandate of protection, to the unavoidable impairment of public instream uses and values." *Waiāhole I*, 94 Hawai'i at 139, 141-42, 9 P.3d at 451, 453-54.

There are no absolute priorities under the Public Trust Doctrine. "Given the diverse and not necessarily complementary range of water uses, even among public trust uses alone, (the Court) consider(s) it neither feasible nor prudent to designate absolute priorities between broad categories of uses under the water resources trust. There are no absolute priorities between uses under the water resources trust…(and) the Commission inevitably must weigh competing public and private water uses on a case-by-case basis, according to any appropriate standards provided by law (emphasis added)." *Waiāhole I*, 94 Hawai'i at 142, 9 P.3d at 454. The public trust creates an affirmative duty of the Commission "to take the public trust into account in the planning and allocation of water resources, and to protect public trust uses whenever feasible[1] (emphasis added)." *Waiāhole I*, 94 Hawai'i at 141, 9 P.3d at 453.

The water code does not place a burden of proof on any particular party; instead, the water code and case law interpreting the code have affirmed the Commission's duty to establish interim IFS that 'protect instream values to the extent practicable' and 'protect the public interest.' *In re 'Īao Ground Water Management Area High-Level Surface Water Use Permit Applications and Petition to Amend Interim Instream Flow Standards of Waihe'e River and Waiehu, 'Īao, and Waikapu Streams Contested Case Hearing* ("*Nā Wai `Ehā*"), 128 Hawai'i 228, 258, 287 P.3d 129, 159 (2012)), *citing In re Water Use Permit Applications* ("*Waiāhole II*"), 105 Hawai'i 1, 11, 93 P.3d 643, 653 ((2004)); and HRS §174C-71((2))((A)). In setting an interim IFS, the Commission "need only reasonably estimate instream and offstream demands." *Nā Wai 'Ehā*", 128 Hawai'i at 258, 287 P.3d at 159 (2012)); "*Waiāhole I*", 94 Hawai'i at 155 n. 60, 9 P.3d at

[1] The Court refers to the term "feasible" as a balancing of benefits and costs and not to mean "capable of achievement." (*Waiāhole I*, 94 Hawai'i, at 141 n. 39; 9 P.3d, at 453 n. 39.)

467 n. 60. "In requiring the Commission to establish instream flow standards at an early planning stage, the Code contemplates the designation of the standards based not only on scientifically proven facts, but also on future predictions, generalized assumptions, and policy judgments." *Waiāhole I*, 94 Hawai‘i at 155, 9 P.3d at 467.

Further, Article 12, §7 of the Hawai`i Constitution states that: “The State reaffirms and shall protect all rights, customarily and traditionally exercised for subsistence, cultural and religious purposes and possessed by ahupua`a tenants who are descendants of native Hawaiians who inhabited the Hawaiian Islands prior to 1778, subject to the right of the State to regulate such rights.”

Where scientific evidence is preliminary and not yet conclusive regarding the management of fresh water resources, it is prudent to adopt the "precautionary principles" in protecting the resource[2]. That is, where there are present or potential threats of serious damage, lack of full scientific certainty should not be a basis for postponing effective measures to prevent environmental degradation…In addition, where uncertainty exists, a trustee's duty to protect the resource mitigates in favor of choosing presumptions that also protect the resource.[3] The "precautionary principle" appears in diverse forms throughout the field of environmental law… The Hawai‘i Supreme Court confirmed that the principle, in its quintessential form, states: at minimum, the absence of firm scientific proof should not tie the Commission's hands in adopting reasonable measures designed to further the public interest. "*Waiāhole I*", 94 Hawai‘i at 155 n. 60 p.13.

Based upon the best available information presented in each of the Instream Flow Stream Assessment Reports (IFSAR) (Exhibit 8), staff have developed a recommendation that seeks to balance public trust uses and the reasonable and beneficial needs of non-public trust uses. This process is challenging due to the unique nature of each stream, the various instream and noninstream uses of water, and the logistical challenges of instituting an interim IFS. Whether attempting to compare stream characteristics across multiple hydrologic units or within one unit, no single principal or equation determines the rate of flow restoration. However, the principals established by the State Constitution, the laws dictating the Hawai‘i State Water Code (HRS chapter 174C), and the statutes which are used to implement these laws (HRS) are applied equally.

EXISTING DHHL WATER RESERVATIONS

Thus far, the Commission has established a total of 29 potable and non-potable water reservations, all for DHHL, in both water management areas and non-designated water management areas. Table 1 shows the previous water reservations made by administrative rule in water management areas, pursuant to HRS §174C-49(d) or by Commission action prior to the publication of the State Water Projects Plan 2017 Update.

[2] Commission on Water Resource Management. 1997. In the Matter of Water Use Permit Applications, Petitions for Interim Instream Flow Standard Amendments, and Petitions for Water Reservations for the Waiāhole Ditch Combined Contested Case Hearing. Final Decision & Order. CCH-OA-95-01.
[3] Ibid.

Table 1. DHHL Water Reservations prior to the State Water Projects Plan 2017 Update.
[WMA = Water Management Area]

Approval Process	Island	Location	Effective Date	Reservation (mgd)
§13-171-61	Oʻahu	Waipahu-Waiawa WMA	02/18/1994	1.724
§13-171-62	Oʻahu	Waimānalo WMA	02/18/1994	0.124
§13-171-63	Molokaʻi	Kualapuʻu WMA	06/10/1995	2.905*
CWRM Action	Hawaiʻi	Keauhou Aquifer	08/17/2015	3.398

* Per HAR §13-171-63, this amount shall be in excess of the existing uses of water on Hawaiian home lands as of the effective date of this rule (Eff. June 10, 1995)

STATE WATER PROJECTS PLAN 2017 UPDATE

More recently, reservation actions were supported by preliminary findings in the most recent update of the State Water Projects Plan, which was formally adopted by the Commission on May 16, 2017. The State Water Projects Plan is the component of the Hawaiʻi Water Plan that documents the water needs of all State agencies over a 20-year planning horizon. The Engineering Division of the Department of Land and Natural Resources is responsible for the development and update of the State Water Projects Plan. In addition to inventorying the existing and future water needs for State projects, through the State Water Projects Plan, Engineering Division also promotes partnerships and cost sharing to coordinate water development projects and water infrastructure improvements of potentially competing State agencies. Based on the State Water Projects Plan, Engineering Division pursues legislative funding to support new source development through Capital Improvement Project requests and administers a water credit allocation program for State agencies. Implementation of the State Water Projects Plan in close coordination with the County Water Use and Development Plan is needed to ensure orderly authorization and development of new State sources and water system infrastructure.

Initially adopted in 1990 and revised in 2003, a third update of the State Water Projects Plan was completed and adopted in 2017[4]. Due to funding constraints, the Engineering Division focused this most recent State Water Projects Plan update exclusively on DHHL. DHHL was selected because: 1) they are the largest landowner amongst State agencies and thus could have the most significant impact on water resource development and use, and 2) DHHL water needs are an identified public trust purpose under the State Constitution and Water Code.

The Engineering Division and its consultant worked extensively with DHHL staff to identify priority tracts and proposed phasing over the 20-year planning horizon and to determine the breakdown of each tract in terms of residential units and agricultural acreages. The 20-year

[4] Engineering Division also received separate funding to update the State Water Projects Plan for the North Kona region on the island of Hawaiʻi, as well as for a comprehensive statewide update. The statewide update will incorporate the 2017 update (which documents DHHL water needs) as well as the regional update for North Kona in order to develop comprehensive and coordinated water development strategies that consider and coordinate the needs and plans of all State agencies.

timeframe is established under HAR §13-170-42(c), which requires the State Water Projects Plan to consider a 20-year projection period for analysis purposes.

Potable water requirements were calculated by correlating DHHL's land use designations to an equivalent zoning designation in the County Water System Standards (or other applicable standards when necessary) and applying the respective unit rate (Exhibit 1). All demands from the domestic component of homesteading (Residential, Subsistence Agriculture, Pastoral) and municipal (Community Use, Commercial, Industrial) land use designations were considered to be potable.

Non-potable requirements were considered to be irrigation demands for agricultural land use designations (Subsistence, Supplemental, and General Agriculture) and stock water (sustenance water for livestock) for the Pastoral land use designation. Agricultural non-potable demands were calculated using a unit rate of 3,400 gallons per acre per day, as recommended by the Department of Agriculture's Agricultural Water Use and Development Plan. Based on published studies, a livestock watering unit rate of 20 gallons per head per day was used for Pastoral land use designations. The unit rate non-potable requirements are shown in Exhibit 1.

A range of forecasts - high, medium, and low – were developed for both potable and non-potable end use water demands. Variability was achieved by adjusting project development data while keeping water demand unit rates fixed. Examples of adjustments included varying unit buildout rates, utilizing different unit density rates, and using different percentages of utilization of the total area for development. However, while the range of water demands for the various end uses were assessed, only the medium demand projections by water source (e.g., aquifer system areas to be developed) were provided.

The 2017 update of the State Water Projects Plan provides a sound basis and rationale for water reservations statewide for DHHL for both potable needs (groundwater) and non-potable needs (surface water) by hydrologic unit. After discussions with DHHL staff, it was decided that the establishment of additional water reservations begin with potable groundwater needs in non-designated areas on the islands of Kaua‘i, Maui, Lana‘i, and Hawai‘i for the following reasons:

- DHHL's needs within designated ground water management areas on the island of O‘ahu are most likely to be met through the Honolulu Board of Water Supply's (HBWS) integrated municipal water system. As shown in Table 1, DHHL has existing reservations from the Waipahu-Waiawa and Waimanalo Aquifer System Areas on O‘ahu. As DHHL tracts are developed, these reservations are to be converted to water use permits and transferred to the HBWS for water service. DHHL has no current plans to pursue new source development and does not plan to operate new water systems on O‘ahu. According to DHHL, DHHL is already in discussions with HBWS to service DHHL tracts on O‘ahu and has received verbal commitment from HBWS. HBWS is in the process of updating its Water Use and Development Plan, and the regional watershed management plans for the Primary Urban Center, ‘Ewa District, and Central O‘ahu are currently underway and should incorporate DHHL needs and strategies based on the 2017 State Water Projects Plan.

- DHHL's needs within non-designated aquifer system areas on the island of Oʻahu (Waiʻanae Sector Area) will also be met through the Honolulu Board of Water Supply's (HBWS) integrated municipal water system. DHHL will rely on HBWS for new source development in the Waiʻanae Sector Area. DHHL is already in discussions with HBWS to service DHHL tracts on Oʻahu and has received verbal commitment from HBWS.

- Besides Oʻahu, the only other areas that are currently designated as a groundwater management area is the island of Molokaʻi, and the ʻĪao Aquifer System on Maui. As shown in Table 1, there is an existing water reservation for DHHL for the Kualapuʻu Ground Water Management Area for 2.905 mgd in addition to existing uses; however, the 2017 State Water Projects Plan shows a projected need for only 0.840 mgd until 2031.

- Staff's preliminary review of non-potable surface water needs in the 2017 State Water Projects Plan indicate that in some cases, where there are available streamflow records, proposed future needs exceed the available flow in the stream. In most cases, however, there is no available streamflow data to compare with the proposed water needs.

- Additionally, current information on other existing off-stream uses is lacking. **Therefore, reservations for surface waters should be done in concert with staff's establishment of instream flow standards (emphasis added)**, which will involve the collection of the data and information necessary to vet the amounts to be reserved.

On June 20, 2017, the Commission approved a reservation of 6.903 mgd of non-potable water from the Waimea Surface Water Hydrologic Unit, on the island of Kauaʻi, for DHHL's 15,061 acres of land mauka of the mana plain, which were historically fed by the Kōkeʻe Ditch with water diverted from Kōkeʻe, Kauaikinanā, Kawaikōī, and Waiakoali streams during the operation of the Kekaha Sugar Company. This reservation was filed on April 25, 2017 following the April 18, 2017 Commission-approved Waimea Watershed Agreement Mediated Settlement. This reservation supersedes DHHL's previous petition for 33.145 mgd filed with the Commission on November 17, 2015.

On October 16, 2018, the Commission approved a reservation of 0.513 mgd of non-potable water from the Wailua Surface Water Hydrologic Unit, on the island of Kauaʻi, for non-potable water needs of DHHL's lands East of Kālepa Ridge.

On March 27, 2020, the Commission approved a reservation of 1.600 mgd non-potable water from four tributaries of the Wailuku River (i.e., ʻĀwehi, Aale, Laualu, Kapehu).

On May 18, 2021, the Commission approved a reservation of 2.00 mgd non-potable water from the Honokōhau Stream for agricultural use in the Honokōwai tract in West Maui.

Table 2 shows all water reservations established via Commission action in non-designated water management areas, pursuant to HRS §174C-101(a).

On June 12, 2019, DHHL submitted their final environmental impact statement for the Pūlehunui Regional Infrastructure Master Plan (Pūlehunui Master Plan) on Maui. Staff from DHHL and CWRM began discussing the availability of non-potable water no meet non-potable demands in this development. On December 16, 2020, DHHL submitted their formal reservation for non-potable water for future DHHL land uses in Pūlehunui and Kēōkea-Waiouli. The revised acreage, use, and water duties for this reservation are provided in Table 3. Based on these data, DHHL determined their non-potable reservation to be 11.1775 mgd, of which 1.3275 mgd was for the Pūlehunui Master Plan. The breakdown for this reservation is provided in Table 3.

Table 2. DHHL Water Reservations in Non-Designated Water Management Areas

Island	Hydrologic Unit	type	Action Date	Initial Reservation (mgd)	Current Reservation (mgd)
Kauaʻi	Waimea*	non-potable	06/20/2017	6.903	6.903
	Wailua	potable	09/18/2018	0.708	0.708
	Wailua*	non-potable	10/16/2018	0.513	0.513
	Anahola	potable	09/18/2018	1.470	1.470
	Kekaha	potable	09/18/2018	0.336	0.336
	Makaweli	potable	09/18/2018	0.405	0.405
Lanaʻi	Leeward	potable	09/18/2018	0.067	0.067
Maui	Honokōhau*	non-potable	05/18/2021	2.000	2.000
	Honokōwai	potable	09/18/2018	0.770	0.770
	Kamaʻole	potable	09/18/2018	2.547	2.547
	Keʻanae	potable	09/18/2018	0.003	0.003
	Kawaipapa	potable	09/18/2018	0.118	0.118
	Lualaʻiula	potable	09/18/2018	0.063	0.063
Hawaiʻi	Wailuku*	non-potable	03/17/2020	1.600	1.600
	Keauhou	potable	08/17/2015	3.398	3.398
	Hawi	potable	09/18/2018	0.148	0.148
	Māhukona	potable	09/18/2018	3.014	3.014
	Honokaʻa	potable	09/18/2018	0.396	0.396
	Hakalau	potable	09/18/2018	0.083	0.083
	Onomea	potable	09/18/2018	0.250	0.250
	Hilo	potable	09/18/2018	0.492	0.492
	Keaʻau	potable	09/18/2018	1.336	1.336
	ʻŌlaʻa	potable	09/18/2018	0.025	0.025
	Nāʻālehu	potable	09/18/2018	0.185	0.185
	Pāhoa	potable	09/18/2018	0.660	0.660

* Surface Water Hydrologic Unit

CONSISTENCY WITH THE HAWAII WATER PLAN

The Hawaiʻi Water Plan is the State's long-range water plan, and staff believes it is important that water reservations be consistent with, and have basis in, the Hawaiʻi Water Plan (HWP). Under the current planning framework, the State Water Projects Plan outlines the water needs for

State projects (in this case for DHHL), identifies potential supply options, and feeds into the County Water Use and Development Plans. This enables State water needs to be integrated with the needs of all other use sectors (i.e., military, municipal, private, and agriculture) within each county into a comprehensive resource development strategy and implementation plan. However, county updates to their Water Use and Development Plan are often not as frequent, comprehensive, or timely to provide for such reservations as needed. As previously described, the 2017 Update to the State Water Projects Plan identifies the non-potable water needs of DHHL.

Should water reservations be approved, staff will inform the counties so that the reservations will be incorporated into the County Water Use and Development Plans as required by law. Reserving water for DHHL promotes the Commission's approach to managing the resource and protecting the public trust through the collaboration and consistency framework provided by the HWP.

Table 3. Acreage, water demand rate (gallons per acre per day, gpad) and total water demand (gallons per day) by land use for the DHHL water reservation, with non-potable totals.

Land Use	Type	Area (acre)	Rate (gpad)	Water Demand (gpd)
Pūlehunui				
Subsistence Agriculture	non-potable	269	2,500	672,500
Supplemental Agriculture	non-potable	28	2,500	70,000
General Agriculture	non-potable	154	2,500	385,000
Industrial	potable	31	--	--
Community Use	non-potable	80	2,500	200,000
Commercial		84	--	--
	Total =	646	Total =	1,327,500
Kēōkea & Waiohuli				
Residential	potable	1,160	--	--
Subsistence Agriculture	potable	170	--	--
Community Use	potable	69	--	--
Conservation	potable	773	--	--
General Agriculture	non-potable	3,940	2,500	9,850,000
	Total =	6,112	Total =	11,117,500

BACKGROUND

On May 24, 2001, Native Hawaiian Legal Corporation (NHLC), on behalf of Na Moku Aupuni O Koolau Hui (Na Moku), Beatrice Kepani Kekahuna, Marjorie Wallett, and Elizabeth Lehua Lapenia[5], filed 27 Petitions to Amend the Interim Instream Flow Standards of which 22 were affected by the water delivery system managed by the East Maui Irrigation (EMI) Co. On

[5] The Commission was notified by letter on May 10, 2007, that NHLC "no longer represent Ms. Lapenia and are, therefore, no longer authorized to advance the claim with respect to the parcel identified as TMK: 2-9-008:31 or LCAw-S-1 Claimant: Naoo on her behalf."

July 23, 2001, NHLC met with Commission staff to discuss the handling of the 27 petitions. Agreement was reached that efforts would focus on Honopou, Hanehoi, Waiokamilo, Kualani, Pi‘ina‘au, Palauhulu, and Wailuanui streams.

Extensive hydrological[6] and ecological[7] studies conducted by the U.S. Geological Survey, fieldwork by the State of Hawai‘i Division of Aquatic Resources and Commission on Water Resource Management, were then proceeded by numerous public outreach meetings.

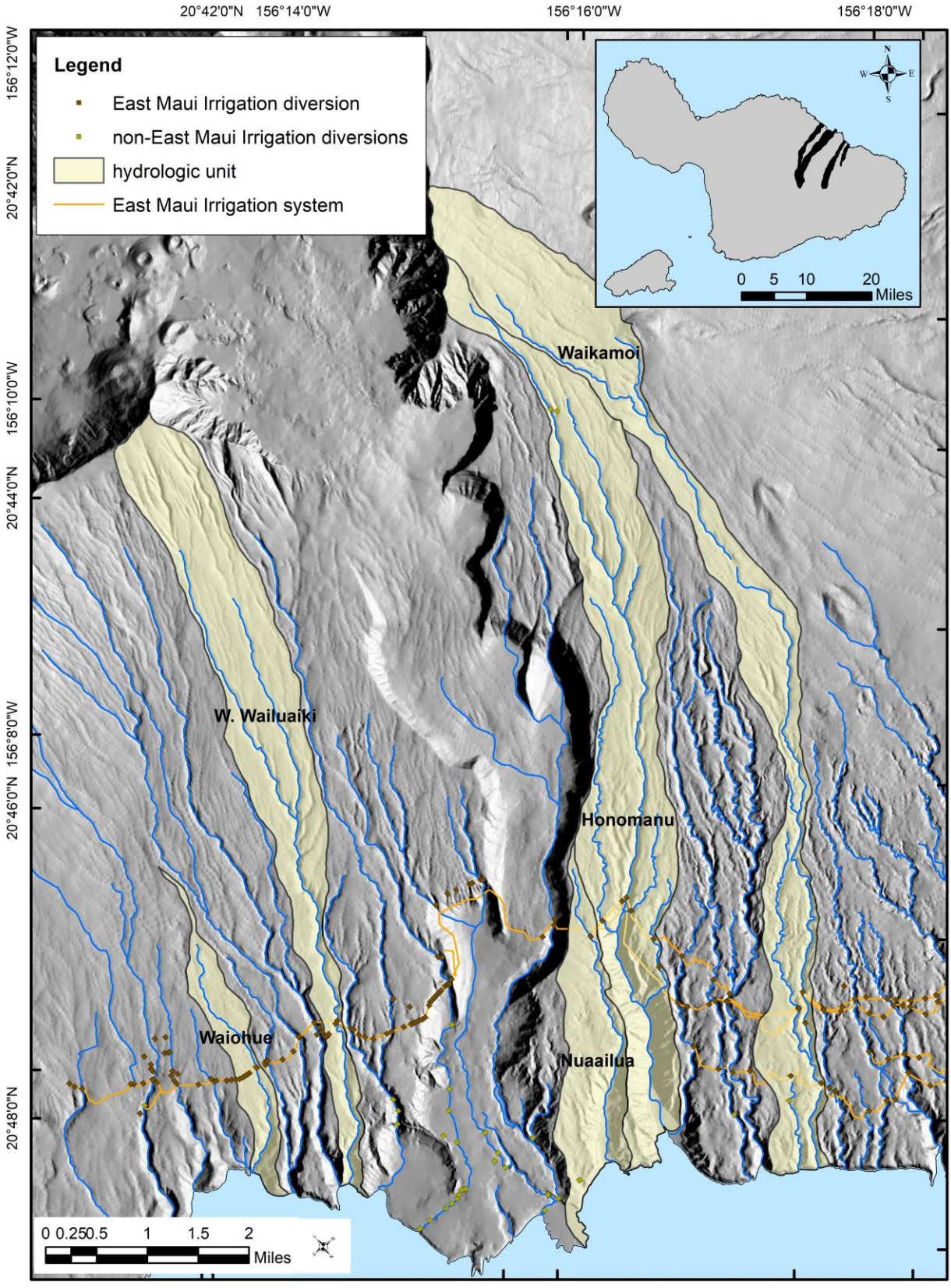
There were multiple site visits, public fact-gathering meetings, and data reports leading up to and following initial Commission action on September 25, 2008[8]. On September 25, 2008, the Commission approved, with amendments, the recommendations to amend the interim IFS for five of the 21 total surface water hydrologic units covered by the 27 east Maui petitions[9]. Instream uses in these streams included the cultivation of wetland kalo.

On December 16-17, 2009, Commission staff presented its submittal to address the interim instream standards for the remaining 16 surface water hydrologic units to address Petitions to Amend the Interim Instream Flow Standards for the Surface Water Hydrologic Units of Waikamoi (6047), Puohokamoa (6048), Haipuaena (6049), Punalau (6050), Honomanu (6051), Nuaailua (6052), Ohia (6054), West Wailuaiki (6057), East Wailuaiki (6058), Kopiliula (6059), Waiohue (6060), Paakea (6061), Waiaaka (6062), Kapaula (6063), Hanawi (6064), and Makapipi (6065), Maui. Following considerable testimony and discussions with various stakeholders, the Commission deferred action on the submittal and directed staff to collect additional information from key stakeholders in the categories of short term, mid-term, and long-term issues. The additional data submitted, as requested by the Commission, is provided as the Compilation of Data Submissions, Part II, PR-2010-01[10].

On May 25, 2010, Commission staff presented updated recommendations for interim IFS in the other 16 hydrologic units recommended by staff addressing streamflow in streams whose instream uses included habitat for freshwater biota, aesthetic values, and recreational values[11]. This staff submittal specifically addresses the key points that the Commission sought clarification on and provides two streamflow restoration approaches (seasonal and annual) to address the needs of native stream organisms and cultural gathering practices. The Commission approved annual flow restoration values for two streams (Makapipi and Hanawi), and seasonal flow restoration for four streams (Waiohue, East Wailuaiki, West Wailuaiki, and Waikamoi). This decision was contested by the petitioners, and the East Maui Contested Case Hearing (East Maui CCH) proceeded from 2011 to 2017.

[6] Gingerich, S.B. 2005. Median and low-flow characteristics for streams under natural and diverted conditions, Northeast Maui, Hawaii. Scientific Investigations Report 2004-5262.
[7] Gingerich, S.B., Wolff, R.H. 2005. Effects of surface-water diversions on habitat availability for native macrofauna, Northeast Maui, Hawaii. U.S. Geological Survey Scientific Investigations Report 2005-5213.
[8] https://dlnr.hawaii.gov/cwrm/surfacewater/ifs/eastmauiiifs1
[9] https://files.hawaii.gov/dlnr/cwrm/submittal/2008/sb200809C2.pdf
[10] https://files.hawaii.gov/dlnr/cwrm/activity/iifsmaui1/PR201001.pdf
[11] https://files.hawaii.gov/dlnr/cwrm/submittal/2010/sb201005C1.pdf

Figure 1: Location map of Waikamoi, Honomanū, Nua‘ailua, West Wailuaiki, Waiohue, surface water hydrologic units, East Maui.



Following the conclusion of the East Maui CCH, the Commission issued a final Decision & Order[12] (2018 Decision & Order), which evaluated the best available information presented in the East Maui CCH regarding the availability of water, the instream uses of water, and the non-instream uses of water, and ordered the full restoration of streams which supported extensive cultivation of wetland kalo or community usage. These streams were identified as Honopou, Hanehoi, Palauhulu, Waiokamilo, Wailuanui, and Makapipi. Some of these streams also supported high levels of low elevation (e.g., estuarine) and higher elevation habitat for freshwater biota. In regions where streams were considered "gaining", such that groundwater contributed to increased flow downstream of the water delivery systems, the Commission considered these sources as opportunities to utilize water to meet non-instream uses. The 2018 Decision & Order had a goal of being realistically implemented, measurable, understood by stakeholders, and to reasonably accommodate non-instream uses under the current conditions, such that on-going monitoring can be used to adapt to changing circumstances.

As part of the 2018 Decision & Order, the Commission evaluated the availability of water from all sources, including the other streams and groundwater resources not part of the 2001 petition. This includes streams diverted by the EMI system outside of the petition as well as streams diverted by Maui County's Upper Kula and Lower Kula water systems. The Commission estimated the quantity of water which was available in each stream and the quantity of water which would be available for off-stream use for a given interim IFS. In the balance with non-instream water use, the Commission's 2018 Decision & Order provided for public trust uses of domestic water and 90% of the reasonable irrigation needs of the important agricultural lands of Central Maui serviced by the EMI system. However, in the 2018 Decision & Order, the available hydrologic data was limited to the Gingerich (2005) study that assumed climatic stability from the 1942-2001 period.

Since the publication of this study and its use in the East Maui CCH, additional climatic and hydrologic studies have been published.

Further, the Department of Hawaiian Home Lands formally requested a reservation of water from East Maui for its non-potable needs in the Central Aquifer Sector of Maui in December 2020. The non-potable needs of DHHL were not part of the original East Maui CCH. As DHHL's water needs are a public trust use that must be considered in the balancing of water management, the 2018 Decision & Order must also be revisited to address this deficiency.

ISSUES/ANALYSIS:

This section of the submittal begins with general considerations of issues that broadly apply to the development of interim IFS for the 5 surface water hydrologic units (Figure 1). The analysis presented is based on additional information that was previously collected before and following the December 16-17, 2009 and the May 25, 2010 Commission meetings, and should be considered together with the analysis presented in the December 2009 and May 2010 submittals.

[12] https://files.hawaii.gov/dlnr/cwrm/cch/cchma1301/CCHMA1301-20180620-CWRM.pdf

Hydrogeologic Context

The first step in developing an interim IFS is assessing the hydrogeology of the hydrologic unit. Freshwater resources originate as precipitation, falling in the form of rain, but also through fog drip intercepted by vegetation. Some of the precipitation evaporates from the canopy or the soil, some is transpired by plants, some flows as overland flow in runoff contributing to surface flow, and some infiltrates the soil and contributes to groundwater recharge. Much groundwater is stored in the basal aquifer found in the dike-free lava flows of the shield building phase of the volcano. This basal aquifer lens sits on the brackish transition zone, which then overlies saltwater. "High-level" groundwater occurs where water is impounded by dikes or perched on buried low-permeability horizons. Where the stream channel has incised into high-elevation groundwater, streams gain base flow (Izuka et al., 2015[13]). In East Maui, the surface geology is characterized by Kula volcanics, which are mainly aa flows (lava characterized by jagged, sharp surfaces with massive, relatively dense interior) poured out at progressively longer intervals so that numerous valleys were cut between the younger lava flows. The older flows are massive, aggregating 2,000 feet thick on the summit and thin toward the isthmus where they are only about 50 feet thick. In the eastern end of Haleakala near Nahiku, perched high-level groundwater is held up by the relatively low permeability Kula volcanics and associated weathered soils and ash beds (Gingerich, 1999[14]). Elsewhere they contain fresh water at sea level, but it is brackish along the leeward shore. Areas near the heads of the hydrologic units include geologic formations (weathered cinders, spatter, and pumice) originally built along fissures by fire fountains (sprays of gases carrying magma from vents, spewing up to several hundred feet high, producing "spatter") at the source of the lava flows, forming a few perched spring water systems. The Honomanū volcanic series, which predates the Kula volcanics, forms the basement of the entire Haleakala mountain to an unknown depth below sea level. They are predominantly pahoehoe flows (lava characterized by a smooth or ropy surface with variable interior, including lava tubes and other voids), ranging from 10 to 75 feet thick and are very vesicular. The Honomanū basalts are extremely permeable and yield water freely[15].

Hydrologic Considerations

Streams are largely characterized by different hydrologic and geologic components that affect flow regimes, particularly the groundwater-surface water interactions and rainfall-driven runoff. The amount of water flowing in a given stream is also affected by regional climate variations (e.g., rainfall, fog drip, solar radiation). The quantity and quality of data available to characterize these geologic and hydrologic components also varies considerably from stream to stream. For streams with long-term continuous data, the process for developing an interim IFS may be greatly different from that for streams with limited hydrologic data. For example, the groundwater contributions to surface flow (i.e., base flow) can be determined using continuously

[13] Izuka, S.K., Engott, J.A., Rotzoll, K., Bassiouni, M., Johnson, A.G., Miller, L.D., Mair, A. 2015. Volcanic aquifers of Hawai'i—Hydrogeology, water budgets, and conceptual models. U.S. Geological Survey Scientific Investigations Report 2015-5164.
[14] Gingerich, S.B., 1999. Ground-water occurrence and contribution to streamflow, Northeast Maui, Hawaii. U.S. Geological Survey Water-Resources Investigations Report 99-4090.
[15] Stearns, H.T., MacDonald, G.A. 1942. Geology and Ground-water Resources of the Island of Maui, Hawaii. Bulletin of Hydrography, 7. U.S. Geological Survey. Honolulu, HI.

recorded data and statistical analyses, while record-augmentation is used with partial-record gaging stations to estimate low-flow characteristics where no continuous data exist.

Groundwater-surface water interactions influence the extent of gaining and losing stream reaches. A gaining reach is where the streambed intersects the underlying water table and groundwater contributes to streamflow as seepage or springs. A losing reach is where the streambed is above the water table and surface water infiltrates into the streambed and recharges the aquifer, sometimes leaving the stream dry even in undiverted conditions.

A common misconception is that flow restoration from diversions is immediately followed by continuous flow downstream from the point of release all the way to the coast (analogous to turning on a faucet); however, this is not always the case. For a stream that is losing, restored flow infiltrates underground once it reaches the losing section, and flow is often absent downstream of the losing reach. In some cases, flow will become continuous only after enough water has infiltrated the streambed and raised the water table, allowing base flow to be maintained by equilibrium with sub-surface flow. In other cases, the restored stream will remain dry at low-flows where the water table drops below the elevation of the stream bed. A stream can also become dry from prolonged periods of little or no rainfall as the water table drops below the streambed. In this case, adequate rainfall is necessary to restore the interaction between surface and groundwater, and to return base flow in the stream.

Most reaches in the hydrologic units of East Maui are gaining reaches, although streams that incise Honomanū and Hana volcanics are typically losing reaches due to the high permeability of these geologic layers.

Trends in Rainfall and Streamflow

Long-term (1920-2012) and recent (1983-2012) trends indicate significant declines in rainfall across areas of East Maui, particularly during the dry season[16]. Long-term declines in rainfall are generally coupled with a long-term decline in surface water availability and groundwater recharge, with consequences for base flow (Figure 2). Updated flow duration statistics for continuously operated USGS gaging stations are provided in Table 5. USGS continuous record gaging stations at three locations in East Maui were used to determine the estimated total flow duration value for the median baseflow (BFQ_{50}). Based on these data, the BFQ_{50} is approximately the total flow Q_{75}.

Commission staff have work closely with the Division of Aquatic Resources (DAR) to gather additional hydrological and ecological data. These efforts include a comprehensive survey of stream mouths in East Maui, temporal and spatial biota surveys in East Maui, and additional hydrological data collection. These data are being used to inform follow up recommendations.

[16] Frazier, A.G. and Giambelluca, T.W. (2017). Spatial trend analysis of Hawaiian rainfall from 1920 to 2012. International Journal of Climatology, 37(5): 2522-2531.

Table 5. Estimated median (Q_{50}) and low (Q_{95}) total flow duration statistics (cubic feet per second) at active continuous long-term monitoring stations in East Maui for the 1984-2013 period.

USGS ID	Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
16508000	6.2	5.4	4.8	4.3	3.9	3.6	3.2	2.9	2.6	2.2
16518000	8.9	7.8	6.9	6.0	5.2	4.5	3.9	3.4	2.8	2.2
16578000	2.0	1.8	1.6	1.3	1.2	1.0	0.86	0.72	0.60	0.47

Differences between Gingerich (2005) and Cheng (2016) are provided in Table 6.

Table 6. Comparison of streamflow in cubic feet per second (million gallons per day) between the 1942-2001 and the 1984-2013 periods of record for median (Q_{50}) and low (Q_{95}) total flow and median baseflow (BFQ_{50}, estimated as Q_{75}) at active continuous long-term monitoring stations East Maui.

	Q_{50}		Q_{75}		Q_{95}	
USGS ID	1942-2001	1984-2013	1942-2001	1984-2013	1942-2001	1984-2013
16508000	7.1 (4.59)	6.2 (4.00)	4.6 (2.97)	3.6 (2.33)	2.4 (1.55)	2.2 (1.42)
16518000	10 (6.64)	8.9 (5.43)	6.0 (3.88)	4.5 (2.90)	2.5 (1.62)	2.2 (1.42)
16587000	2.2 (1.42)	2.0 (1.29)	1.8 (1.17)	1.0 (0.65)	0.46 (0.30)	0.47 (0.30)

To provide context for the recommendations outlined in this submittal, data from all streams in East Maui affected by these water delivery systems are detailed. This includes topographic and geographic features of each primary stream in each hydrologic unit (Table 7), hydrologic features (Table 8), and biological features (Tables 7 and 8; Figures 5, 6, and 7).

Updated Ecological Data

The available habitat that can be colonized by recruiting amphidromous species in East Maui varies with stream size, which is primarily a function of drainage area, rainfall, and geology. The length of stream that supports various assemblages of species can be differentiated by the elevation of the stream reach and the presence of waterfalls, as identified in Figure 3. The 2001 petitioned streams account for 4.786 miles of potential low elevation (<100 feet elevation) stream habitat (82.0%), while the 2021 petitioned streams represent 1.048 miles of potential low elevation stream habitat (18.0%). Similarly, of the available potential stream habitat including mid-elevation (<600 feet elevation) reaches, the 2001 petitioned streams account for 27.392 miles (73.8%) and the 2021 petitioned streams account for 9.702 miles (26.2%).

From 2020 to 2022, Commission staff and staff from the Division of Aquatic Resources conducted stream biota and habitat surveys at 56 locations, with 38 locations in the East Maui region. Stream surveys spanned a variety of reach types, from low-elevation (<100 ft), low gradient (<4%) reaches near stream mouths, to high elevation (>1200 ft), high gradient (>10%) reaches, and reach locations spanning the 400-800 ft mid-elevation range. Sites were selected based on accessibility, diversity of elevations, streamflow, and terminal reach condition (e.g., estuary or waterfall). Surveys in East Maui at low and mid-elevation reaches were conducted with the lower elevation irrigation systems inactive for the proceeding four years, providing continual flow and connectivity between stream mouth and study reach. The goal of the study was to test the hypothesis that terminal reach condition affected upstream recruitment of specific amphidromous species to middle- and high-elevation reaches. Previous work has examined the

behavioral and morphological traits of amphidromous fishes in Hawaiʻi to make generalizations about habitat preferences (Figure 4). However, no large-scale, comprehensive survey of stream biota has been conducted to test if stream mouth affects community structure. The density (e.g., normalized abundance) and size of native and non-native species were quantified using visual point-quadrat surveys (20x per reach) along with the collection of stream channel and habitat characteristics.

Figure 2. Median (Q_{50}) annual baseflow for three long-term continuous record gaging stations in East Maui.

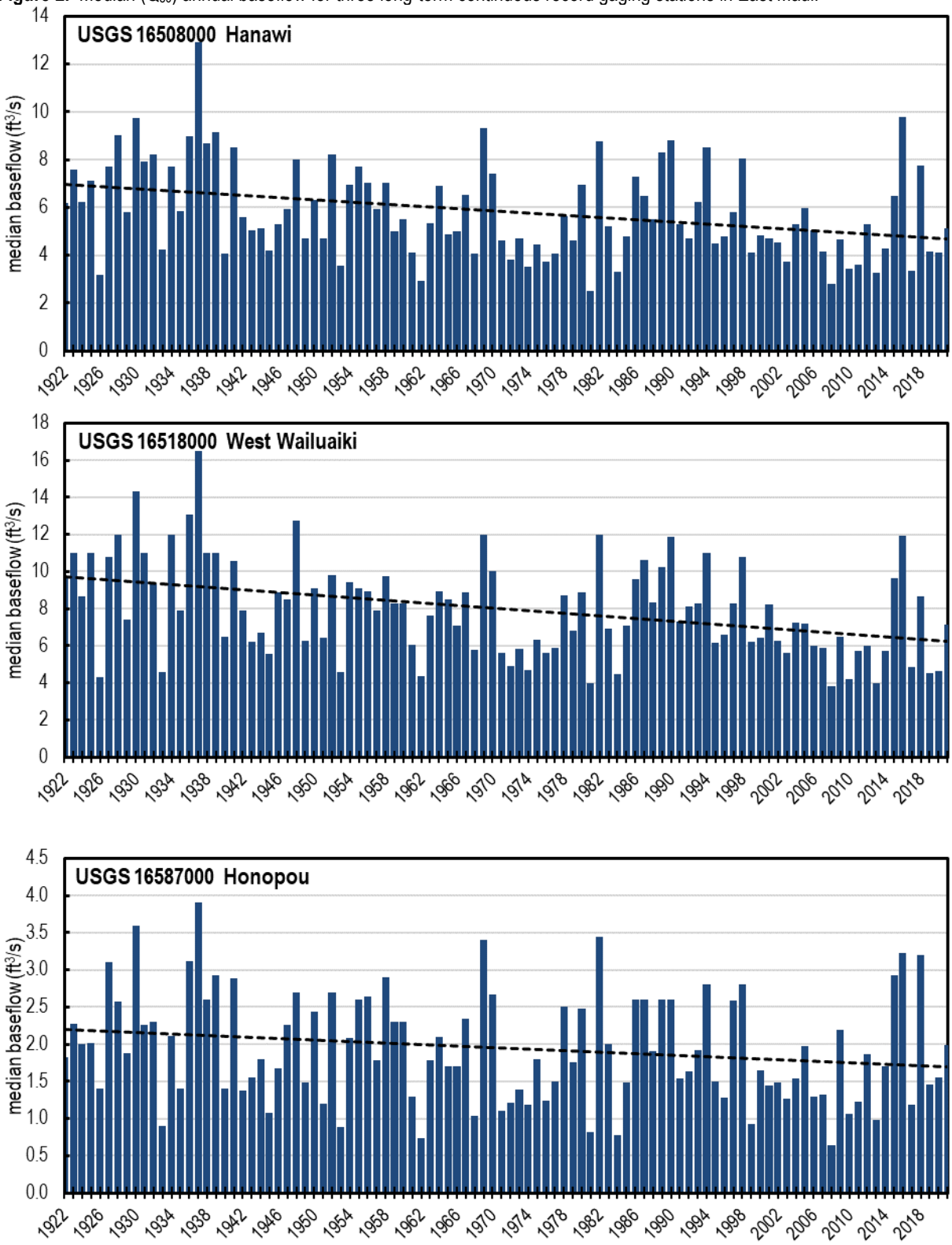


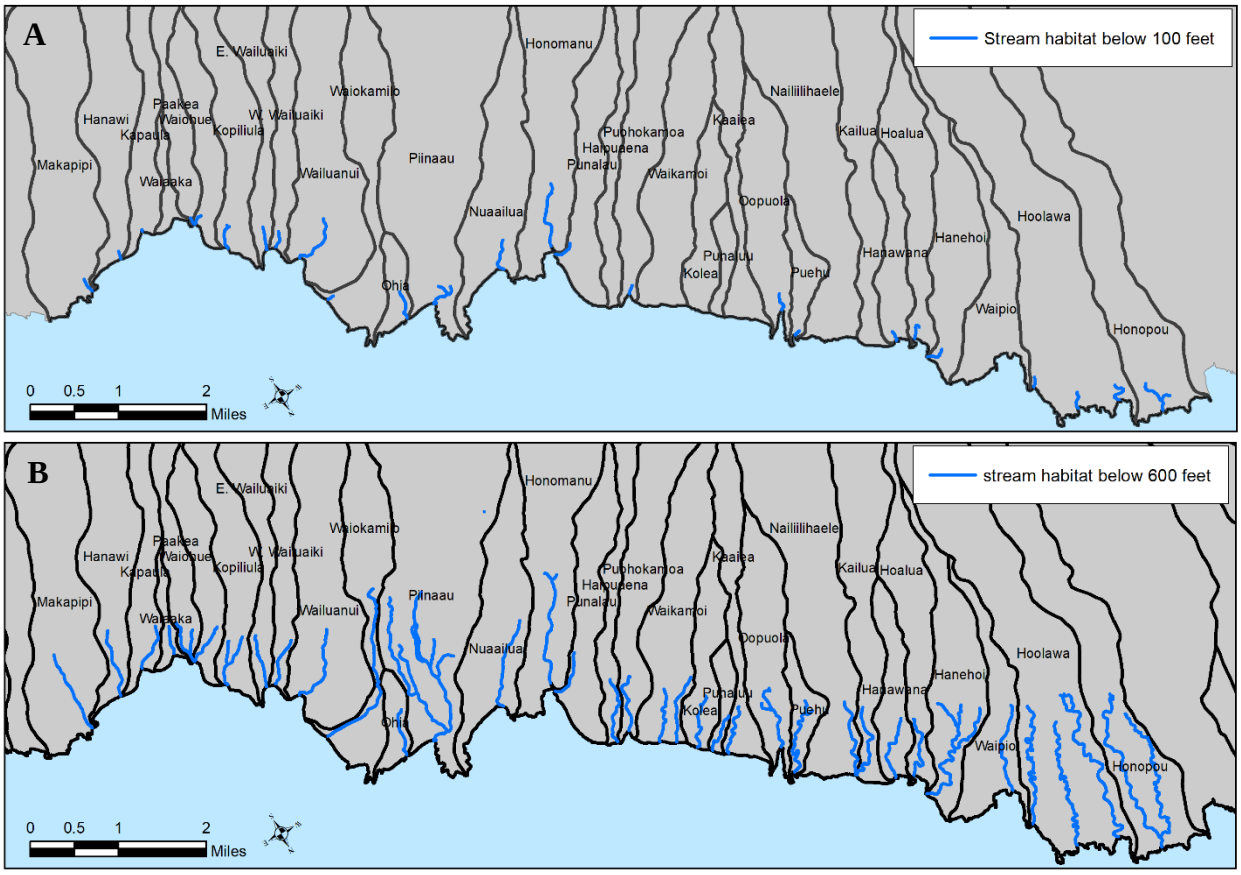
Table 7. General topographic features affected by surface water delivery systems in East Maui.

Hydrologic Unit	Drainage Area (mi^2)	Maximum Elevation (ft)	Length of longest stream (mi)	Terminal reach	Percent of surface geology as Hana volcanics (%)	Percent of surface geology as Kula volcanics (%)	Percent of surface geology as Honomanū volcanics (%)
Honopou	2.8	2290	7.17	Estuary	0.0	100.0	0.0
Hoʻolawa	3.6	3510	9.37	Estuary	28.2	71.4	0.3
Waipiʻo	0.6	1530	3.12	Waterfall	0.0	95.3	4.7
Hanehoi	1.5	2290	5.14	Waterfall	1.7	95.4	2.7
Hoalua	1.3	3530	7.03	Estuary	21.5	74.0	4.5
Hānawana	0.7	1540	2.75	Waterfall	19.4	75.1	5.4
Kailua	4.9	6550	8.73	Waterfall	59.1	40.5	0.3
Nailiilihaele	3.5	5210	10.6	Waterfall	13.2	85.4	0.4
Puehu	0.49	1680	2.94	Waterfall	0.0	96.6	3.4
ʻOʻopuola	1.0	2060	3.41	Estuary	0.0	96.2	3.6
Kaʻaiea	1.1	2720	5.61	Waterfall	0.0	97.5	2.5
Punaluʻu	0.20	1190	1.62	Waterfall	0.0	90.1	9.9
Kōlea	0.6	1860	2.96	Waterfall	0.0	95.0	5.0
Waikamoi	4.6	9310	12.6	Waterfall	0.8	98.3	0.9
Puohokamoa	3.2	5640	9.0	Estuary	0.0	99.3	0.7
Haʻipuaʻena	1.6	6030	8.98	Waterfall	0.0	99.8	0.2
Punalau	1.1	2560	3.77	Estuary	0.0	89.8	9.9
Honomanū	5.4	8310	9.82	Estuary	0.0	88.9	11.1
Nuaʻailua	1.6	2420	3.61	Estuary	3.2	78.1	17.8
Piʻinaʻau	20.5	10010	16.0	Estuary	56.0	32.0	5.7
Waiokamilo	2.7	6490	9.34	Waterfall	48.5	41.8	4.9
Wailuanui	6.6	8860	12.2	Estuary	30.5	58.1	4.7
West Wailuaiki	4.1	8840	8.78	Estuary	0.2	98.4	1.3
East Wailuaiki	3.9	8500	8.48	Estuary	0.9	97.6	1.4
Kopiliʻula	4.8	8320	8.43	Estuary	31.1	67.8	1.0
Waiohue	1.4	4000	2.95	Estuary	23.1	75.5	0.6
Paʻakea	0.7	2190	5.46	Estuary	53.7	46.3	0.0
Waiaaka	0.14	1640	1.47	Estuary	0.7	94.7	4.4
Kapaula	0.8	2660	3.43	Estuary	34.9	64.6	0.6
Hānawī	5.7	8070	8.02	Estuary	59.4	40.6	0.1
Makapipi	5.3	7620	6.14	Waterfall	94.8	5.2	0.0

Table 8. General hydrologic features of streams and their main tributaries affected by surface water delivery systems in East Maui including available flow (regulated or natural) at 1250ft. [note: -- not available, watershed was too small for evaluation]

Hydrologic Unit	Estimated Q_{50} at ~1250 ft elevation (cfs)	Estimated Q_{50} gain at ~700 ft elevation from ~1250 ft elevation (cfs)	Length of stream below 100 ft elevation (mi)	Length of stream below 600 ft elevation (mi)
Honopou	2.0	0.18	0.552	4.330
Hoʻolawa	--	--	0.338	2.631
Hoolawaliilii	3.3	1.2	--	--
Hoolawanui	3.0	0.81	--	--
Mokupapa	--	--	0.115	1.915
Waipiʻo	0.73	0.27	0.000	1.066
Hanehoi	2.0		0.228	2.629
Hoalua	1.3	1.5	0.193	0.860
Hanawana	--	0.44	0.117	0.799
Kailua	7.8	0.55	0.000	1.013
Oanui	1.7	--	--	--
Nailiilihaele	13	0.53	0.000	0.959
Puehu	--		0.069	1.249
ʻOʻopuola	1.0	0.09	0.216	1.021
Kaʻaiea	3.8	0.27	0.000	0.647
Punaluʻu	--	0.48	0.000	0.491
Kōlea	--	0.55	0.000	0.708
East Kōlea	0.30	--	--	--
West Kōlea	0.65	--	--	--
Waikamoi	6.6	0.61	0.000	0.805
Alo	2.5	--		
Waihinepee	--	0.89	0.000	0.675
Puohokamoa	8.7	0.30	0.103	0.731
Haʻipuaʻena	4.8	0.39	0.000	0.807
Punalau	6.0	0.99	0.239	0.567
Honomanū	3.8	--	0.790	1.479
Nuaʻailua	0.46	--	0.390	1.089
Piʻinaʻau	0.38	--	0.531	5.843
Palauhulu	5.4	--	--	--
Waiokamilo	6.1	--	0.071	2.118
Wailuanui	--	--	0.650	0.965
East Wailuanui	3.1	--	--	--
West Wailuanui	3.8	--	--	--
West Wailuaiki	8.9	--	0.197	0.571
East Wailuaiki	7.7	--	0.263	0.614
Kopiliʻula	6.6	--	0.044	0.909
Puaʻakaʻa	0.97	--	--	--
Waiohue	5.2	--	0.135	0.496
Paʻakea	1.5	--	0.073	0.806
Waiaʻaka	0.86	--	0.000	0.319
Kapaula	4.3	--	0.024	0.554
Hānawī	6.2	--	0.091	0.815
Makapipi	unknown	--	0.166	0.959

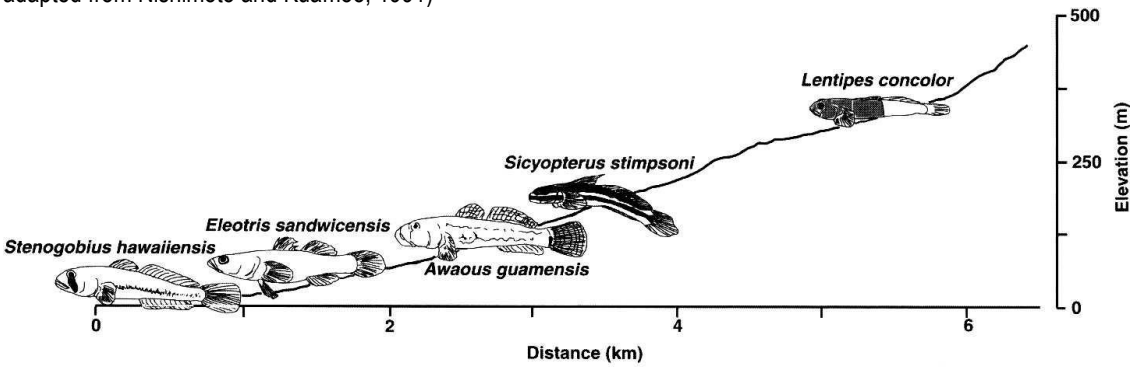
Figure 3. Stream reach lengths in the East Maui that have the potential to support low-elevation freshwater species (below 100 feet in elevation) (A) and mid-elevation freshwater species (below 600 feet in elevation) (B).



Streams with estuaries at their mouths supported a greater number of species and at higher densities compared to streams with terminal waterfalls (Figure 5). As expected, amphidromous species abundance varied by elevation and each species’ climbing abilities, with better climbers inhabiting higher elevation reaches. The exception to this was in stream mouths of terminal reach waterfalls, where, likely due to a lack of competition, ‘o‘opu alamo‘o which could be found near the mouth (Figure 5). We observed a difference in ‘o‘opu nākea (*Awaous stamineous*) abundance among reach elevations, with more fish occupying lower-elevation reaches than in mid- or high-elevation in reaches without terminal waterfalls. We also observed greater densities of ‘o‘opu nōpili (*Sciopterus stimpsoni*) in mid-elevation reaches in streams without terminal waterfalls. These conclusions support previous work identifying the distribution of species likely to inhabit stream reaches of various characteristics[17].

[17] Tingley, R.W., Infante, D.M., MacKenzie, R.A., Cooper, A.R., Tsang, Y-P. (2019). Identifying natural catchment landscape influences on tropical stream organisms: classifying stream reaches of the Hawaiian Islands. *Hydrobiologia*, 826: 67-83.

Figure 4. Elevational profile of a terminal-estuary stream on the Big Island of Hawaii (Hakalau Stream). (Source: McRae, 2007, adapted from Nishimoto and Kuamoo, 1991)



Data Summaries

Data summaries for each of the five East Maui streams can be found online in the instream flow standard assessment report for each hydrologic unit and summaries of these data are provided in previous staff submittals from 2010[18].

Waikamoi
https://files.hawaii.gov/dlnr/cwrm/ifsar/PR200901.pdf

Honomanū
https://files.hawaii.gov/dlnr/cwrm/ifsar/PR200905.pdf

Nua‘ailua
https://files.hawaii.gov/dlnr/cwrm/ifsar/PR200906.pdf

West Wailuaiki
https://files.hawaii.gov/dlnr/cwrm/ifsar/PR200908.pdf

Waiohue
https://files.hawaii.gov/dlnr/cwrm/ifsar/PR200911.pdf

[18] https://files.hawaii.gov/dlnr/cwrm/submittal/2010/sb201005C1.pdf

Figure 5. Density of native and non-native species at low- (<100 ft a.s.l; mouth), mid-reach (100-600 ft a.s.l.), and high- (> 600 ft a.s.l.; mauka) elevation reaches for streams with a terminal reach waterfall or an estuary using 2020-2022 point-quadrat biota survey data.

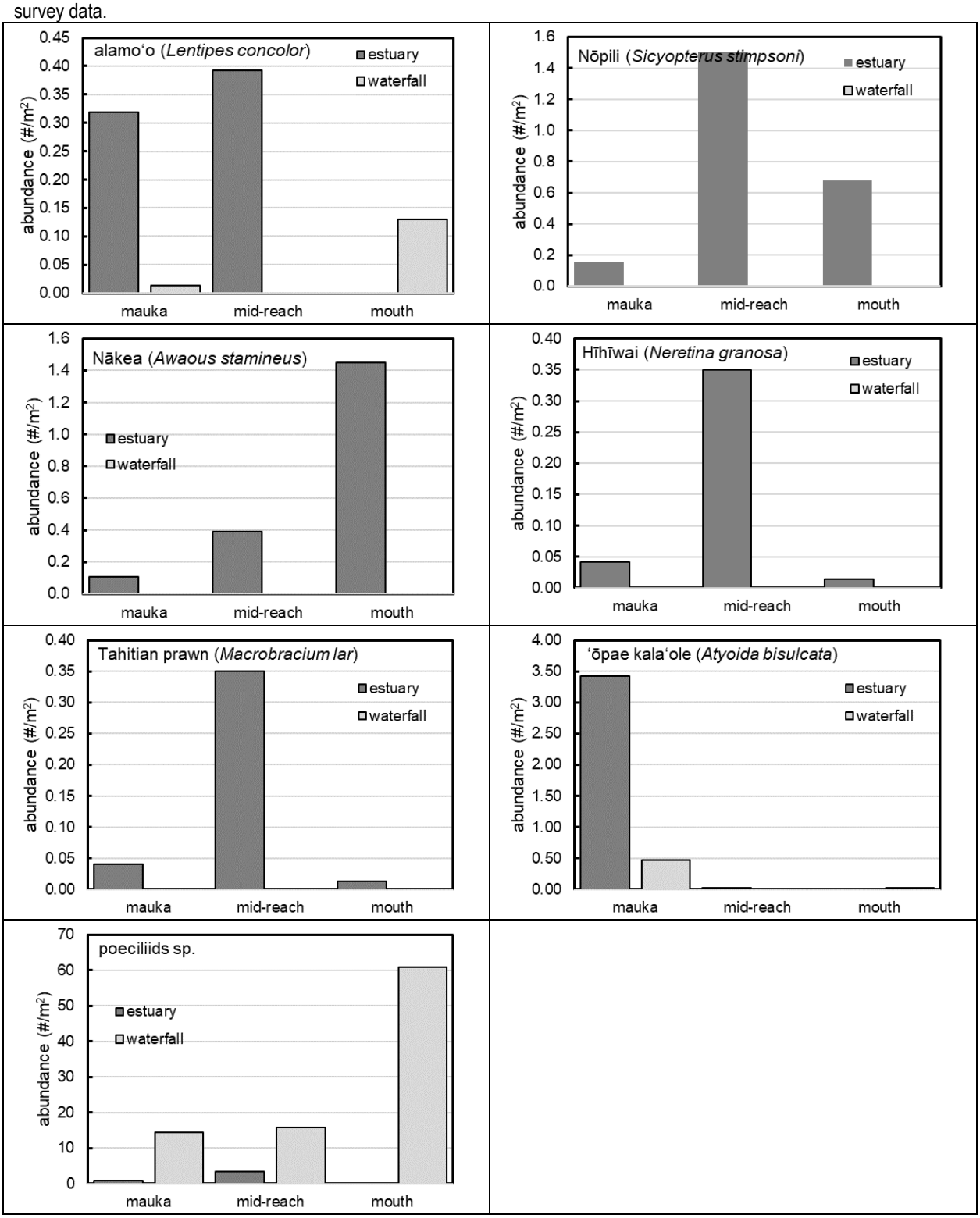


Figure 6. Abundance (#/m^2) of ʻoʻopu nākea (*Awaous stamineus*), hīhīwai (*Neretina granosa*), ʻōpae oehaʻa (*Macrobrachium grandimanus*), and ʻoʻopu naniha (*Eleotris sandwicensis*) at low-elevation stream reaches after partial streamflow restoration in 2010 (H90 seasonal restoration) and after full streamflow restoration in 2016.

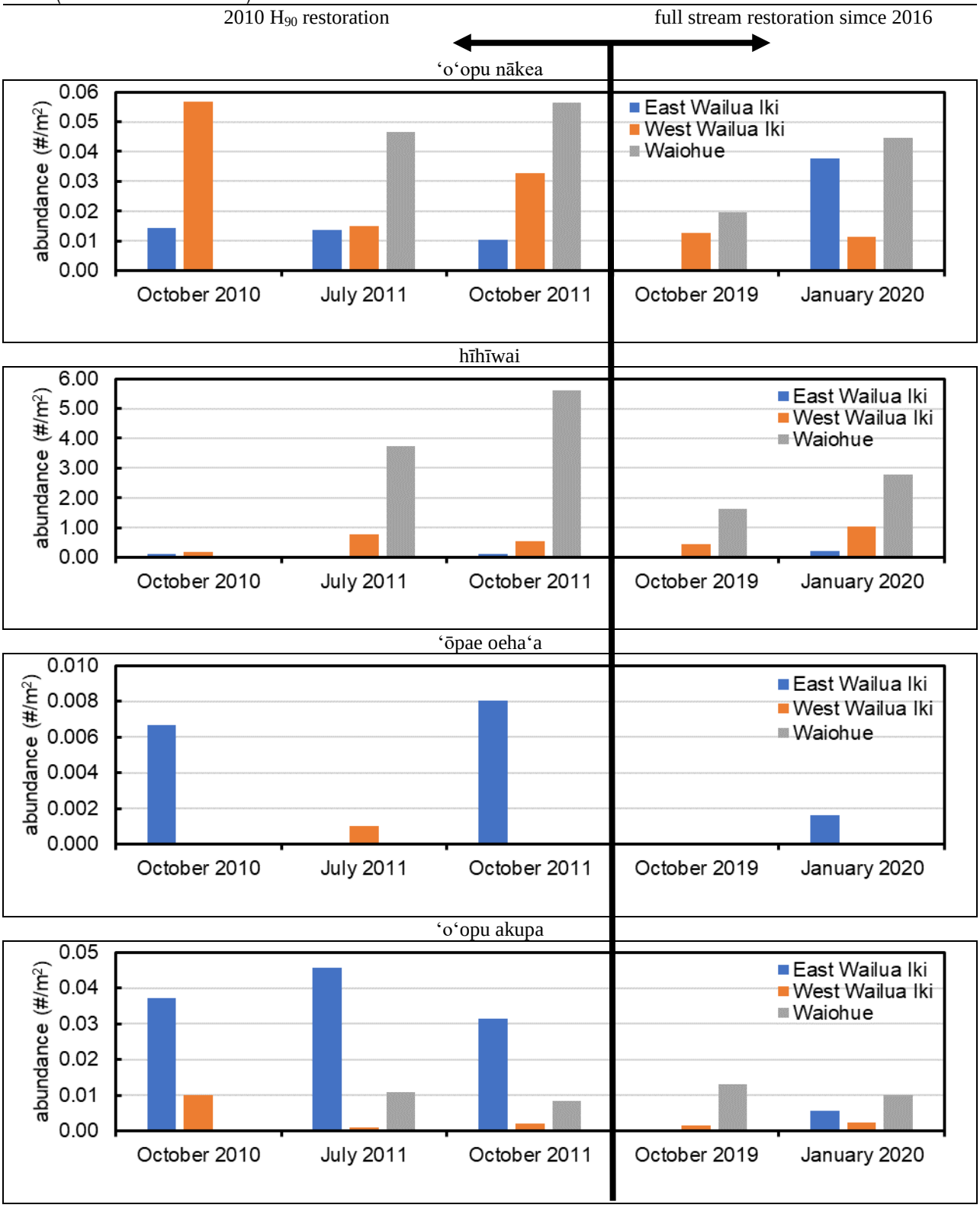
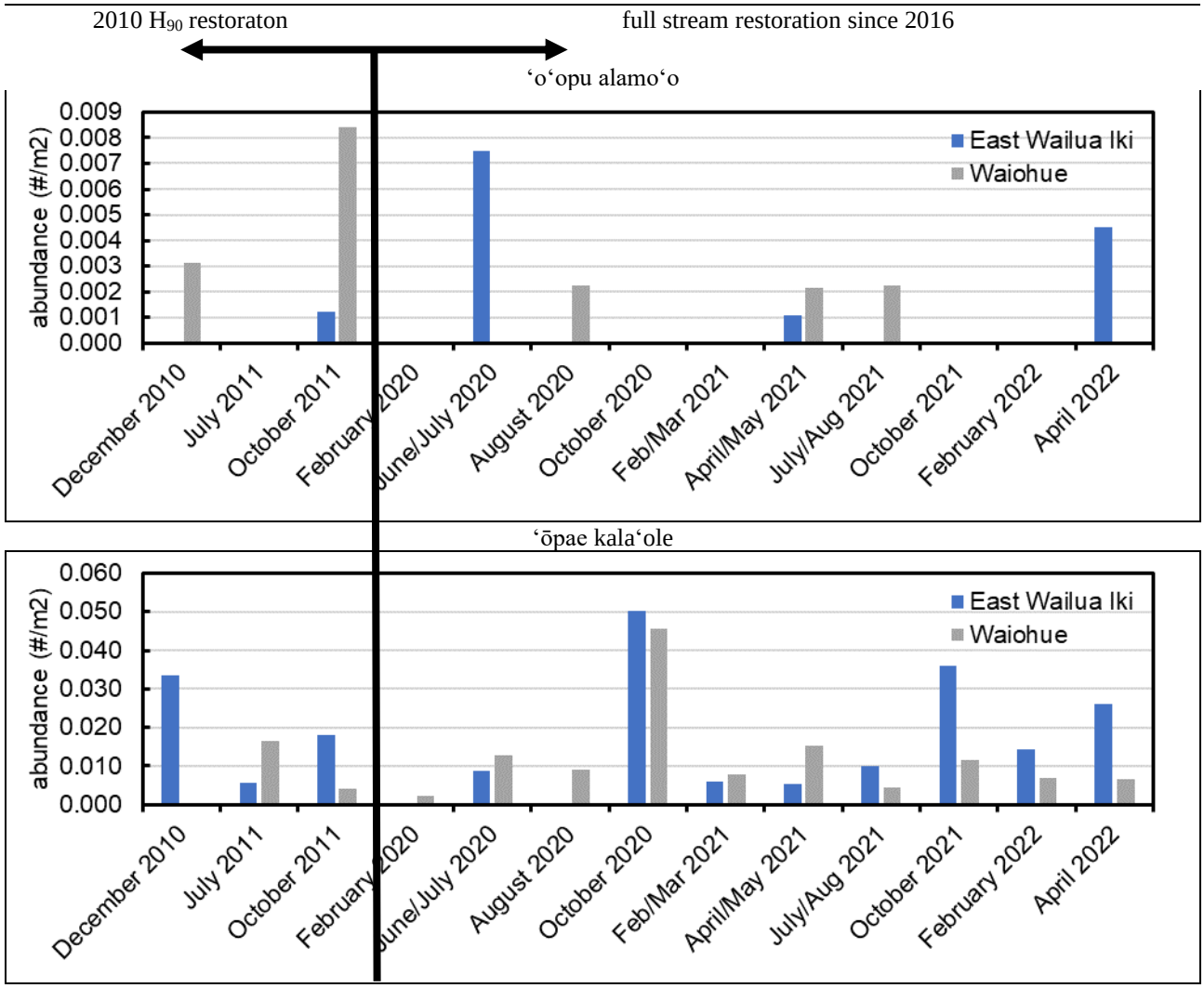


Figure 7. Abundance (#/m^2) of ʻoʻopu alamoʻo (*Lentipes concolor*) and ʻōpae kalaʻole (*Atyoida bisulcata*), at high-elevation stream reaches after partial streamflow restoration in 2010 (H_{90} seasonal restoration) and after full streamflow restoration in 2016.



UPDATES TO BEST AVAILABLE INFORMATION

In the following section are updated hydrological and biological data for each hydrologic unit. Updated hydrological data are provided from Cheng (2016[19]) and Strauch (2022[20]).

Waikamoi Hydrologic Unit

With the closure of HC&S in 2016, diversions to the New Hāmākua and Center ditches were discontinued. The 2018 Decision & Order designated lower Waikamoi Stream as a habitat stream and ordered an interim IFS that supported 90% of the estimated habitat. However, staff from DAR and CWRM surveyed Waikamoi stream at two elevations from 2020-2022 and found no native species observed in the terminal reach above the terminal waterfall and no ʻoʻopu alamoʻo or ʻoʻopu nopili in the higher elevation site. At the higher elevation survey, abundance of ʻōpae kalaʻole was relatively low compared to other East Maui streams. It is likely that the terminal waterfall with an overhanging lip and no plunge pool limits recruitment of native species to this stream.

Updated hydrological data are provided in Table 9.

Table 9. Historic natural and regulated low-flow duration streamflow statistics at various locations. [H-U = Haiku-Uka boundary]

		Discharge, in ft^3/s, for selected percentages of time (from 5 to 95 percent) the indicated discharge was equaled or exceeded									
Location ID	station name	Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
16555000	Waikamoi abv Wailoa[a]	7.0					3.5				1.1
16554000	East Waikamoi at H-U	1.6	1.3	1.1	0.93	0.93	0.71	0.52	0.52	0.37	0.32
LP-6	Diverted at Lower Pipeline	1.4	1.3	1.1	0.93	0.93	0.71	0.52	0.52	0.37	0.32
16554000	Waikamoi at H-U	2.7	2.3	1.8	1.7	1.4	1.1	0.93	0.79	0.62	0.43
LP-7	Diverted at Lower Pipeline	0.0	2.3	1.8	1.7	1.4	1.1	0.93	0.79	0.62	0.43
	Gains in flow blw H-U	3.8	3.3	2.5	2.1	1.7	1.3	0.91	0.55	0.41	0.22
16555000	Waikamoi abv Wailoa[b]	8.0	6.8	5.4	4.8	4.0	3.1	2.4	1.9	1.5	0.97
W-2	Regulated flow available	6.6	3.3	2.5	2.1	1.7	1.3	0.91	0.55	0.41	0.22

[a]Gingerich (2005) USGS SIR 2004-5262 for 1942-2001 period
[b]Cheng (2016) USGS SIR 2016-5216 for 1984-2013 period

Honomanū Hydrologic Unit

With the closure of HC&S in 2016, diversions to the Spreckels Ditch in Honomanū were discontinued. The 2018 Decision & Order designated lower Honomanū Stream as a habitat stream and ordered an interim IFS that supports 90% of the estimated habitat. However, below the Spreckels Ditch diversions, each stream tributary stream flows over a waterfall and continues along a deeply incised stream channel with exposed Honomanū Volcanics resulting in the stream losing flow to groundwater recharge. In 2019, USGS installed a continuous real-time streamflow monitoring station on Honomanū near Hana Highway funded by the Commission and the State of Hawaiʻi Department of Transportation. During the extreme drought periods observed from 2020 to 2022, the stream went dry on numerous occasions, as evidenced by the

[19] Cheng, C.L. (2016). Low-flow characteristics for streams on the Islands of Kauaʻi, Oʻahu, Molokaʻi, Maui, and Hawaiʻi, State of Hawaiʻi. Scientific Investigations Report 2016-5103.
[20] Strauch, A.M. (2022). Low-flow characteristics and surface water availability in East Maui, Hawaiʻi. Commission on Water Resource Management, State of Hawaiʻi Department of Land and Natural Resources. PR-2022-01.

USGS station (Figure 8). From March 19, 2021 to September 30, 2022, Honomanū had a mean daily flow of zero for 103 days (18.4%) with all diversions inactive. The losing reach limits the Commission’s ability to enforce any interim IFS value as any flow quantity is not attainable during drought periods.

Staff from DAR and CWRM surveyed Honomanū Stream at three elevations on multiple occasions from 2020-2022 and found some of the greatest abundances of native freshwater biota on Maui. The presence of a large, low-gradient estuary supported by spring flow increases recruitment to the stream. Since the 2018 Decision & Order, historic lo‘i complexes have been re-established in the wetlands near the stream mouth. The nearshore environment in Honomanū is an important fishing ground as well.

In order to protect these instream uses while implementing a management strategy that is attainable, staff suggest permanently abandoning three out of the four Spreckels Ditch intakes on Honomanū Stream: Banana Falls intake (Diversion 302), Center Falls Intake (Diversion 300), and High Falls Intake (Diversion 301) and eliminating the interim IFS.

Updated hydrological data for Honomanū Stream above S-4 (Diversion 278) intake on Spreckels Ditch are provided in Table 10. Estimated hydrological data for the S-2 (Banana Falls Intake), S-3 (Center Falls Intake), and S-5 (High Falls Intake) are provided in table 11.

Table 10. Historic natural and regulated low-flow duration streamflow statistics at Spreckels Ditch intake S-4 on Honomanū Stream for the 1984-2013 period.

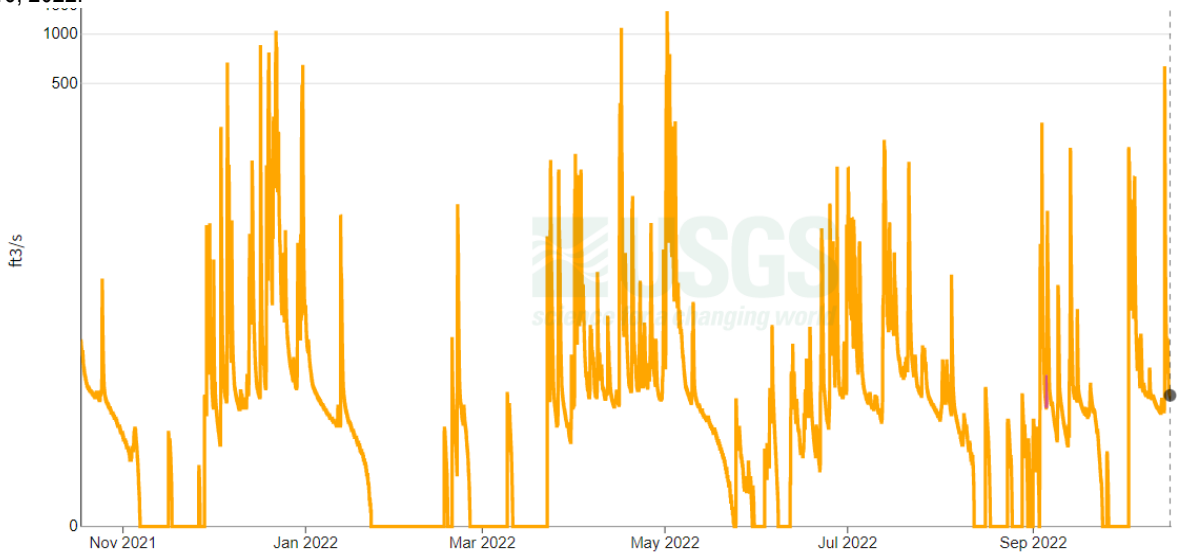
USGS ID	elev (ft)	drainage area (mi^2)	Number of complete water years	Length of record	Discharge, in ft^3/s, for selected percentages of time (from 50 to 95 percent) the indicated discharge was equaled or exceeded									
					Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
16527000	1,733	3.17	49	1915-1963	6.2	5.3	4.6	4.0	3.6	3.1	2.6	2.2	1.7	1.1
	estimated natural flow			1942-2001[a]	5.7					2.8				1.1
	estimated natural flow			1984-2013[b]	4.9	4.3	3.8	3.1	2.6	2.2	1.8	1.4	1.1	0.73
S-4	Regulated flow available			1984-2013	3.8	2.9	2.6	2.4	2.1	1.6	1.2	1.0	0.74	0.47

[a]Gingerich (2005) USGS SIR 2004-5262
[b]Cheng (2016) USGS SIR 2016-5216

Table 11. Estimated natural low-flow duration streamflow statistics at various locations for the 1984-2013 period.

stream	elev (ft)	drainage area (mi^2)	Discharge, in ft^3/s, for selected percentages of time (from 50 to 95 percent) the indicated discharge was equaled or exceeded									
			Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
Honomanū: Banana Falls	1,810	0.79	2.3	2.0	1.8	1.6	1.4	1.4	1.3	1.3	1.2	1.2
Honomanū: Center Falls	1,670	0.23	1.1	1.0	0.89	0.77	0.68	0.59	0.52	0.47	0.40	0.33
Honomanū: High Falls	1,720	0.26	1.4	1.2	1.1	0.94	0.83	0.74	0.66	0.60	0.52	0.45

Figure 8. Streamflow measured at USGS 16527500 on Honomanū Stream at Hana Highway from October 18, 2021 to October 16, 2022.



Nua‘ailua Hydrologic Unit

With the closure of HC&S in 2016, the diversion to the Spreckels Ditch in Nua‘ailua was discontinued. The 2018 Decision & Order designated a connectivity flow for Nua‘ailua despite the potential for habitat available.

Staff from DAR and CWRM have surveyed Nua‘ailua Stream at two elevations on multiple occasions from 2020-2022 and found great abundances of native freshwater biota. The presence of a large, low-gradient estuary supported by spring flow increases recruitment to the stream. The nearshore environment in Nua‘ailua is an important fishing ground that is likely to benefit from greater flow restoration. Estimated low-flow duration statistics are provided in Table 12 from Strauch (2022).

In order to protect these instream uses, staff suggest permanently abandoning S-1 Nua‘ailua Intake (Diversion 325) and eliminating the interim IFS.

Table 12. Estimated natural low-flow duration streamflow statistics at Nua‘ailua Stream above Spreckels Ditch.

USGS ID	elev (ft)	drainage area (mi^2)	Length of record	Discharge, in ft^3/s, for selected percentages of time (from 50 to 95 percent) the indicated discharge was equaled or exceeded									
				Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
			1942-2001[a]	0.56					0.28				0.19
			1984-2013[b]	0.46	0.38	0.33	0.28	0.25	0.22	0.21	0.20	0.19	0.19

[a]Gingerich (2005)
[b]Strauch (2022)

West Wailuaiki Hydrologic Unit

West Wailuaiki stream supports both low-elevation and high-elevation habitat for native freshwater biota. With the closure of HC&S in 2016, the diversion to the Ko‘olau Ditch in West Wailuaiki was discontinued. The 2018 Decision & Order designated West Wailuaiki Stream as a habitat stream and ordered an interim IFS of full restoration.

Staff from DAR have surveyed West Wailuaiki Stream at one elevation on multiple occasions from 2019 to 2020 and found no increase in abundance relative to surveys conducted in 2010 and 2011 (Figure 6). Updated flow duration statistics from Cheng (2016) are provided in Table 13.

Table 13. Historic natural low-flow duration streamflow statistics at USGS 16518000 West Wailuaiki Stream above Ko‘olau Ditch.

USGS ID	elev (ft)	drainage area (mi^2)	Number of complete water years	Length of record	Discharge, in ft^3/s, for selected percentages of time (from 50 to 95 percent) the indicated discharge was equaled or exceeded									
					Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
16518000	1,550	2.1	103	1944-2013	9.0	8.0	7.1	6.3	5.6	4.9	4.2	3.6	3.0	2.3
			70	1942-2001[a]	10				6.0					2.5
			30	1984-2013[b]	8.9	7.8	6.9	6.0	5.2	4.5	3.9	3.4	2.8	2.2

[a]Gingerich (2005)
[b]Cheng (2016)

Waiohue Hydrologic Unit

Waiohue stream supports both low-elevation and high-elevation habitat for native freshwater biota, although the terminal reach estuary is relatively short. With the closure of HC&S in 2016, the diversion to the Ko‘olau Ditch in Waiohue was discontinued. The 2018 Decision & Order designated Waiohue Stream as a habitat stream and ordered an interim IFS of full restoration.

Staff from DAR have surveyed Waiohue Stream at two elevations on multiple occasions from 2019 to 2022 and found no increase in abundance following full flow restoration relative to surveys conducted in 2010 and 2011 (Figure 6 and Figure 7).

Table 14. Estimated natural low-flow duration streamflow statistics at USGS 16515000 on Waiohue Stream above Ko‘olau Ditch.

USGS ID	elev (ft)	drainage area (mi^2)	Period of Record	Number of complete water years	Length of record	Discharge, in ft^3/s, for selected percentages of time (from 50 to 95 percent) the indicated discharge was equaled or exceeded									
						Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
16515000	1,316	0.32	1922-63	40	1923-1962	6.5	6.0	5.6	5.3	4.9	4.5	4.2	3.9	3.6	3.1
					1942-2001[a]	6.2					5.0		3.0		
					1984-2013[b]	5.2	4.7	4.4	4.2	3.9	3.7	3.4	3.2	2.9	2.5

[a]Gingerich (2005)
[b]Cheng (2016)

AVAILABILITY OF WATER

The flow-duration values for the total amount of surface water available in the entire East Maui Irrigation System below the Upper and Lower Kula Water Systems for the 1984-2013 climate period before and after the 2018 Decision & Order are also provided in Table 15.

Table 15. Water available from surface water sources in cubic feet per second (million gallons per day) in the Huelo region as part of the 2021 petition (i.e., without Hanehoi or Honopou), and estimated total water available in the EMI system for the 1984-2013 period before and after implementation of the 2018 Decision & Order.

	Discharge ($ft^3 s^{-1}$) for selected percentages of time (from 50 to 95 percent) the indicated discharge was equaled or exceeded									
location	Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
1984-2013 estimated water available in EMI system	168 (109)	143 (92)	126 (81)	110 (71)	98 (63)	85 (55)	73 (47)	63 (41)	53 (34)	41 (27)
1984-2013 estimated water available after 2018 D&O IIFS implementation	107 (69)	88 (57)	75 (48)	64 (41)	56 (36)	48 (31)	39 (25)	33 (21)	27 (17.5)	20 (13)
1984-2013 estimated water available after 2022 Huelo recommendations are implementation	86 (56)	68 (44)	56 (36)	47 (30)	40 (26)	33 (21)	30 (19)	25 (16)	20 (13)	15 (10)
1984-2013 estimated water available after the 2022 Huelo recommendations and the 2022 Keanae, and Honomanū recommendations are implemented	98 (64)	75 (49)	61 (40)	51 (33)	44 (28)	34 (22)	30 (19)	24 (15)	19 (12)	13 (9)

NON-INSTREAM USE CONSIDERATIONS

Potable water demand

Maui DWS utilizes surface water at three different water treatment facilities each sourcing water from different delivery systems. The Olinda and Piiholo water treatment facilities primarily diverts water from the Honomanū, Haipuaena, Puohokamoa, and Waikamoi hydrologic units via the Waikamoi Flume/Upper Kula pipeline at 4500 ft in elevation, and the Lower Kula pipeline at 2800 ft in elevation, respectively. The Kamole water treatment facility utilizes water from the Wailoa Ditch, diverted as far away as Nāhiku and transported via the Koolau or from Nua‘ailua and Honomanū via the Spreckels Ditch to the Wailoa Ditch. The Olinda WTF relies upon large storage reservoirs (~130 million gallons) to provide a reliable supply the approximately 1-2 mgd of water to be treated for the potable water system in Kula and Ulupalakua. The Piiholo WTF relies upon the larger baseflows available at the 2800 ft elevation to feed the single reservoir (~50 million gallon) to supply the approximately 2-4 mgd of water to be treated for the potable water system in Makawao, Haiku, and Pukalani. The Kamole WTF relies upon the larger capacity of the Ko‘olau/Wailoa ditch to supply the approximately 4.5 mgd of water to be treated for the potable water system in Haiku and Paia. Booster pumps allow for potable water to be pumped up to higher elevations from the lower treatment facilities during drought periods to compensate for reduced streamflow available at higher elevations.

Per the 2018 agreement between EMI and Maui DWS, EMI will make up to 12 mgd available from Wailoa Ditch and an additional 4 mgd as needed upon notice.

The updated Maui Island Water Use and Development Plan projects a demand growth for the Upcountry Water System to 8.53 mgd by 2035 and an additional 7.3 mgd to meet 100% of the Upcountry Water System meter priority list. Due to logistical constraints associated with the development of additional groundwater sources, Maui DWS is planning to rely on water treated at the Kamole WTF and pumped up to higher reservoirs to meet potable water demand during drought conditions. Ensuring sufficient water is available for potable water use is a high priority.

Agricultural water demand

There are three existing agricultural water demands for diverted surface water from East Maui streams in the Central Aquifer Sector: commercial agriculture conducted by Mahi Pono, commercial agriculture conducted by leases in the Maui Agricultural Park, and subsistence agriculture or small commercial agriculture utilizing potable water supply delivered by Maui DWS. The DHHL is proposing to develop commercial, subsistence, and general agriculture in the Pūlehunui and Kēōkea-Waiouli tracts.

The largest agricultural demand is expected to be from Mahi Pono. A detailed description of the Mahi Pono Farm Plan is included in the Final Environmental Impact Statement[21]. Mahi Pono plans to irrigation 26,600 acres of agricultural lands that have recently been converted from sugarcane to diversified agriculture. The 1:5 year drought irrigation demand for various crops under drip irrigation are provided for a lower field (Table 16) and an upper field (Table 17).

Maui County operates the Kula Agriculture Park, with 709 acres. There are 800 acres of other farms serviced by East Maui water systems, equating to approximately 3.6-4.2 mgd of demand.

Total surface water use for the full build-out scenario of the existing Mahi Pono farm plan has a 1:5 year drought irrigation demand of between 64 and 75 cfs (41.3-49.0 mgd). This includes the use of between 7.3 cfs and 9.3 cfs (4.7 and 6.0 mgd) of brackish groundwater available from the Paia aquifer system. Because the sustainable yield of this aquifer system is 7 mgd, pumpage must be limited to below sustainable yield until further data supports modification of the aquifer’s sustainable yield. Additional brackish groundwater from the Haiku aquifer system may be available at well 6-5520-001, but the elevation of this well (59 ft a.s.l.) prohibits its use in most fields.

[21] https://files.hawaii.gov/dlnr/ld/FEIS/FEIS-V3.pdf

Table 16. Estimated water demand for various row and orchard crops for Tax Map Key parcel 3-8-006-003 (1213.12 acres) representing a lower Mahi Pono field in agriculture using trickle drip irrigation.

IWREDSS Crop	Hydrologic Soil Condition	Soil Conservation Service Curve No.	estimated water demand (mgd) 1 in 5 yr draught	estimated water demand (gallons) 1 in 5 yr draught	estimated water (gal/acre) 1 in 5 yr draught
Domestic Garden	n/a	77, 86, 91	3.86	3,856,000	3,179
Eucalyptus	Fair	43, 65, 76	2.11	2,110,000	1,739
Papaya	Fair	43, 65, 76	1.45	1,454,000	1,199
Lychee	Fair	43, 65, 76	3.43	3,431,000	2,828
Avacado	Fair	43, 65, 76	3.64	3,641,000	3,001
Mango	Fair	43, 65, 76	3.64	3,641,000	3,001
Citrus	Fair	43, 65, 76	3.08	3,083,000	2,541
Macadamia	Fair	43, 65, 76	3.48	3,475,000	2,865
Generic Crop	Good	67, 78, 85	3.82	3,818,000	3,147

Table 17. Estimated water demand for various row and orchard crops for Tax Map Key parcel 2-5-002-002 (2,451 acres) representing an upper Mahi Pono field in agriculture using trickle drip irrigation.

IWREDSS Crop	Hydrologic Soil Condition	Soil Conservation Service Curve No.	estimated water demand (mgd) 1 in 5 yr draught	estimated water demand (gallons) 1 in 5 yr draught	estimated water (gal/acre) 1 in 5 yr draught
Domestic Garden	n/a	86, 91	6.81	6,812,000	2,780
Eucalyp, yng	Fair	65, 76	3.36	3,361,000	1,371
Papaya	Fair	65, 76	2.43	2,425,000	990
Lychee	Fair	65, 76	5.85	5,851,000	2,388
Avacado	Fair	65, 76	6.23	6,233,000	2,543
Mango	Fair	65, 76	6.23	6,233,000	2,543
Citrus	Fair	65, 76	5.54	5,535,000	2,259
Macadamia	Fair	65, 76	5.95	5,950,000	2,428
Generic Crop	Good	78, 85	6.63	6,631,000	2,706

AVAILABILITY OF ALTERNATIVE SOURCES

Alternatives to East Maui surface water include wastewater reclamation, catchment, stormwater reclamation, desalination, and development of new wells. Each alternative was determined to be of limited value either due to lack of infrastructure, high development costs, ineffectiveness, or a combination thereof.

There are two potential alternative water sources that may be used to meet the needs of non-instream uses: 1) R1 recycled wastewater is available from the Pukalani Wastewater Treatment Facility (<1 mgd) and R2 recycled wastewater is available from the Kahului Wastewater Treatment Facility (4-6 mgd) (i.e., recycled water alternatives; 2) groundwater from the Kahului, Paia, or Haiku aquifer systems (i.e., groundwater alternatives).

Recycled Water Alternatives

Wastewater treated to the R1 level can be used for row crop irrigation, while wastewater treated to the R2 level is limited to orchard irrigation. Historically, some of the sugarcane produced by Hawaiian Commercial and Sugar was irrigated with recycled water. However, due to the integrated nature of the current irrigation system (i.e., both row crop and orchards are irrigated with the same sourced water), it is not possible to utilize the R2-level water. If Maui County were to upgrade the Kahului Wastewater Treatment Facility, then this source of water would be available for agricultural uses.

Groundwater Alternative

The sustainable yields, current (2021) 12-month moving average, and 5-year average for the Kahului, Paia, Makawao, and Haiku aquifer systems are provided in Table 18. The sustainable yield was exceeded in the Kahului aquifer system every month from 2017 to 2022. Wells in the Paia aquifer system operated by both Maui County DWS and Mahi Pono are relied upon during drought periods to supplement the lack of surface water available for potable and non-potable needs. The 2021 12-month moving average pumpage in the Paia aquifer system was 2.439 mgd compared to a sustainable yield of 7 mgd, with a maximum monthly pumpage of 6.410 mgd. Relative to their sustainable yields, there is little pumpage from the Makawao and Haiku aquifer systems.

Table 18. Current sustainable yields for aquifer systems in the Central Aquifer Sector and current (2021) 12-month moving average (MAV) pumpage, 2017-2022 5-year average reported pumpage, and maximum reported monthly pumpage. [million gallons per day, mgd]

System	Sustainable Yield (mgd)	2021 12-month MAV (mgd)	2017-2022 5-year average (mgd)	2017-2022 Maximum Pumpage (mgd)
Kahului	1	3.048	5.551	9.632
Paia	7	2.439	0.877	6.410
Makawao	7	0.673	0.579	1.713
Haiku	24	0.912	0.869	1.195

Maui Department of Water Supply Groundwater Sources

Maui DWS has identified four alternatives including the exchange of Hamakuapoko Well water for Wailoa Ditch water for municipal use, use of recycled water from wastewater treatment plants on the Upcountry system (does not currently exist), use of reclaimed stormwater (currently being studied by the U.S. Department of Agriculture's Natural Resources Conservation Service), and various strategies outlined in the County Water Use and Development Plan to meet increasing Upcountry demands.

Maui County Department of Water Supply (Maui DWS) estimates their system loss for the Upcountry Maui systems to be approximately 14-percent. In the case of Maui DWS, the Commission had specifically asked the County to consider a plan for shifting Upcountry Maui reliance on surface water from 85-percent to a more even balance between surface water and ground water. The previous Draft County Water Use and Development Plan outlines five strategies to meet anticipated Upcountry demands. The first strategy, referred to as the "Reference Strategy" calls for incremental basal well development as needed. Using the "Reference Strategy" as a baseline, Maui DWS explained that developing more ground water sources to reduce surface water demands would cost over $117 million over a 25-year planning period, $85 million of which could be attributed to electricity costs. All five strategies, including: a) Incremental basal well development; b) Expansion of raw water storage capacity; c) Drought proof full basal well backup; d) Improved Kamole Water Treatment Plant Capacity; and e) Limited growth with extensive conservation measures; are presented by Maui DWS in their updated Water Use and Development Plan[22].

Maui DWS operates six wells the service their Upcountry Water System, although only five have been utilized in any capacity in the last five years (Table 19). This system integrates the groundwater from these wells with treated surface water from the three upcountry surface water treatment facilities (WTF): Olinda WTF, Piiholo WTF, and Kamole WTF. Groundwater pumpage to service the Upcountry Water System is extremely costly, due to the high elevation of the population. Further, many of the Maui DWS wells are located below historic pineapple fields, which leached legacy pesticides into the groundwater system, necessitating additional treatment before distribution.

[22] https://waterresources.mauicounty.gov/162/Maui-Island-Water-Use-Development-Plan

Table 19. Wells registered to Maui DWS servicing the Upcountry Water System, current (2021) 12-month moving average (MAV) pumpage, and 10-year average pumpage. [million gallons per day, mgd]

Well ID	Well name	Aquifer System	2021 12-month MAV (mgd)	2017-2022 5-year average pumpage (mgd)
6-5420-002	Hamakuapoko 1	Paia	0.018	0.007
6-5320-001	Hamakuapoko 2	Paia	0.025	0.009
6-5420-001	Old Maui HS	Paia	0.000	0.000
6-5118-002	Pookela MDWS	Makawao	0.246	0.217
6-5419-001	Haiku	Haiku	0.257	0.271
6-5317-001	Kaupakulua MDWS	Haiku	0.565	0.562

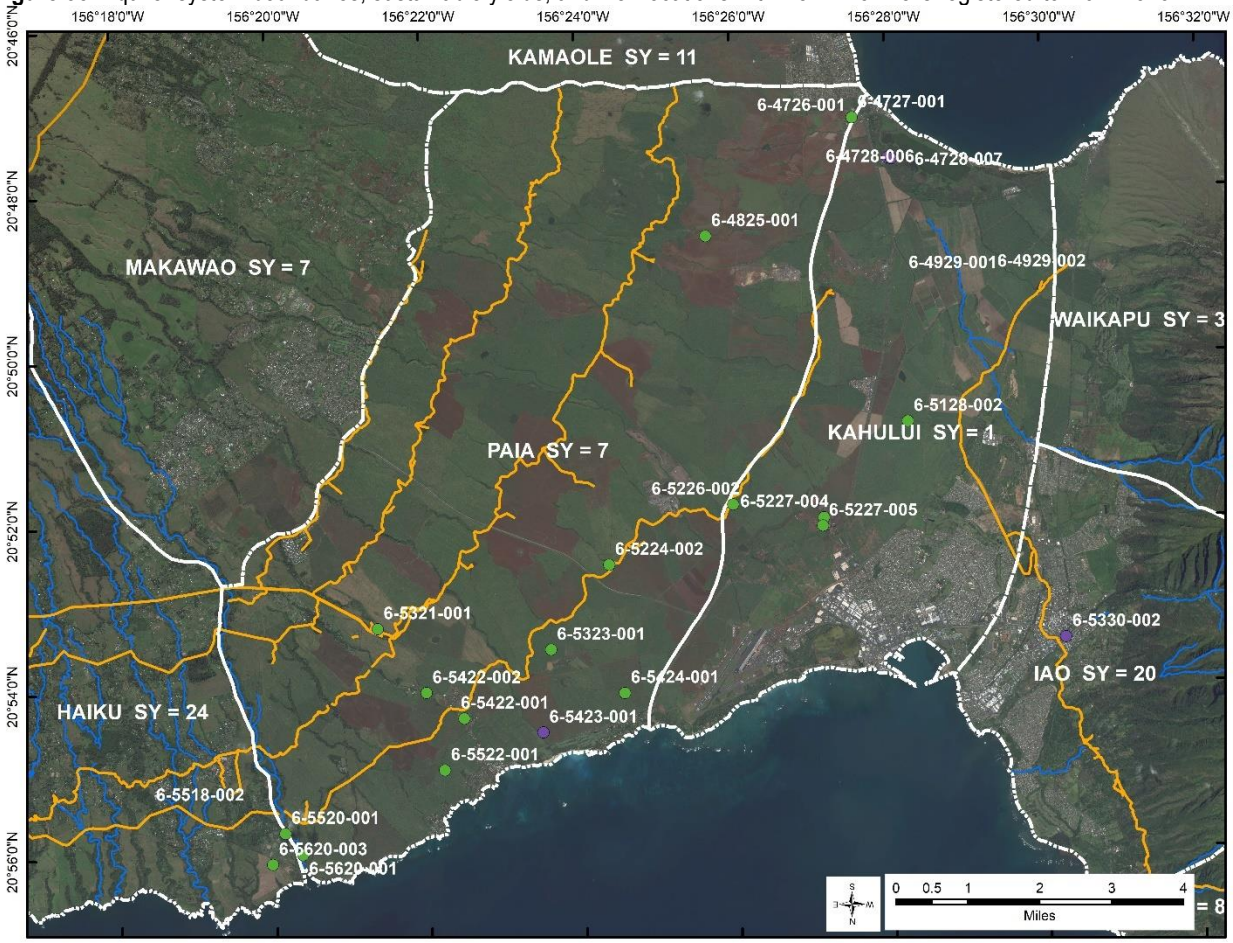
Mahi Pono Groundwater Sources

Mahi Pono operates two wells in the Kahului aquifer system which service the Maʻalaea fields in combination with surface water from West Maui streams. These wells do not service the fields supplied by surface water from East Maui. Mahi Pono operates nine wells in the Paia aquifer system and one well in the Haʻiku aquifer system which is combined with surface water to support non-potable irrigation demand (Table 20). From 2017-2022, the 5-year average pumpage from the Paia aquifer system was 0.534 mgd. Mahi Pono does not have any wells in the Makawao aquifer system. Historic pumping rates from the Haiku, Paia, and Kahului aquifers was possible because of the large volumes of imported surface water that augmented recharge in the region. With the reduction in recharge associated with reduced irrigation usage, these historic pumping rates are not sustainable. Given the current (2021) 12-month moving average of pumpage, there is approximately 4.5 mgd available from the Paia aquifer system, where most of Mahi Pono wells are located (Figure 35). Almost all wells are located at the lowest elevation ditch (Haiku Ditch) and could not be used to service the upper fields.

Table 20. Wells registered to Mahi Pono servicing their irrigation needs of the Central Aquifer Sector, current (2021) 12-month moving average (MAV) pumpage, and 5-year average pumpage. [million gallons per day, mgd]

Well ID	Well name	Aquifer System	2021 12-month MAV (mgd)	2017-2022 5-year average pumpage (mgd)
6-4825-001	Kihei Shaft	Paia	<0.001	0.000
6-5323-001	Paia-Pump 2	Paia	0.001	0.001
6-5321-001	Kaheka-Pump 18	Paia	0.000	0.000
6-5520-001	Maliko Pump 11	Paia	0.000	0.000
6-5522-001	Kuau Pump 12	Paia	0.295	0.236
6-5422-001	Paia Mill-Pump 13	Paia	0.373	0.298
6-5422-002	Paia-Pump 17	Paia	0.000	0.000
6-5424-001	HC&S 4	Paia	0.000	0.000
6-5226-002	Puunene-Pump 6	Paia	0.000	0.000
6-5520-001	Maliko Pump 11	Haiku	0.000	0.000
6-5224-002	Puunene-Pump 9	Kahului	0.000	0.001
6-5128-002	Waikapu Sh-Pump 7	Kahului	0.181	0.106

Figure 35. Aquifer system boundaries, sustainable yields, and well locations with well ID for wells registered to Mahi Pono.



Commission staff do not recommend increase usage of groundwater resources which are available to Mahi Pono as an alternative to surface water due to the discontinuation of large-scale furrow irrigation, limited use of unlined reservoirs historically contributed to artificial recharge of the Paia and Kahului aquifer systems. This artificial recharge allowed past pumpage from these aquifers to greatly exceed the estimated sustainable yield. Without one or more deep monitoring wells to verify aquifer conditions, Commission staff do not recommend pumpage exceeding the sustainable yield.

Based on the information presented, it appears that increasing reliance on ground water while simultaneously reducing surface water supplies may not be a feasible alternative. For Maui DWS, additional water is available from the Makawao aquifer system; however, the high cost of pumping to meet Upcountry demands may be financially burdensome on Maui’s limited customer base. Maui DWS should continue to explore water source development alternatives as technology advances.

IMPLICATIONS OF WATER RESERVATION

Should the Commission approve this water reservation, the water reservation will be documented in the Water Resource Protection Plan, along with the prior-approved water reservations. The reservation will be included in the calculation of authorized planned use for consideration in water management area designation. Upon the designation of any of the hydrologic units as surface water management areas, staff will initiate review and rule-making pursuant to HRS §174C-49(d) and Hawaii Administrative Rule §13-171-60(b).

The utilization of 15.24 (cfs) (9.85 mgd) of surface water from the Nāhiku, Keʻanae, and Honomanū streams by DHHL represents 22% of the estimated 70 cfs natural medium (Q_{50}) streamflow available and 100% of the estimated 7.8 cfs natural low (Q_{95}) streamflow available. Under low-flow conditions, the entirety of the DHHL reservation will not be available due to a lack of streamflow and the domestic water needs supplied by Maui DWS.

RECOMMENDATIONS

The 2018 Decision & Order had a goal of being realistically implemented, measurable, understood by stakeholders, and to reasonably accommodate non-instream uses under the current conditions, such that on-going monitoring can be used to adapt to changing circumstances. Staff have considered these tenets in its recommendations presented here.

1. Reservation of Non-Potable Water for Department of Hawaiian Home Lands

ACTION 1.1: Staff recommends that the Commission approve a surface water reservation of 15.24 cfs (9.85 mgd) for the Department of Hawaiian Home Lands (DHHL) to meet their foreseeable future non-potable water needs in Central Maui serviced by the East Maui Irrigation System from the Nāhiku, Keʻanae, and Honomanū Streams.

IMPLEMENTATION

- Staff will coordinate between DHHL and East Maui Irrigation/Mahi Pono, to transport the recommended reservation of water to DHHL developments when the demand exists.
- Staff recommends that DHHL, EMI, and Maui DWS coordinate management during drought conditions and that a water shortage plan be adopted.

2. Summary of Recommendations to Protect Instream Uses

Commission staff make the following conclusions that differ from the 2018 Decision & Order in CCH-MA13-01:

1. The terminal reach waterfall on Waikamoi limits the upstream migration of amphidromous species and restricts the utility of Waikamoi as a habitat stream.

2. The full restoration of streamflow in Waiohue and West Wailuaiki from 2016 to 2022 has not increased the abundance of amphidromous species at the stream mouth or at the upper reaches relative to abundances observed in 2010 and 2011. However, staff recommends 80% of BFQ_{50} for restoration given the declines in rainfall in order to provide greater instream flows for recreational, aesthetic, aquatic, and cultural practices.

Staff recommendations the following amended interim IFS:

WAIKAMOI (6047) RECOMMENDATION

ACTION 2.1: Amend the interim IFS on Waikamoi Stream just above the Hana Highway to 0.26 cfs (0.17 mgd).

Staff recommends that one measurable instream IFS be established for Waikamoi Stream below all EMI diversions and just above Hana Highway, near an altitude of 550 feet, shall be established at an estimated flow of 0.26 cfs (0.17 mgd), representing a connectivity flow, or 20% of the Q_{75} flow or estimated BFQ_{50}. The following tables provides a comparison of flow duration statistics using the differing periods of record, and the timeline of management decisions related to Waikamoi Stream.

Q_{50}		Q_{75}		Q_{95}	
1942-2001	1984-2013	1942-2001	1984-2013	1942-2001	1984-2013
7.0	6.6	3.5	1.3	1.1	0.22

2010 Interim IFS	2018 Decision & Order	2022 Recommendation
2.8 cfs (1.81 mgd) wet season 0.0 cfs (0.00 mgd) dry season	H_{90} flow (64% of BFQ_{50}) = 3.8 cfs (2.46 mgd)	20% BFQ_{50} (regulated Q_{75}) for connectivity = 0.26 cfs (0.17 mgd)

IMPLEMENTATION

- Staff will continue to maintain a continuous monitoring station on Waikamoi Stream at Hana Highway (CWRM 6-67).

ENFORCEMENT

- Staff will continue to work with the diversion operator to maintain the interim IFS at all times. Failure to meet the interim IFS will result in potential fines related to the severity of the violation.

HONOMANŪ (6051) RECOMMENDATION

ACTION 2.2: Amend the interim IFS on Honomanū Stream just above the Hana Highway to eliminate the interim IFS and reflect the full restoration of streamflow at Banana Falls intake (Diversion 302), Center Falls Intake (Diversion 300), and High Falls Intake (Diversion 301).

Staff recommends the abandonment of Diversion 302 (Banana Falls Intake, S-2), Diversion 300 (Center Falls Intake, S-3), and Diversion 301 (High Falls Intake, S-5) and full flow restoration at these locations to support instream values. The interim IFS as established in the 2018 Decision & Order will be abandoned. The following tables provides a comparison of flow duration

statistics using the differing periods of record (in cfs), and the timeline of management decisions related to Honomanū Stream.

Q_{50}		Q_{75}		Q_{95}	
1942-2001	1984-2013	1942-2001	1984-2013	1942-2001	1984-2013
5.7	3.8	2.8	1.6	1.1	0.47

2010 Interim IFS	2018 Decision & Order	2022 Recommendation
0.0 cfs (0.00 mgd)	H_{90} flow (64% of BFQ_{50}) = 4.2 cfs (2.71 mgd)	Full restoration at 3 of 4 diversions

IMPLEMENTATION
- EMI will submit the appropriate Stream Diversion Works Permits within 60 days of Commission Action to abandon the diversions.
- CWRM will continue to fund USGS station 16527500 on Honomanu Stream near Hana Hwy to improve our understanding of groundwater-surface water interactions and the consequences of streamflow restoration.

ENFORCEMENT
- Staff will continue to work with the diversion operator to maintain the interim IFS at all times. Failure to meet the interim IFS will result in potential fines related to the severity of the violation.

NUA‘AILUA (6052) RECOMMENDATION

ACTION 2.3: Amend the interim IFS on Nua‘ailua Stream just above the Hana Highway to eliminate the interim IFS and reflect the full restoration of streamflow at Diversion 325 on Nua‘ailua Stream (S-1).

Staff recommends the abandonment of Diversion 325 (S-1) and full flow restoration on Nua‘ailua Stream. The following tables provides a comparison of flow duration statistics using the differing periods of record (in cfs), and the timeline of management decisions related to Nua‘ailua Stream.

Q_{50}		Q_{75}		Q_{95}	
1942-2001	1984-2013	1942-2001	1984-2013	1942-2001	1984-2013
0.56	0.46	0.28	0.22	0.19	0.19

2010 Interim IFS	2018 Decision & Order	2022 Recommendation
3.1 (2.00)	Connectivity = 0.28 (0.18)	Full restoration

IMPLEMENTATION
- EMI will submit the appropriate Stream Diversion Works Permits within 60 days of Commission Action to abandon the diversions.

- CWRM will continue to maintain a continuous monitoring station (CWRM 6-202) on Nua‘ailua Stream near Hana Hwy to improve our understanding of groundwater-surface water interactions and the consequences of streamflow restoration.

ENFORCEMENT

- Staff will continue to work with the diversion operator to maintain the interim IFS at all times. Failure to meet the interim IFS will result in potential fines related to the severity of the violation.

WEST WAILUAIKI (6057) RECOMMENDATION

ACTION 2.4: Amend the interim IFS on West Wailuaiki Stream just above the Hana Highway to 3.60 cfs (2.33 mgd).

Staff recommends that one measurable instream IFS be established for West Wailuaiki Stream just above Hana Highway, near an altitude of 1,235 feet, shall be established at an estimated flow of 3.60 cubic feet per second (2.33 million gallons per day). This flow represents 80% of the Q_{75} flow or the estimated median baseflow (BFQ_{50}). The following tables provides a comparison of flow duration statistics using the differing periods of record (in cfs), and the timeline of management decisions related to West Wailuaiki Stream.

Q_{50}		Q_{75}		Q_{95}	
1942-2001	1984-2013	1942-2001	1984-2013	1942-2001	1984-2013
10	8.9	6.0	4.5	3.0	2.2

2010 Interim IFS	2018 Decision & Order	2022 Recommendation
3.8 cfs (2.46 mgd) wet season 0.4 cfs (0.26 mgd) dry season	Full restoration	80% of Q_{75} (BFQ_{50}) = 3.60 cfs (2.33 mgd)

IMPLEMENTATION

- In order to meet the interim IFS, staff propose that EMI increase the invert of the transmission ditch from West Wailuaiki Stream to the gravel trap to maintain the interim IFS in the stream at all times.
- CWRM will continue to fund USGS station 16518000 on West Wailuaiki Stream at 1,550 ft to improve our understanding of climate change impacts to watershed hydrology
- CWRM will continue to maintain a continuous monitoring station (CWRM 6-65) on West Wailuaiki Stream near Hana Hwy to improve our understanding of groundwater-surface water interactions and the consequences of streamflow restoration.

ENFORCEMENT

- Staff will continue to work with the diversion operator to maintain the interim IFS at all times. Failure to meet the interim IFS will result in potential fines related to the severity of the violation.

WAIOHUE (6060) RECOMMENDATION

ACTION 2.5: Amend the interim IFS on Waiohue Stream just above the Hana Highway to 2.96 cfs (1.91 mgd).

Staff recommends that one measurable instream IFS be established for this stream. The proposed interim IFS for Waiohue Stream below Diversion 280 near an altitude of 1,295 feet, shall be established at an estimated flow of 2.96 cubic feet per second (1.91 million gallons per day). This flow represents 80% of the Q_{75} flow or the estimated median baseflow (BFQ_{50}).

Q_{50}		Q_{75}		Q_{95}	
1942-2001	1984-2013	1942-2001	1984-2013	1942-2001	1984-2013
6.2	5.2	5.0	3.7	3.0	3.2

2010 Interim IFS	2018 Decision & Order	2022 Recommendation
3.2 cfs (2.10 mgd) wet season 0.1 cfs (0.06 mgd) dry season	Full restoration	80% of Q_{75} (BFQ_{50}) = 2.96 cfs (1.91 mgd)

IMPLEMENTATION

- In order to meet the interim IFS, staff propose that EMI increase the invert of the transmission ditch from Waiohue Stream to the gravel trap to maintain the interim IFS in the stream at all times.
- CWRM will continue to maintain a continuous monitoring station (CWRM 6-64) on Waiohue Stream near Hana Hwy to improve our understanding of groundwater-surface water interactions and the consequences of streamflow restoration.

ENFORCEMENT

- Staff will continue to work with the diversion operator to maintain the interim IFS at all times. Failure to meet the interim IFS will result in potential fines related to the severity of the violation.

All other implementation and monitoring from the 2018 Decision and Order not explicitly amended herein, shall still remain intact and be fully enforceable.

Ola i ka wai,

M. KALEO MANUEL
Deputy Director

APPROVED FOR SUBMITTAL:

SUZANNE D. CASE
Chairperson