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

COMMISSION ON WATER RESOURCE MANAGEMENT

June 15, 2021
Honolulu, Hawaiʻi

Approve Order to Honolulu Board of Water Supply to Bulkhead
Haʻikū Tunnel (Well No. 2450-001) at the 10-foot Thick Dike 1,200 feet
From the Portal Entrance and Reduce Their Withdrawal to 0.3 million gallons per day
Heʻeia Hydrologic Unit, Koʻolaupoko, Oʻahu

SUMMARY OF REQUEST

Staff is requesting the Commission on Water Resource Management (Commission) consider the recommendations for improving high-elevation aquifer storage in the Koʻolaupoko Aquifer System for protecting instream uses in Heʻeia Stream affected by groundwater withdrawals from Haʻikū Tunnel by bulkheading Haʻikū Tunnel (Well No. 2450-001) at the 10-foot thick dike 1,200 feet from the portal entrance. As an interim solution, until the bulkheading is installed, Honolulu Board of Water Supply (HBWS) will reduce their withdrawal from 1.0 million gallons per day to 0.3 million gallons per day, with the resulting difference supporting streamflow.

LOCATION MAP: See Figure 1

LEGAL AUTHORITY

Under the Code, the Commission has the responsibility of establishing IFS on a stream-by-stream basis whenever necessary to protect the public interest in the waters of the State. In the 2000 appellate ruling on the first Waiāhole Ditch Contested Case Decision and Order ("*Waiāhole* I"), the Hawaiʻi 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 Hawaiʻi 97, 148, 9 P.3d 409, 460 (2000). 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"). 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).

"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.

"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.

The analysis for protecting instream uses incorporates a balancing of the public trust uses with reasonable and beneficial uses. In the Heʻeia hydrologic unit, a number of community organizations, public groups, and private individuals who engage in cultural practices, including the growing of kalo, the gathering of medicinal plants and aquatic animals, and engaging in hula, have expressed their concern regarding the diminished flow in Heʻeia Stream. Reductions in streamflow have also limited: (1) the productivity of the Heʻeia fishpond, which has three mākāhā; (2) the vitality of the wetland, which historically supported hundreds of acres of loʻi; (3) habitat for native endemic wildlife, and habitat for native aquatic biota; and (4) recreational value of Heʻeia Stream. In *McBryde Sugar Co v. Robinson,* the Hawaiʻi 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 Hawaiʻi 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 Hawaiʻi at 133, 9 P.3d at 445. The Hawai‘i 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 '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*

[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.)

Contested Case Hearing ("*Nā Wai `Ehā*"), 128 Hawaiʻi 228, 258, 287 P.3d 129, 159 (2012)), *citing In re Water Use Permit Applications* ("*Waiāhole II*"), 105 Hawaiʻi 1, 11, 93 P.3d 643, 653 ((2004)); and HRS §174C-71((2))((A)).

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 "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 Hawaii 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 Hawaiʻi at 155 n. 60 p.13.

In developing the recommendations, staff has attempted to remain consistent in weighing all the instream and noninstream uses of each stream based upon the best available information presented in the Instream Flow Stream Assessment Report (IFSAR), along with the oral and written comments received through the public review process. 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 any decision. 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 Hawaiʻi State Water Code (HRS chapter 174C), and the statutes which are used to implement these laws (HRS) are applied equally.

The assessment of instream uses for windward Oʻahu began with the Waiāhole Ditch Combined Contested Case Hearing (CCH-OA95-1), which concluded with the 2006 Decision and Order by the Commission and with its final appeal to the Intermediate Court of Appeals concluded in 2010. In this submittal, the Commission will address the interim IFS for one stream in windward Oʻahu in the Heʻeia (3028) hydrologic unit (Figure 1). This submittal is based on the best available information provided by the IFSAR, the information in the draft recommendations presented to and discussed by the Commission at the regularly scheduled Commission meeting on January 19, 2021, and subsequent data provided by the HBWS to the Commission.

[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] Commission on Water Resource Management. 1997. CCH-OA-95-01.

HISTORIC CONTEXT

The lands of the Heʻeia Ahupuaʻa were some of the most agriculturally productive lands on the island of Oʻahu. Frequent rainfall and favorable geology provided sufficient baseflow to support extensive loʻi complexes across the broad fertile valleys with spring flow providing further support to many complexes around the large inland wetland. The productivity was also attributed to the extensive water system that distributed surface water throughout the ahupuaʻa. Further, coastal geology provided the perfect setting to support a large fishpond at the stream mouth. The abundant agriculture supported a large population center which developed a unique and rich cultural heritage.

Following the Great Māhele, changes in the socio-political environment led to a transition from predominantly kalo production managed by Hawaiian communities to the cultivation of sugarcane, pineapple, rice, and then cattle grazing managed by immigrant communities. Produce (i.e., truck crops) were grown for the growing urban population in Honolulu.

In 1940, the suburban water utility for windward Oʻahu built the Haʻikū Development Tunnel ("Haʻikū Tunnel"; well 2450-001) in Haʻikū Valley as a municipal water supply for the growing urban population of the Kāneʻohe area. Tunnel construction decreased the baseflow in Heʻeia Stream[4] as well as Kahaluʻu Stream in the neighboring valley[5]. Following the consolidation of all suburban water utilities in 1959, the Honolulu Board of Water Supply (HBWS) assumed operation of the Haʻikū Tunnel. The tunnel is bulkheaded 600 feet from the portal, restoring a small part of the original storage. However, in 1971, USGS recommended an additional bulkhead installed at the 10-foot dike 1,200 feet from the portal to more fully restore the storage capacity of the high elevation aquifer[6].

In 1981, the HBWS built the Haʻikū Well (well 2450-002) to supplement the water supply of the area with an installed pump capacity of 1.008 mgd.

In 1987, with the passage of the State Water Code (HRS 174C), all wells and stream diversions had to be registered with the Commission on Water Resource Management (Commission) by May 31, 1989. While no registrations were received by the Commission in the Heʻeia hydrologic unit by this deadline, in 1992, the Hawaiʻi Community Development Authority (HCDA) provided documentation to register a diversion and ʻauwai that had been historically used for taro farming (Table 1). Additional fieldwork has verified the use of a second diversion and ʻauwai (Hop Tuk).

In 2011, Act 210 established the Heʻeia Community Development District (HCDD), a district under HCDA, consisting of 409 acres of land. Of the total 409 acres, 46 were acquired by the

[4] Hirashima, G.T. 1971. Tunnels and dikes of the Koolau Range, Oahu, Hawaii, and their effect on storage depletion and movement of ground water. U.S. Geological Survey Water-Supply Paper 1999-M.
[5] Hirashima, G.T. 1962. Effect of the Haiku Tunnel on Kahaluu Stream, Oahu. U.S. Geological Survey Professional Paper 450-C.
[6] Hirashima, G.T. 1971.

HCDA through a land exchange with Bishop Estate (now known as Kamehameha Schools, KS). HRS § 206E-201. The act established HCDD as the redevelopment authority to facilitate culturally appropriate agriculture, education, and natural-resource restoration and management of the He‘eia wetlands[7]. This arrangement was in alignment with the HBWS' Ko‘olaupoko Watershed Management Plan and the City and County of Honolulu's Ko‘olaupoko Sustainable Communities Plan. However, a lack of streamflow has continued to affect instream uses, including traditional and customary gathering practices, the cultivation of taro, estuarine ecosystem services, and the productivity of the fishpond.

Table 1. Registrant, diversion ID, diversion name, stream, and additional information in the He‘eia hydrologic unit, Windward Oahu.

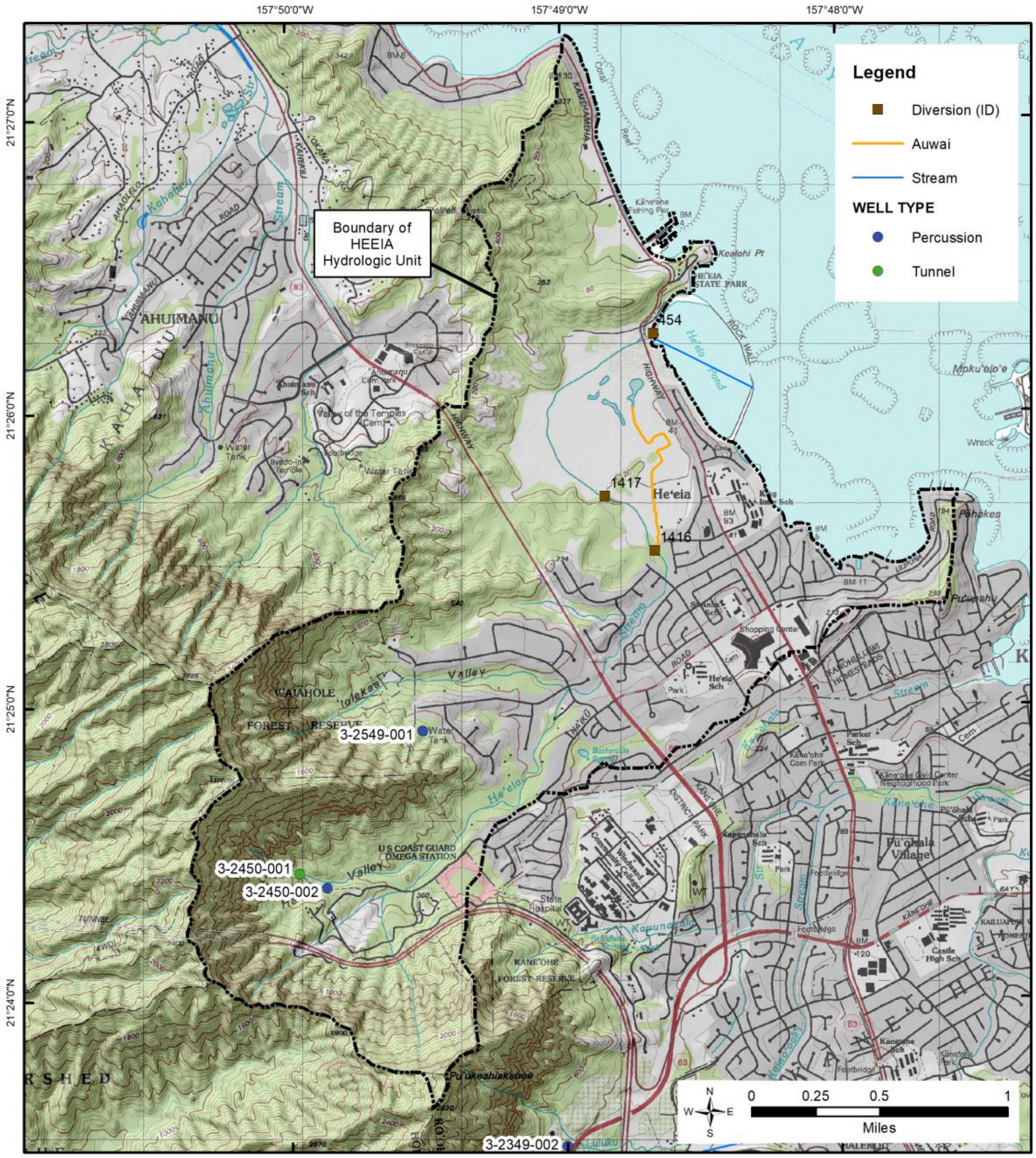
registrant	diversion ID	diversion name	stream name	additional information
HCDA	1416	Wing Wo Tai Intake	He‘eia	‘auwai also captures spring flow
HCDA	1417	Hop Tuk Intake	He‘eia	original ‘auwai restored in 2019
HAW ISLE SEA	454	Fishpond Intakes (x3)	He‘eia	Single registration but three intakes to regulate inflow into He‘eia fishpond

HYDROGEOLOGIC CONTEXT

The surface water hydrologic unit of He‘eia is in the Ko‘olaupoko aquifer system as part of the Windward Aquifer Sector. He‘eia is composed of two valleys: Ha‘ikū and ‘Ioleka‘a. The geology of Ha‘ikū Valley is a heterogeneous composition of rocks from various volcanic events. The basement geology is composed of Ko‘olau Basalt of high permeability, interlaced with low permeable interconnected dikes. On top of this is older alluvium of low permeability, followed by a massive lava flow of the Honolulu Volcanic Series with low permeability, pyroclastics of the Honolulu Volcanic Series of high permeability, and then deposits of younger alluvium, colluvium, and lava flows with higher permeability[8]. The low permeability of certain layers generates substantial lateral movement of groundwater in the valley, particularly at the interface of the Honolulu Volcanics and older alluvium layers, discharging into streams as spring flow (Figure 2). The water accumulated in dike compartments commonly discharges into the stream or as spring flow where incision has exposed the compartment. In the Ha‘ikū Tunnel, a bulkhead was placed at the site of a dike 600 feet from the portal, restoring a small amount of the original storage[9]. Hirashima (1971) suggested that to increase storage, an additional bulkhead should be installed and valved separately at the site of the 10-foot dike approximately 1,200 feet from the portal.

[7] He‘eia Community Development District Plan & Rules. Draft Report. October, 2018. Prepared by Townscape, Inc.
[8] Stearns, H.T. Vaksvik, K.N. 1935. Geology and ground-water resources of the island of Oahu, Hawaii. U.S. Geological Survey Division of Hydrography. Bulletin 1.
[9] Hirashima, G.T. 1971.

Figure 1. The He‘eia hydrologic unit, stream, wells, registered diversions and ‘auwai system, windward O‘ahu.



Large quantities of water have been drained from storage by the construction of horizontal tunnels and the current rate of discharge is a fraction of the rate at full storage[10]. In addition to the basal aquifer, Ha‘ikū Valley has two higher elevation aquifers: one with a potentiometric surface above ground level in the alluvium or pyroclastics of the Honolulu Volcanics; and a second at 170 feet below ground level (i.e., 155 feet a.m.s.l.) in the dike compartment of the

[10] Hirashima, G.T. 1971.

Koʻolau Basalt[11]. The two aquifers are separated by the thick basalt lava flow of the Honolulu Volcanics.

South of Waiāhole Stream, the crest of the Koʻolau Range is southwest of the rift zone, within the marginal dike zone. The marginal dike zone is characterized by more widely spaced dikes (e.g., tens to hundreds of feet apart) compared to the rift zone (e.g., inches to feet apart). As a result, the recession constant for the Haʻikū Tunnel located in the marginal dike zone (0.00436) is 2- to 4-times that of the development tunnels built for the Waiāhole Ditch Irrigation System (ranging from 0.001-0.00203), indicating that water recharge and withdrawal occurs at much faster rates (and similar to the Waiheʻe Tunnel). As the Haʻikū Tunnel was under construction (at an elevation of 550 feet), a flow of 11.3 mgd was discharged under pressure behind a 10 foot thick dike, indicating a water level of approximately 700 feet in elevation in the compartment[12]. The dewatering of the Tunnel disrupted the natural balance of groundwater storage, lowering the discharge into the stream at higher points in the stream channel. During construction of the Haʻikū Tunnel in November and December 1940 and continuing for several months in 1941, the large quantity of storage was depleted from the high-elevation aquifers. Springs ceased to flow and subsequent flow in Heʻeia Stream decreased. Continued drainage even decreased the flow of Kahaluʻu Stream 2.5 miles north of Haʻikū Valley by 26 percent[13]. A detailed description of the groundwater occurrence, movement, and interactions with surface water in this area is described by Nichols et al. (1996)[14].

SURFACE FLOW

Streamflow conditions have been monitored in the Heʻeia hydrologic unit at USGS station 16275000 from 1911-1919, from 1939-1977, and from 1982-present. The Haʻikū Tunnel was constructed in 1940 and 1941 for municipal water supply, draining high-elevation aquifers that supported groundwater discharge to Heʻeia Stream. Prior to tunnel development in October 1940, the groundwater system equilibrium discharged approximately 3.28 cfs (2.11 mgd) to the stream above 272 feet in elevation at USGS 16275000 (Table 2). Hirashima (1971) estimated the average base flow in Heʻeia stream as 2.0 mgd. The artificial reduction in groundwater storage following tunnel construction and groundwater withdrawal reduced the groundwater discharge to the stream by approximately 50%. The mean daily flow and low-flow duration discharge characteristics before and after tunnel construction reflect this decline in baseflow (Table 2 and Figure 3).

[11] Izuka, S.K., Hill, B.R., Shade, P.J., Tribble, G.W. 1993. Geohydrology and possible transport routes of polychlorinated biphenyls in Haiku Valley, Oahu, Hawaii. U.S. Geological Survey Water-Resources Investigations Report 92-4168.
[12] Takahashi, K.J., Mink, J.F. 1985. Evaluation of major dike-impounded ground-water reservoirs, island of Oahu. U.S. Geological Survey Water-Supply Paper 2217.
[13] Hirashima, G.T. 1962.
[14] Nichols, W.D., Shade, P.J., Hunt Jr., C.D. 1996. Summary of the Oahu, Hawaii, regional aquifer-system analysis. U.S. Geological Survey Professional Paper 1412-A.

Figure 2. Cross-section depiction of the geology of Ha‘ikū Valley with marginal dike zone and dike complex areas identified providing context for the groundwater-surface water interactions, Windward O‘ahu. (Source: Izuka et al. 1993)

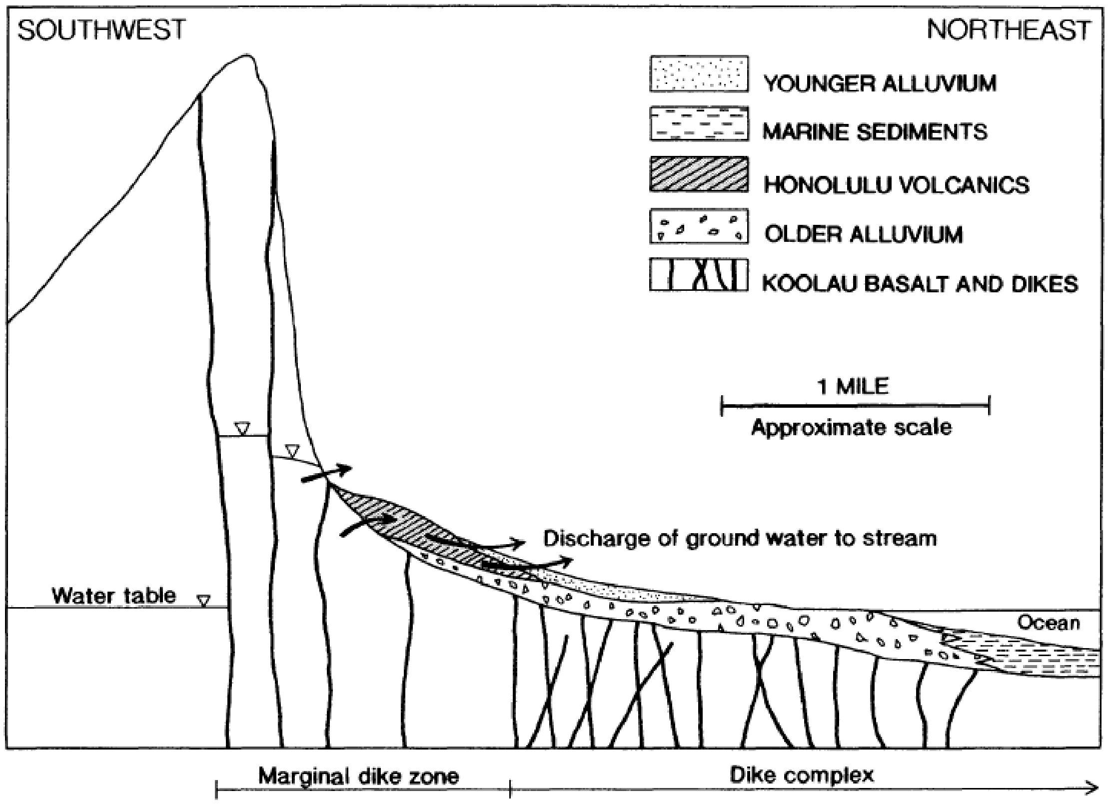


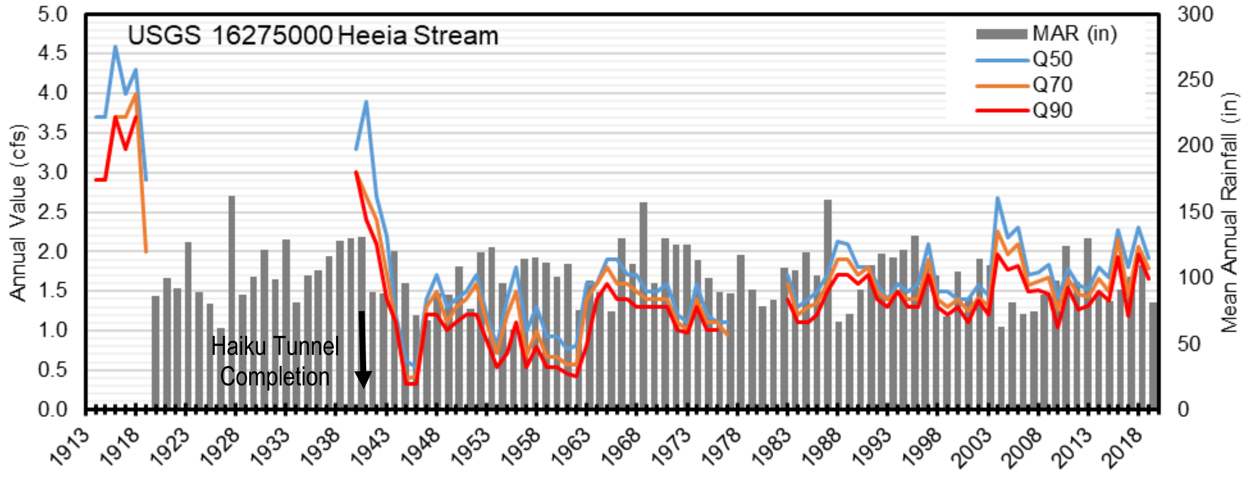
Table 2. Estimated mean daily flow, median (Q_{50}) and low flow (Q_{60} to Q_{95}) values for He‘eia stream at USGS 16275000 before (1911-1940) and after (1941-present) Ha‘ikū Development Tunnel (well 2450-001) construction in the He‘eia hydrologic unit on Windward Oahu. [cfs = cubic feet per second; mgd = million gallons per day]

time period	median baseflow	mean daily flow	discharge (Q) for a selected percentage ($_{xx}$) discharge was equaled or exceeded			
			Q_{50}	Q_{70}	Q_{90}	Q_{95}
1914-1940	3.28 (2.11)	4.5 (2.94)	3.7 (2.39)	3.3 (2.13)	2.9 (1.87)	2.9 (1.87)
1941-present	1.23 (0.79)	2.6 (1.68)	1.5 (0.97)	1.2 (0.78)	0.43 (0.28)	0.36 (0.23)
1989-2019	1.48 (0.96)	2.4 (1.58)	1.7 (1.12)	1.5 (0.98)	1.3 (0.84)	1.26 (0.81)

OTHER HYDROLOGIC CONSIDERATIONS

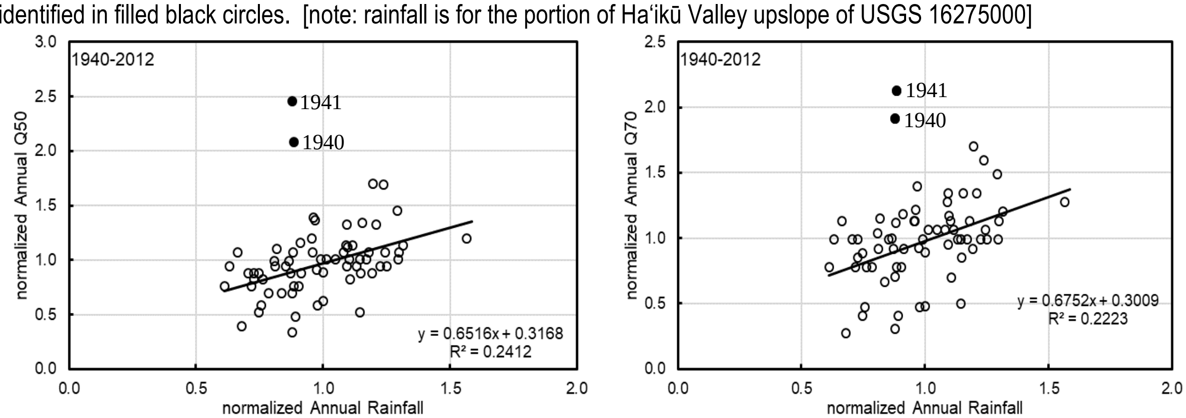
Groundwater-surface water interactions influence the extent of gaining and losing stream reaches. A gaining reach is where the streambed intersects the underlying water table and groundwater contributes to streamflow as seepage or springs. A losing reach is where the streambed is above the water table and surface water infiltrates the streambed recharging the aquifer. The extent of groundwater contributions to streamflow influence median and low-flow statistics. While overlapping rainfall and streamflow data are sparse prior to tunnel development, the years 1940 and 1941 are obvious outliers when normalized annual rainfall is compared to normalized annual Q_{50} or Q_{70}, indicating an anomalous amount of baseflow relative to rainfall compared to data from the post-tunnel construction time period (Figure 4).

Figure 3. Annual Q_{50}, Q_{70}, and Q_{90} values (in cubic feet per second, cfs) for Heʻeia stream at USGS 16275000 and mean annual rainfall from 1920-2012 (from Frazier and Giambelluca, 2012). Haʻikū Tunnel was constructed from October 1940 to March 1941



The Haʻikū Tunnel withdraws water at an elevation of 550 feet. Most, if not all the groundwater withdrawal from the tunnel would have supported surface flow during equilibrium conditions (pre-tunnel construction)[15] and can be estimated based on the change in baseflow (Table 2).

Figure 4. Normalized annual rainfall vs normalized annual Q_{50} (left) and Q_{70} (right) from 1940-2012. Points for 1940 and 1941 identified in filled black circles. [note: rainfall is for the portion of Haʻikū Valley upslope of USGS 16275000]



Heʻeia Stream gains streamflow via groundwater seepage as it flows from mauka to makai. During selected periods of time, the USGS made synoptic measurements (simultaneous point measurements) at locations during low-flow conditions. These "seepage" measurements are used to quantify the gains and losses of streamflow due to interactions with the groundwater system. Many measurements were made in the early 1940s and early 1960s, and again in the late 1980s. Using the upstream and downstream measurements, and the length of stream channel between the measurements, estimates of gains and losses of streamflow can be calculated. Overall, Heʻeia Stream is gaining flow below the Haʻikū Tunnel to its confluence with the ʻIolekaʻa Stream at an elevation of 140 feet, corresponding to the stream channel incising the Honolulu Volcanics in Haʻikū Valley.

[15] Hirashima, G.T. 1962.

Gains in streamflow ranged from 10.0 to 13.2 cfs per mile of channel (6.64 to 8.53 mgd per mile) at higher elevations and between 6.0 to 0.23 cfs per mile (4.0 to 0.16 mgd per mile) of channel at middle elevations. Total net gain in seepage from 570 feet in elevation to the marsh at 95 feet in elevation is approximately 7.0 cfs (4.5 mgd). This is further supported by the 8.34 cfs (5.39 mgd) measured on 9/20/2018 and 10.33 cfs (6.68 mgd) measured on 11/16/2018 above the Hop Tuck Intake in Heʻeia Marsh when mean daily flow was measured as 2.17 cfs (1.40 mgd), and 2.51 cfs (1.62 mgd) at USGS station 16275000; resulting in stream gains of 6.17 cfs (3.99 mgd) and 7.82 cfs (5.05 mgd), respectively, including surface water inflow from ʻIolekaʻa Stream.

CLIMATE CHANGE

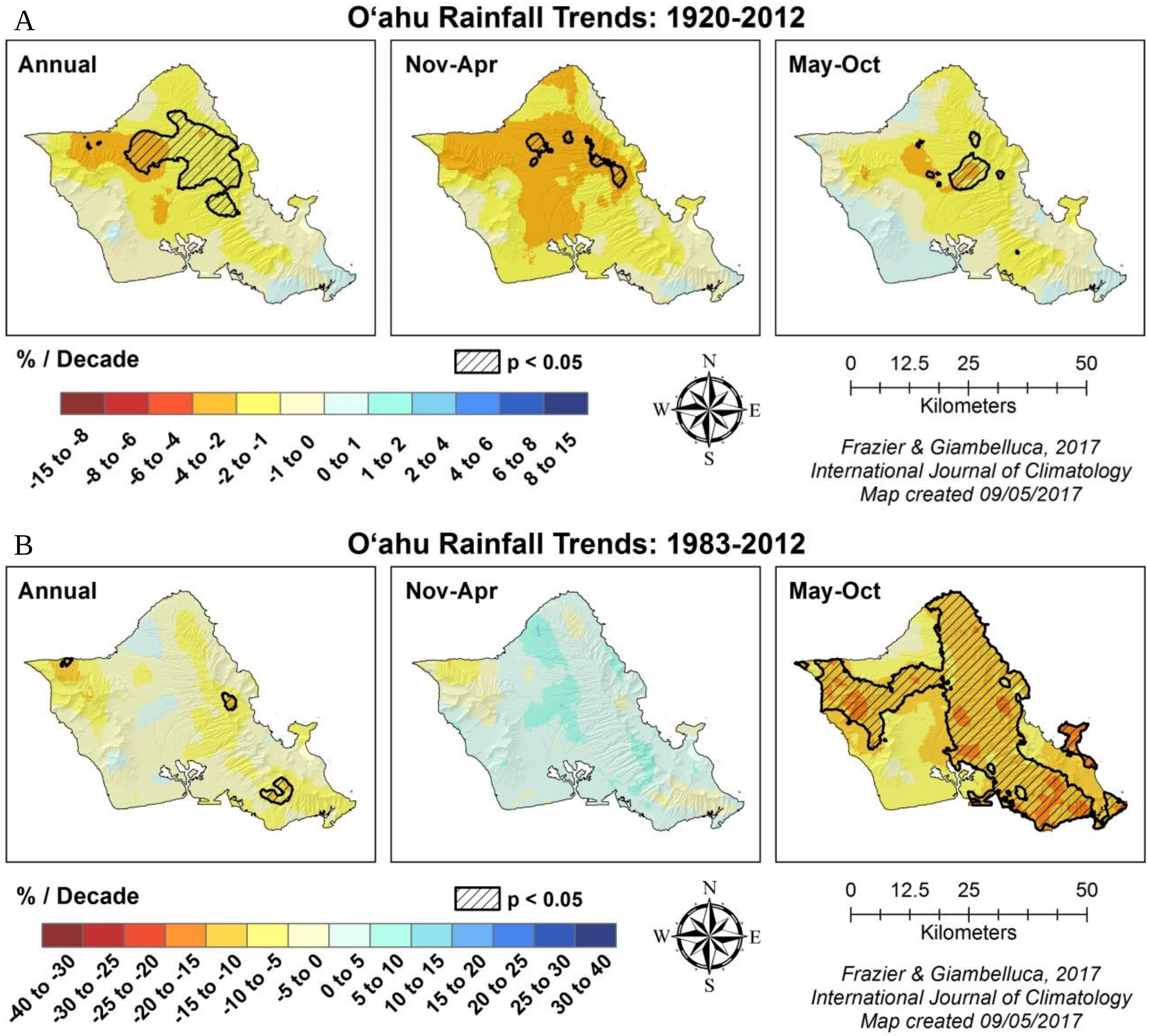
Long-term (1920-2012) and recent (1983-2012) trends in rainfall indicate significant declines in rainfall across certain areas of windward Oʻahu (Figure 5), particularly during the dry season. However, there has been minimal change in rainfall within the Heʻeia hydrologic unit[16]. Total annual and seasonal rainfall trends indicate no significant ($p > 0.1$) trend in dry season, wet season, or total annual rainfall[17] (Figure 6). Dynamical[18] and statistical[19] downscaled rainfall estimates for the mauka portion of Heʻeia watershed (i.e., above USGS 1627500) for current and future projected changes in rainfall are provided in Table 5. Overall, end-of-century annual and seasonal rainfall is projected to increase in Heʻeia based on the dynamical downscaled data and projected to decrease based on the statistical downscaled data.

ISSUES/ANALYSIS

The next step to developing an IFS is to weigh often-competing instream and noninstream uses of water against the amount of water available to accommodate the needs of these uses. Again, the quantity and quality of information varies from stream to stream. This step is further complicated by the tremendous variability of instream and noninstream uses across and within surface water hydrologic units. For example, one stream may support extensive kalo cultivation while another may primarily support domestic uses. The potential of the stream and hydrologic unit to support additional water use in the future has also been considered, as has the four public trust purposes of water. The process is to be based upon best available information when weighing the present or potential, instream and noninstream uses in order to provide balance.

[16] Frazier, A.G. Giambelluca, T.W. 2017. Spatial trend analysis of Hawaiian rainfall from 1920 to 2012. International Journal of Climatology, 37(5): 2522-2531.
[17] Non-parametric Mann-Kendall trend test for hydrologic time-series with Sen's slope estimate: dry season rainfall (Z_{90} = -0.63; Sen's slope Q = -0.019, 95% CI = -0.097, 0.045); wet season rainfall (Z_{90} = -0.47; Sen's slope Q = -0.037, 95% CI = -0.196, 0.117); total annual rainfall (Z_{90} = -0.64; Sen's slope Q = -0.054, 95% CI = -0.238, 0.126)
[18] Zang, C., Wang, Y., Hamilton, K, Lauer, A. 2016. Dynamical downscaling of the climate for the Hawaiian Islands. Part II: Projection for the Late Twenty-first Century. Journal of Climate, 29:8333-8354.
[19] Elison Timm, O., Giambelluca, T.W., Diaz, H.F. 2015. Statistical downscaling of rainfall changes in Hawaii based on the CMIO5 global model projections. Journal of Geophysical Research: Atmospheres, 120:92-112.

Figure 5. Annual, wet season (Nov-Apr) and dry season (May-Oct) rainfall trends for the 1920-2012 (A) and 1983-2012 (B) periods, Oahu. Hashed line areas represent significant trend over the period. (with permission from Frazier and Giambelluca, 2017)



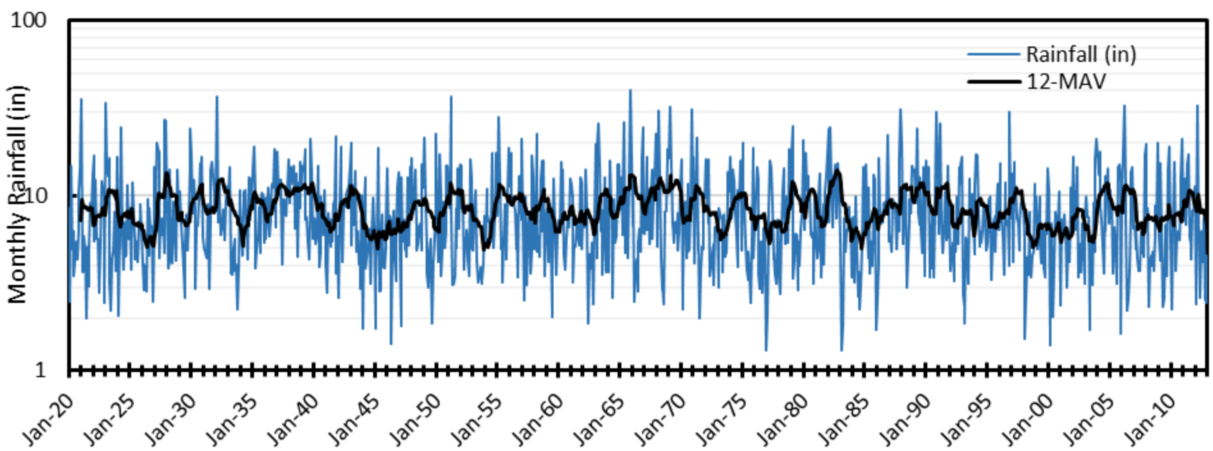
Instream Use Considerations:

The Hawaiian ahupua‘a concept is focused on mauka-to-makai streamflow, with many cultural representations of the stream, including ceremonial and religious traditions tied to flowing water that are severed when connectivity is lost. The resurgence of traditional Hawaiian culture, local food productivity, and the protection of freshwater, wetland, and estuarine habitat for native and endemic species have amplified the need to incorporate a biocultural landscape perspective. Additionally, community awareness of the interconnectivity of the land (‘āina), freshwater (wai) and ocean (kai) resources within an ahupua‘a is pushing resource managers to re-imagine the landscape as an ecologically, economically, and culturally sustainable place.

Table 5. Present day observed rainfall, future mean rainfall, future percent change in rainfall, and future absolute change in rainfall for annual, dry season, and wet season time periods for the 4.5 RCP and 8.5 RCP climate projections in the mauka portion of the He'eia watershed based on dynamical and statistical downscaling. note: values affected by rounding; RCP = Representative Concentration Pathway (Source: A. Frazier, pers. comm)

	Annual		Dry Season		Wet Season	
Present Day Mean (1990-2009) (in)	97.5		39.6		57.2	
Dynamical Downscaling	**RCP 4.5**	**RCP 8.5**	**RCP 4.5**	**RCP 8.5**	**RCP 4.5**	**RCP 8.5**
Future (2080-2100) Mean (in)	100.0	111.8	43.2	51.2	59.6	66.4
Future Percent Change	+8.7%	+14.8%	+8.7%	+29.5%	+4.2%	+16.1%
Present Day Mean (1978-2007) (in)	104.7		43.0		61.7	
Statistical Downscaling	**RCP 4.5**	**RCP 8.5**	**RCP 4.5**	**RCP 8.5**	**RCP 4.5**	**RCP 8.5**
Future (2071-2099) Mean (in)	100.7	99.8	39.3	36.7	61.4	63.1
Future Percent Change	-3.9%	-4.7%	-8.7%	-14.8%	-0.5%	+2.3%

Figure 6. Monthly rainfall for the portion of the watershed that contributes to streamflow measured at USGS 16275000 on He'eia Stream from 1920-2012, He'eia hydrologic unit Oahu. Bold line indicates 12-month moving average (with permission from A. Frazier).



In He'eia, restoration of upland and lowland stream, riparian, and cultural resources by community organizations and non-profit groups has expanded the cultivation of lo'i kalo, the production of aquaculture, and the amount of usable habitat for native biota. Based on historic data and current land ownership, it is likely that 0.014 square miles (9 acres) of wetland lo'i can be grown in Ha'ikū Valley and 0.347 square miles (222 acres) of wetland lo'i could be developed in the He'eia wetland. This would require at least 1.80 mgd of flow through water (1.92 mgd total) based on 0.200 mgd per acre per day in the upland region, much of it supplied by spring flow.

The Heʻeia ahupuaʻa serves as a living laboratory and center for educational opportunities at all levels and ages. The non-profit organization Papahana Kuaʻola leases 63 acres of land from Kamehameha Schools to create an innovative and culturally-minded program of education, land restoration, food production, and environmental sustainability in Haʻikū Valley. Their programs focus on cultural stewardship of the land and water resources, native species restoration, and education.

Kākoʻo ʻŌiwi leases 38 acres of land within the 405 acre Heʻeia wetland owned by HCDA to cultivate loʻi kalo and other culturally important food crops. There is currently one ʻauwai from an unregistered diversion (Hop Tuck Intake) and one ʻauwai from a registered diversion (Wing Wo Tai Intake) supplying sufficient water for three loʻi complexes (approximately 3.5 acres), which is anticipated to grow to 11 acres in the near-term (<5 years) and to as much as 80 acres (<20 years). Kākoʻo ʻŌiwi is experimenting with kalo varieties that require less water to reduce their water demand. Using a consumptive demand of 13,540 gallons per acre per day (gpad) and a flow-through demand of 200,000 gpad, the current instream loʻi kalo water demand is 0.75 mgd, with an anticipated water demand at full implementation of their long-term plan much more. Additional water would be needed to irrigate other food crops grown on site.

The maintenance and restoration of stream and wetland habitat in Heʻeia will benefit from increased streamflow. Historic biota surveys documented by the Division of Aquatic Resources (DAR) has identified numerous endemic species including *Atyoida bisulcata* (ʻōpae kalaʻole), *Eleotris sandwicensis* (ʻoʻopu akupa), *Kuhlia xenura* (āholehole), *Eleotris sandwicensis* (ʻoʻopu nōpili), *Macrobrachium grandimanus* (ʻōpae ʻoehaʻa), *Stenogobius hawaiiensis* (ʻoʻopu naniha) and *Neritina vespertina* (hapawai) in the lower and middle reaches[20]. Decreased flow downstream of the Haʻikū Development Tunnel affects the availability of habitat for these endemic aquatic species, the ability of wetlands to support endangered waterbirds, and the functioning of the nearshore fishpond. Increased streamflow will support the upstream recruitment of post-larvae juveniles of aquatic amphidromous species. Streamflow also benefits the operation of the Heʻeia fishpond at the mouth of the stream by supplying freshwater and nutrients that increase the productivity of the aquatic food chain as well as reduced salinity important for juvenile fish[21].

Other instream uses that must be considered in Heʻeia include the maintenance of water quality (e.g., temperature, dissolved oxygen, transport of sediment and turbidity), the aesthetic value of water flowing in a stream, ecosystem services (e.g., supporting riparian species of value, streambank stability, biogeochemical cycling), and the recreational value to the community.

Noninstream Use Considerations and Availability of Alternative Sources:
The Heʻeia hydrologic unit is part of the Koʻolaupoko aquifer system within the Windward Aquifer Sector. The HBWS water distribution system sources water from across the aquifer

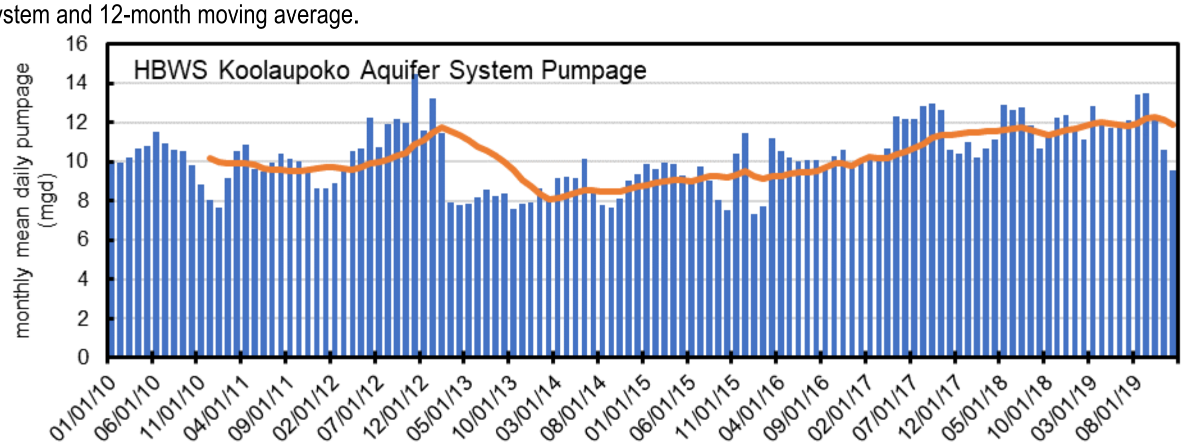
[20] Parham, J.E., Higashi, G.R., Lapp, E.K., Kuamoo, D.G.K., Nishimoto, R.T., Hau, S., Fitzsimons, J.M., Polhemus, D.A., Devick, W.S. 2008. Heʻeia, Oʻahu (Watershed Code 32008). In: Atlas of Hawaiian Watersheds and Their Aquatic Resources. Division of Aquatic Resources, State of Hawaii Department of Land and Natural Resources.
[21] Keala, G., Hollyer, J.R., Castro, L. 2007. Loko iʻa: A Manuel on Hawaiian Fishpond Restoration and Management. College of Tropical Agriculture and Human Resources, University of Hawaiʻi at Mānoa.

system and can deliver water to urban areas within and outside of the hydrologic unit (e.g., Kāne‘ohe, Kailua). In 2000, the HWBS potable water system delivered 19.840 mgd to the Ko‘olaupoko District, which includes the aquifer systems of Ko‘olaupoko, and Waimānalo, and the surface water hydrologic units from Kualoa to Makapu‘u. Based on a slight (4%) decline in the population, the low-, mid-, and high-projected municipal water demand in 2030 for the district is 17.575 mgd, 17.944 mgd, and 18.313 mgd, respectively, from 18.060 mgd in 2000[22]. In 2000, the HBWS system imported 8.838 mgd of groundwater from the Ko‘olauloa District into the Ko‘olaupoko District, but this is projected to decline to 6.600 mgd by 2030 through conservation. The total installed pump capacity in the aquifer system is 14.55 mgd, with 86 wells. Total monthly pumpage from the aquifer system by the HBWS is provided in Figure 7 and summarized in Table 6. From 2010 to 2019, the HBWS mean pumpage from the aquifer system was 10.27 mgd, with a median of 10.20 mgd, and a maximum of 14.44 mgd. The HBWS can offset reductions in withdrawal from any single source with water sourced from other wells. HBWS frequently ceases withdrawals from the Ha‘ikū Tunnel for extended periods of time (Figure 8). From 2013 to 2019, HBWS withdrew water from the Ha‘ikū Tunnel only 42 out of 84 months, with an average of 1.019 mgd and a maximum of 2.064 mgd.

The 2019 update to the Water Resources Protection Plan[23] revised the sustainable yield of the Ko‘olaupoko Aquifer System based on updated information from 30 mgd to 28 mgd. The largest metered water consumers (CY 2009) in the Ko‘olaupoko District for HBWS are identified in Table 7, most of which is for non-potable uses.

Figure 8 depicts the mean daily tunnel withdrawal and groundwater pumpage for the three HBWS wells in the He‘eia hydrologic unit. It is also possible that withdrawal of groundwater from Ha‘ikū well and ‘Ioleka‘a well affects stream flow.

Figure 7. Total monthly mean daily pumpage by the Honolulu Board of Water Supply (HBWS) from the Ko‘olaupoko Aquifer System and 12-month moving average.



[22] Ko‘olau Poko Watershed Management Plan. 2012. Honolulu Board of Water Supply. Prepared by Townscape, Inc.
[23] Water Resource Protection Plan 2019 Update. State of Hawaii Commission on Water Resource Management. Prepared by Townscape, Inc.

As stated in the "*Waiāhole I*" Decision and Order, the Commission believes that an integrated water resource plan must be developed in order to prepare for Oʻahu's water future[24]. This plan must address how we will meet water demand given our dwindling supply and must prioritize competing demands. An integrated water resource plan encompasses the concept of least-cost planning and considers all types of resources equally: new supply, conservation, reclaimed water, alternative rate structures, as well as other demand management methods. The planning process would assess and balance competing needs such as urban, agricultural, appurtenant rights, traditional and customary gathering rights, Hawaiian Home Lands rights, and stream protection, and set priorities for allocation decisions. An interim IFS that balances competing public trust uses can support the City & County of Honolulu's Koʻolau Poko Sustainable Communities Plan[25], which identifies the protection of Heʻeia, including it's high-quality perennial stream, wetland habitat, and ancient Hawaiian fishpond.

ALTERNATIVE SOURCES

Most of the largest metered water consumers identified in Table 7 are non-potable uses. The Kaneohe Klipper Golf Course (KKGC) is located on the Kaneʻohe Marine Corps Base Hawaiʻi (MCBH) in the HBWS Koʻolaupoko District.

In 1966, KKGC was the first golf course in Hawaiʻi to utilize recycled water, using 0.6 to 1.0 mgd of R-2 water produced on site. Because of issues related to inconsistent disinfection and sprinkler clogging, the KKGC switched to irrigating with potable water from HBWS. KKGC is now the largest consumer of potable water in the HBWS Koʻolaupoko District. As a practical policy of the Commission, water use should be matched with the level of quality; with high quality potable water reserved for domestic consumption, and non-potable needs met with lower quality recycled water. The long history of documented R-2 on site use suggests that this is a practicable alternative to using potable water. Considering that HAR §13-169-22 provides for the review of water use permits when necessary:

> (a) The Commission shall retain and continue to have jurisdiction for the purpose of reviewing and modifying every permit as may be necessary in fulfillment of its duties and obligations under this code

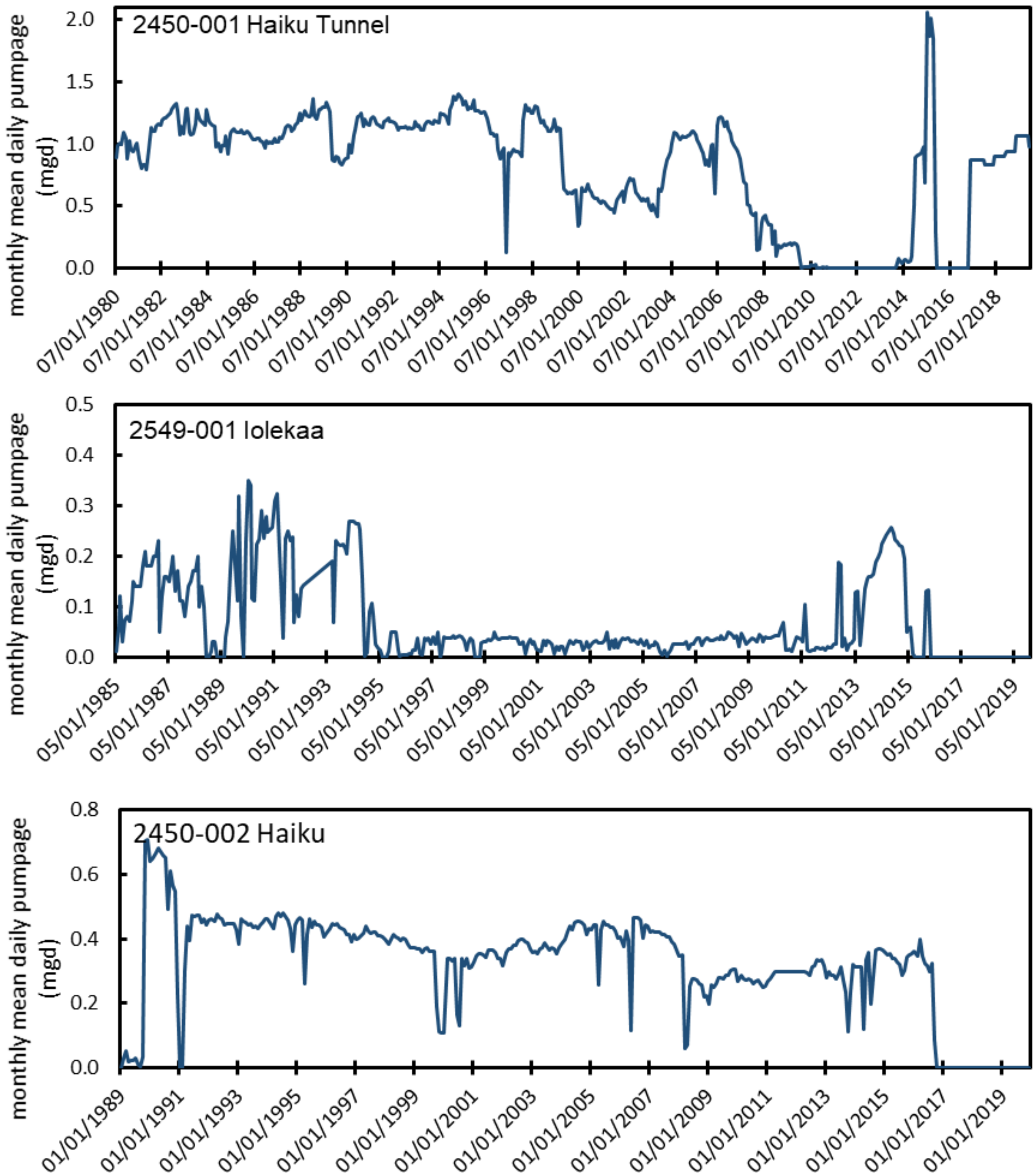
It is possible that in review of the HBWS Koʻolaupoko water use permits, a future Commission action may reduce the permitted amounts based on the availability of non-potable water to meet non-potable needs.

[24] Commission on Water Resource Management. 1997. p. 217. CCH-OA-15-001.
[25] Koʻolau Poko Sustainable Communities Plan. 2017. City and County of Honolulu. https://luc.hawaii.gov/wp-content/uploads/2019/12/A17-804-DPP-Exhibit.pdf

Table 6. Groundwater pumpage from source wells for the Honolulu Board of Water Supply from the Koʻolaupoko Aquifer System from 2013-2020. Note: values include months with zero withdrawal and the statistical distribution of pumpage thus has positive skew [Flows in million gallons per day, mgd]

well ID	well name	year drilled	pump capacity (mgd)	average monthly pumpage (mgd)	median monthly pumpage (mgd)	maximum monthly pumpage (mgd)
2247-001	Kamooalii II	1985	n/a	n/a	n/a	n/a
2248-001	Kamooalii I	1985	n/a	n/a	n/a	n/a
2348-002	Kuou I-1	1955	--	0.670	0.578	1.720
2348-003	Kuou I-2	1955	3.024	0.000	0.000	0.000
2549-001	Iolekaa	1966	0.302	0.057	0.000	0.257
2651-001	Kahaluu Tunnel	1947	n/a	1.846	1.842	2.575
2651-002	Waihee Tunnel	1955	n/a	3.770	4.260	7.721
2651-003	Kahaluu	1980	1.008	0.716	0.787	1.831
2652-002	Waihee Incline 1	1976	n/a	0.000	0.000	0.000
2652-003	Waihee Incline 2	1976	n/a	0.000	0.000	0.000
2652-001	Waihee Incline 3	1971	n/a	0.854	0.955	2.160
2652-004	Waihee Incline 4	1976	n/a	0.000	0.000	0.000
2751-002	Waihee I-1	1972	1.008	0.000	0.000	0.000
2751-003	Waihee I-2	1972	1.008	0.000	0.000	0.000
2348-005	Kuou II	1986	1.008	0.095	0.083	0.636
2348-006	Kuou III	1995	0.720	0.447	0.462	0.811
2349-001	Luluku Tunnel	1948	n/a	0.104	0.093	0.307
2349-002	Luluku	1984	1.008	1.001	1.006	1.180
2450-001	Haiku Tunnel	1940	n/a	0.525	0.594	2.064
2450-002	Haiku	1981	1.008	0.163	0.159	0.399
		Total =		10.248	10.819	

Figure 8. Monthly mean daily reported pumpage from Ha'ikū Tunnel (well 2450-001), 'Ioleka'a Well (well 2549-001) and Ha'ikū Well (well 2450-002). Note: period of record differs between graphs.



In 2021, HBWS experimented with reducing their water withdrawal from Ha'ikū Tunnel to examine if stream baseflow responded. While the reduction in withdrawal from an average of 1.0 mgd in 2020 to approximately 0.5 mgd did not occur until the beginning of April 2021, some increase in stream baseflow is observed in May 2021. An existing bulkhead installed and valved at 600 feet from the portal provides some small storage.

Table 7. Honolulu Board of Water Supply (HBWS) largest metered water consumers (CY 2009). (Source: Ko‘olau Poko Watershed Management Plan, 2012)

	HBWS Customer	Average daily consumption (mgd)		HBWS Customer	Average daily consumption (mgd)
1	Kāne‘ohe Marine Corps Base	1.698	6	Hawaii State Hospital	0.070
2	Mid Pacific Country Club	0.128	7	Hawaiian Memorial Park Cemetery	0.052
3	Kailua Regional WWTP	0.128	8	Pali Golf Course	0.044
4	Sea Life Park	0.104	9	Blue Stone Apartment Complex, Kailua	0.045
5	Olomana Golf Links	0.064	10	Pu‘u Ali‘i Community Association, Kāne‘ohe	0.047

ASSESSMENT SUMMARY: HE‘EIA STREAM

Maintenance of Fish and Wildlife Habitat. The 1990 Hawaii Stream Assessment ranks He‘eia's aquatic resources as "moderate" (2 out of 4). Many native freshwater species have been found in the He‘eia hydrologic unit, including ‘o‘opu nōpili, āholehole, ‘o‘opu naniha, and ‘ōpae kala‘ole, ‘ōpae ‘oeha‘a and hapawai. Several native damselfly species (e.g., *Megalagrion sp., Megalagrion nigrohamatum nigrolineatum*) have also been identified in He‘eia, meeting the criteria as a biotic stream of importance for native macrofauna diversity (>5 spp.) established by DAR. Many native and endangered wetland birds of cultural importance live, breed, nest, and forage in the He‘eia wetland, including the Hawaiian Stilt (*Himantopus mexicanus knudseni*), Hawaiian coot (*Fulica alai*), and Hawaiian moorhen (*Gallinule chloropus sandvicensis*).

Outdoor Recreational Activities. He‘eia has "substantial" (3 out of 4) outdoor recreational opportunities based on the Hawaii Stream Assessment, including hiking trails, fishing, swimming, and hunting.

Maintenance of Ecosystems. The riparian resources of He‘eia were classified as "outstanding" (4 out of 4) by the Hawaii Stream Assessment. Non-native trees and shrubs can have a negative impact on the ecosystem, but are largely being managed by control measures. Streamflow returning to the ocean supports a diversity of nearshore and intertidal species, improving the fisheries, the muliwai, and the functioning of the fishpond.

Aesthetic. He‘eia Stream supports continual mauka to makai flow with much aesthetic value and many opportunities for the public to access views of the stream.

Maintenance of Water Quality. He‘eia Stream is classified by the Department of Health as Class 1b inland waters in the upper elevations and Class 2 inland waters in the lower elevations based on land use. It does not appear on the 2018 List of Impaired Waters in Hawai‘i, Clean Water Act §303(d), although there was insufficient data to support any conclusions. Sufficient water is needed to keep stream temperatures low enough to support loʻi kalo cultivation across a large number of loʻi complexes.

Conveyance of Irrigation and Domestic Water Supplies. Heʻeia Stream is not used for the conveyance of irrigation or domestic water supplies.

Protection of Traditional and Customary Hawaiian Rights. Both in Haʻikū Valley and in the Heʻeia wetland, Heʻeia stream supports the cultivation of loʻi kalo. Fishing and gathering of aquatic biota is common in the muliwai and coastal areas. Additional water would benefit the needs of the nearshore fishpond. The return of native freshwater fish following increased flow restoration would support traditional gathering of these species.

The mauka to makai flow of Heʻeia Stream is of central importance to the community's cultural and spiritual sense of place. Various hula groups, educational groups, and community organizations reconnect with the Hawaiian culture through participation in activities centered around the flow of Heʻeia Stream

Paepae o Heʻeia manages the Heeia fishpond as a functioning Hawaiian aquaculture facility, supporting local food production while reinforcing the ancestral knowledge that supported large pre-contact Hawaiian populations.

The entire ahupuaʻa offers a natural laboratory for educational opportunities for all ages. In 2017, Heeia was added to the National Estuarine Research Reserve System (NERR), further solidifying its role in the educational landscape.

Noninstream Uses. From 1989 to 2019, during periods when the wells were in use, there was a mean, median, and maximum withdrawal of 0.869 mgd, 0.941 mgd, and 2.064 mgd of water from Haʻikū Tunnel used for potable water supply, respectively. Similarly, from Haʻikū Well there was a mean, median, and maximum withdrawal of 0.361 mgd, 0.370 mgd, and 0.708 mgd, respectively. From ʻIolekaʻa well there was a mean, median, and maximum withdrawal of 0.072 mgd, 0.035 mgd, and 0.350 mgd, respectively.

RECOMMENDATION

Heʻeia Stream supported one of the most agriculturally productive areas on Oʻahu. The Haʻikū Tunnel, dug at an elevation of 550 feet, depleted the groundwater storage of high-elevation dike compartments which supplied baseflow to Heʻeia Stream. In 1971, the USGS recommended that bulkheading at a 10-foot thick dike compartment at approximately 1,200 feet from the tunnel entrance is the preferred method to restore the storage function of the aquifer. Tunnels with high recession constants (*b*), such as the Haʻikū Tunnel, drain faster than tunnels with lower recession constants, and would therefore benefit more from bulkheading[26]. An existing bulkhead installed and valved at 600 feet from the portal provides some small storage. The substantial ecological

[26] Hirashima, G.T. 1971.

and cultural values supported by Heʻeia Stream, including habitat for native amphidromous species, restored native riparian environment, a healthy estuarine and near-shore ecosystem, recreational and aesthetic values, as well as the productivity of the Heʻeia fishpond and wetland to support a biocultural food production system, merits restoration of Heʻeia Stream to pre-tunnel baseflow. In order to protect these instream uses staff recommends that HBWS bulkhead the 10-foot thick dike compartment at approximately 1,200 feet from the tunnel entrance and valve separately from the bulkhead at 600 feet from the tunnel entrance. Such action would increase spring flow in Haʻikū while providing a more reliable source of water supply for HBWS. This solution is expected to increase the natural capacity of the high-elevation groundwater system to store and discharge water to streams and springs in the moku of Koʻolaupoko.

As an interim measure, until the Haʻikū tunnel is fully bulkheaded, Commission staff recommends that HBWS reduce their withdrawal from the Haʻikū tunnel to 0.3 mgd. When the bulkheading process commences, the Haʻikū tunnel will not be a viable source for HBWS, and therefore the entirety of the tunnel flow will be discharged into the stream.

In order to improve transparency among stakeholders, staff recommends that HBWS provides the daily amount of water withdrawn from each well source (Haʻikū Tunnel, Haʻikū well, and Iolekaʻa well) at monthly intervals.

Following the bulkheading of the tunnel, staff will evaluate the resultant effects on stream baseflow and may amend the interim IFS or amend the HBWS water use permit as needed.

<u>IMPLEMENTATION</u>

- Within two years, HBWS will complete their feasibility study and preliminary engineering design for the proposed bulkhead.
- HBWS will communicate with the Commission and continue to coordinate with Kamehameha Schools, DHHL, Papahana Kuaola, HCDA, NERR, and Kākoʻo ʻŌiwi water users.
- Upon completion of the feasibility study and engineering design, HBWS will have three years to complete the final design and construction of the bulkhead. .
- Following the installation of the bulkhead, staff will work with HBWS, Kamehameha Schools, DHHL, Papahana Kuaola, HCDA, NERR, and Kākoʻo ʻŌiwi to evaluate the implications for baseflow in Haʻikū Stream and determine the feasibility of establishing a numeric instream flow standard.
- If HBWS determines that bulkheading is not a feasible solution upon completion of the feasibility study, staff will recommend an amendment to the interim IFS or amend the HBWS water use permit as needed.

<u>MONITORING</u>

- Streamflow monitoring shall be maintained by HBWS coordinating with USGS.
- At monthly intervals, HBWS will provide monitoring of daily flow withdrawn from the Haʻikū Tunnel, Haʻikū well, and Iolekaʻa well..
- Periodic biological surveys shall be conducted, subject to available funding, to monitor the response of stream biota.

- All claimants shall cooperate with staff in conducting appropriate investigations and studies, particularly with regard to granting access to stream channels and private property related to such investigations, subject to the provisions of the State Water Code, Chapter 174C, HRS.

EVALUATION

- One to two years following the completion of the bulkheading, staff shall report to the Commission on an evaluation of baseflow conditions in Heʻeia and nearby streams and make recommendations to amend instream flow standards at that time.

Ola i ka wai,

M. KALEO MANUEL
Deputy Director

Note: Exhibits 1 and 2 are available from the Commission website at:
http://dlnr.hawaii.gov/cwrm/surfacewater/ifs/oahu/3028-heeia/

Exhibit 1	Instream Flow Standard Assessment Report for Heʻeia Hydrologic Unit 3028, PR-2020-02
Exhibit 2	Compilation of Public Review Comments for Heʻeia (3028), Island of Oʻahu, PR-2020-15

APPROVED FOR SUBMITTAL:

SUZANNE D. CASE
Chairperson