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

for the meeting of the
COMMISSION ON WATER RESOURCE MANAGEMENT

May 18, 2021
Honolulu, Hawai‘i

Request and Delegation of Authority to Chairperson to
Enter into a Joint Funding Agreement with U.S. Geological Survey
To Conduct An Analysis of the Effects of Groundwater Withdrawals on Streamflow,
Waihe‘e and Kahalu‘u Streams, Kahalu‘u Hydrologic Unit, O‘ahu

SUMMARY OF REQUEST:

Staff requests that the Commission on Water Resource Management (Commission) authorize the Chairperson to enter into a Joint Funding Agreement (JFA) with the U.S. Geological Survey (USGS) to conduct an analysis of the impact of groundwater withdrawals from development tunnels and other wells on streamflow in Kahalu‘u and Waihe‘e streams, Ko‘olaupoko, O‘ahu.

BACKGROUND:

Under the State Water Code (Code), Chapter 174C, Hawai‘i Revised Statutes (HRS), the Commission has the responsibility of establishing Instream Flow Standards (IFS) on a stream-by-stream basis whenever necessary to protect the public interest in the waters of the State. Early in its history, the Commission recognized the complexity of establishing IFS for the State’s estimated 376 perennial streams and instead set interim IFS at “status quo” levels. These interim IFS were defined as the amount of water flowing in each stream (with consideration for the natural variability in stream flow and conditions) at the time the administrative rules governing them were adopted in 1988 and 1989.

The 1982 Hawai‘i Supreme Court decision of Reppun v. Board of Water Supply, the Court held that the diversion of water, whether from a stream or from a well, could not continue to the detriment of traditional and customary practices, recreational uses, riparian practices, or aquatic ecosystems. Thus 2.7 million gallons per day (mgd) was to remain in Waihe‘e Stream as measured at USGS station 16284200. However, this decision predates the Code, and did not examine the cumulative effects of groundwater withdrawals from other wells within or outside of the Waihe‘e watershed on streamflow, across the region. As the movement of dike-impounded

groundwater in either the dike complex or marginal dike zone occurs irrespective of watershed boundaries, it is important to consider the consequences of groundwater withdrawals to the streamflow in neighboring watersheds as well. For example, Hirashima (1962[1]) determined that the construction and utilization of the Haʻikū development tunnel negatively affected streamflow in neighboring Kahaluu stream.

Upon reviewing the Waiāhole Ditch Contested Case Decision and Order, the Hawaiʻi Supreme Court held that such "status quo" interim IFS were not adequate to protect streams and required the Commission to take immediate steps to assess stream flow characteristics and develop quantitative interim IFS for affected Windward Oʻahu streams, as well as other streams statewide. The Hawaiʻi Supreme Court also 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."

In order to better understand the effects of groundwater withdrawal from various well sources on streamflow, Commission staff have worked with the Honolulu Board of Water Supply (HBWS) and the USGS to fund concurrent groundwater modeling and streamflow analysis studies. The HBWS is funding a study of the Heʻeia hydrologic unit, with surface water and groundwater historic data analysis, fieldwork, and modeling. The Commission, USGS, and HBWS are interested in understanding the relationship between development tunnel withdrawal and streamflow in Haʻikū, Ioleka'a, Kahaluʻu, or Waiheʻe streams, the magnitude of this relationship, and the effect of various management scenarios (pumping regimes) on streamflow. This JFA between the Commission and USGS will fund the first phase of a similar study for the Kahaluʻu hydrologic unit: focusing on Waiheʻe and Kahaluʻu streams.

The objectives of this study are to:

1. Determine if the effect of a reduction in groundwater withdrawals can be detected in stream flow measurements and stream-gage records and determine the magnitude of that effect.

2. Estimate how much water withdrawn from the tunnel and wells in the Waihee and Kahaluu watersheds comes from outside the watersheds.

3. Quantify current water uses to the extent possible from existing data or short-term measurements

SCOPE OF SERVICES AND FUNDING:

The study proposed here is Phase 1 of a multi-year, two-phased approach.

The attached proposal seeks to complete Phase 1, which involves the historic data analysis, including the examination of streamflow before, during, and following well construction and

[1] Hirashima, G.T. 1962. Effect of the Haiku Tunnel on Kahaluu Stream, Oahu, Hawaii. US Geological Survey Professional Paper 450C.

withdrawal conditions. Phase 1 will take one to two years and involve the analysis of existing data and existing models. This phase requires no fieldwork or long-term monitoring. Phase 1 will cost $245,000. The USGS will defray part of this cost using $25,000 of USGS Cooperative Matching Funds.

Based on the results of Phase 1, Phase 2 may be implemented in a future funding agreement.

FUNDING

The funds for the Commission's share of the work ($220,000) are available from the Department's FY 2021 Budget, LNR 404, Water Resources Program. Funding will come from the Commission's general fund, special fund, or a combination of both.

ENVIRONMENTAL REVIEW (CHAPTER 343)

Hawai‘i Revised Statutes (HRS) Chapter 343 is triggered due to the use of State funds. However, Chapter 343 does not apply because this is a data collection and research study.

Hawaii Administrative Rule §11-200.1-16(a) provides that "*each agency, through time and experience, may develop its own exemption list consistent with both the letter and intent expressed in this subchapter and in chapter 343, HRS, of: (1), Routine activities and ordinary functions within the jurisdiction or expertise of the agency that by their nature do not have the potential to individually or cumulatively adversely affect the environment more than negligibly and that the agency considers to not rise to the level of requiring chapter 343, HRS, environmental review.*"

The Commission's Comprehensive Exemption List, concurred with by the Environmental Council on January 5, 2021, provides for Exemption Type 5, "*Basic data collection, research, experimental management, and resource and infrastructure testing and evaluation activities that do not result in a serious or major disturbance to an environmental resource*;" Part 1, "*Conduct surveys or collect data on existing environmental conditions (e.g., water flow, water quality, hydrologic conditions, geologic conditions, rainfall amounts, etc.).*"

RECOMMENDATION:

Staff recommends that the Commission:

1. Authorize the Chairperson to enter into a Joint Funding Agreement between the Commission on Water Resource Management and the U.S. Geological Survey to conduct an analyses of the effect of groundwater withdrawals from development tunnels and other wells on streamflow in Kahaluʻu and Waiheʻe streams, Koʻolaupoko, Oʻahu.

2. Authorize the Chairperson to make such further amendments or modifications of the contract agreement (consistent with the terms set forth above) as may be necessary to accomplish the goals described here, provided that any amendment or modification does not require additional Commission funding.

The terms of this agreement may be subject to the availability of funding and the approval of the Chairperson and the Department's Deputy Attorney General. Contract execution would be done in accordance with Chapter 103D, HRS, and Chapter 3-122, Hawaiʻi Administrative Rules.

Ola i ka wai,

M. KALEO MANUEL
Deputy Director

Exhibits
1. U.S. Geological Survey, Pacific Islands Water Science Center, Draft Scope of Work, April 26, 2021.

APPROVED FOR SUBMITTAL:

SUZANNE D. CASE
Chairperson

Study of the Effects of Groundwater Withdrawals on Streamflow in the Waiheʻe and Kahaluʻu Watersheds, Oʻahu, Hawaiʻi

Draft Scope of Work
USGS Pacific Islands Water Science Center, April 26, 2021

Background

The State of Hawaiʻi Commission on Water Resource Management (CWRM) is interested in developing interim instream-flow standard (IIFS) for Waiheʻe and Kahaluʻu Streams, Oʻahu, Hawaiʻi (fig. 1). The IIFS seeks to establish minimum streamflow, while balancing the needs for competing uses, including instream uses such as ecological, cultural, and aesthetic uses, with non-instream uses such as stream diversions and groundwater withdrawals that can affect stream base flow. In the watershed of the Waiheʻe and Kahaluʻu Streams, groundwater and surface water are connected in the dike-impounded groundwater setting, where groundwater is stored in compartments of high-permeability lava flows between low-permeability, near vertical, sheet-like volcanic dikes (fig. 2) (Takasaki and Mink, 1985; Izuka and others, 2018). Groundwater accumulates to high altitudes in the compartments and discharges to stream and springs where erosion has breached the compartments. Groundwater withdrawal from the dike-impounded groundwater setting can result in reductions in natural groundwater discharge to streams and springs.

Groundwater is withdrawn for domestic and agricultural use from tunnels (the Waiheʻe and Kahaluʻu Tunnels) and several wells in the Waihee and Kahaluu watersheds (fig. 1). Groundwater withdrawals have resulted in the reduction of stream base flow (Hirashima, 1962, 1963, 1965, 1971; Takasaki and others, 1969). Surface water is diverted from Waiheʻe and Kahaluʻu Streams to support taro and diversified agriculture. Persistent base flow from groundwater discharge also provides habitat for aquatic biota, including a migratory path for anadromous fish (U.S. Fish and Wildlife Service, 2015).

Under a 1982 Hawaiʻi Supreme Court order in Reppun v. Board of Water Supply, 2.7 Mgal/d of streamflow must be maintained at the U.S. Geological Survey (USGS) stream gage 16284200 on Waiheʻe Stream for traditional, customary, and riparian uses in the downstream areas. The Honolulu Board of Water Supply (HBWS) is proposing to establish a Waiheʻe Loʻi Restoration and Riparian Learning Center in Waiheʻe watershed to promote community education and involvement in watershed management (HBWS, 2021). This program involves restoring traditional taro cultivation in existing unused *loʻi* (taro-cultivation ponds) and repairing existing stream-diversion intakes and *ʻauwai* (water-conveyance ditches for the *loʻi*). Because the proposed project involves diversion of additional water from Waiheʻe Stream, the establishment of a quantitative IIFS that effectively and fairly allocates stream water among competing uses would be required.

Problem

CWRM approached the USGS to conduct a study to improve understanding of the hydrology of the Waiheʻe and Kahaluʻu watersheds with focus on the impact of groundwater withdrawals on streamflow. Most studies of the impact of tunnel withdrawals on streamflow in the Waiheʻe and Kahaluʻu watersheds (such as Hirashima, 1962, 1963, 1965, 1971; Takasaki and

EXHIBIT 1

others, 1969) were done prior to the construction of many of the wells currently in use in the watersheds, and therefore do not address the effects of these wells. An updated analysis and improved understanding of the interaction between groundwater and surface water and the impact of groundwater withdrawals on streamflow in Waiheʻe and Kahaluʻu watersheds is needed to inform management decisions for balancing the needs of all competing water uses.

Objective

The objective of the study is to improve understanding of the interaction between groundwater and surface water and the impact of groundwater withdrawals on streamflow in Waiheʻe and Kahaluʻu watersheds. Specific aspects of this objective are discussed below.

1. **Determine whether the effect of a reduction of withdrawals on groundwater discharge to streams can be detected in streamflow measurements and stream-gage records—**The ability to use streamflow measurements or gage records to detect the effects of withdrawals depends on the location and timing of the measurements or gage records relative to where and when the effects emerge on the stream, and the availability of data to evaluate and eliminate effects related to rainfall variations.
2. **Estimate how much of the water withdrawn from the tunnel and wells in the Waiheʻe watershed comes from outside the watershed—**Previous studies (for example Hirashima, 1962, 1963, 1965) indicate that groundwater withdrawals from the dike-impounded settings on Oʻahu may affect streams beyond the surface-water divides of the watershed in which the wells and tunnels are located.
3. **Quantify current water uses to the extent possible from existing data or short-term measurements—**This information will help managers and stakeholders assess the benefits of water taken from Waiheʻe and Kahaluʻu Streams.

Approaches, Deliverables, and Cost

This study will analyze existing data and use an existing groundwater model to meet the stated objectives. The proposed work is contingent upon ability to access necessary data from various entities outside of the USGS, such as climate centers and water users. Execution of the study is anticipated to require two years, including final report publication. Preliminary results could be available in five to six months after data are compiled (please see Deliverables below for limitations on communication of preliminary results).

Approaches

1. Compile available withdrawal, rainfall, and streamflow data for the Waiheʻe and Kahaluʻu watersheds and use a combination of base-flow-separation, flow-duration, statistical modeling, and/or timeseries analyses to determine if response to groundwater withdrawals can be detected in streamflow. Update some of the analyses done by previous studies with more current data. The USGS has operated a continuous-record stream gage on Waiheʻe Stream (16284200) from 1974 to present and on Kahaluʻu Stream (16283200) from 1983 to present (fig. 1). The USGS operated other continuous-record stream gages at various locations on Waiheʻe and Kahaluʻu Streams over different periods including 1935–71 (16283000), 1967–1969 (16283500), 1936–1982 (16284000), 1962–1966 (16283600 and

16283700), 1961–1966 (16283800). Several rain gages have been operated in the watersheds over various periods by various entities including two gages that are active (Giambelluca and others, 2013, Cheng and others, 2021). The USGS will work with CWRM and water users to obtain withdrawal records for the wells and tunnel.

2. Examine historical seepage-run data for patterns of natural groundwater discharge to streams and possible indications of impacts resulting from historical withdrawals.
3. Using the latest recharge estimates for O‘ahu (Engott and others, 2017), do an analysis similar to that done for the He‘eia watershed by Izuka and others (1993) to determine how much of the tunnel flow comes from outside the watershed.
4. Run withdrawal simulations on the existing, unmodified O‘ahu groundwater model. The model runs can simulate impacts of withdrawals on streamflow in the watershed and estimate how much of the withdrawal comes from outside the basin, but with limited precision and accuracy.
5. Compile available water-use data. Availability of data will depend on whether water-use data have been collected and whether the collecting entity is willing to share the data.

Deliverables

1. *Oral presentation of preliminary results*—Preliminary results from will be communicated through oral presentation(s) to CWRM and selected stakeholders, with the understanding that preliminary results are subject to change and are not citable.
2. *Published Report*—Final (citable) results, including descriptions of study methods and conclusions drawn from data collection and analyses, will be documented in a USGS Scientific Investigation Report (SIR). If necessary, an accompanying data release will be published containing finalized data that cannot fit practically in the SIR.

Cost

The total cost to complete the study is $245,000, of which $220,000 will be provided by CWRM and $25,000 will be provided by Federal Matching Funds from the USGS (table 1).

Table 1. Estimated study cost

Total	$ 245,000
USGS contribution	$ 25,000
CWRM contribution	$ 220,000

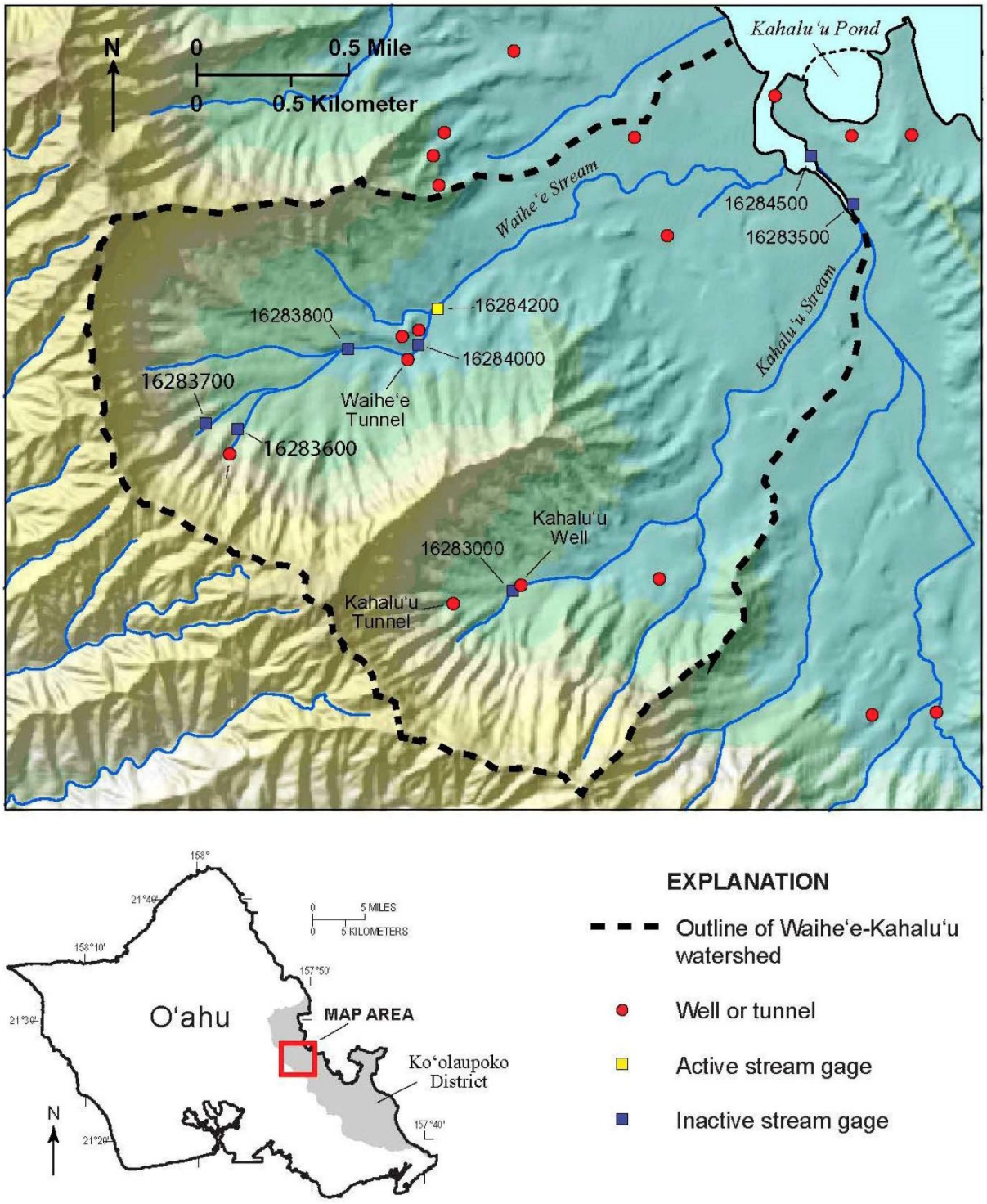

Figure 1. Map of the Waihe'e watershed, O'ahu, Hawai'i.

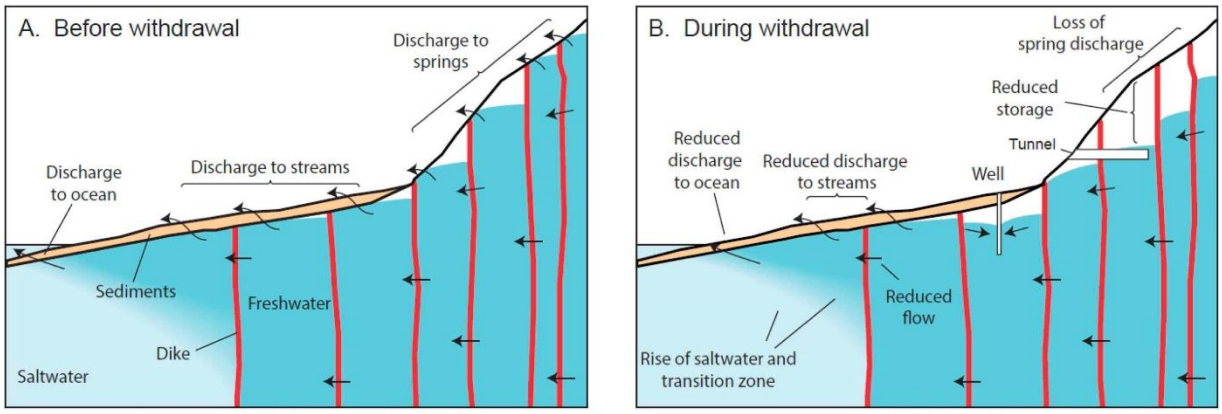

Figure 2. Schematic illustration of the dike-impounded groundwater setting, A, natural conditions before groundwater withdrawals, and B, during withdrawals from wells and tunnels.

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