ORDINANCE NO. ________

BILL NO. ____108______ (2025)

A BILL FOR AN ORDINANCE AUTHORIZING THE MAYOR TO ENTER INTO AN INTERGOVERNMENTAL AGREEMENT WITH THE U.S. GEOLOGICAL SURVEY, PACIFIC ISLANDS WATER SCIENCE CENTER, UNITED STATES DEPARTMENT OF THE INTERIOR FOR WATER RESOURCE INVESTIGATIONS

BE IT ORDAINED BY THE PEOPLE OF THE COUNTY OF MAUI:

SECTION 1. Purpose. The U.S. Geological Survey, Pacific Islands Water Science Center, United States Department of the Interior ("USGS") desires to enter into a Joint Funding Agreement for Water Resource Investigations with the County of Maui Department of Water Supply ("MDWS") to continue its cooperative water-resource monitoring program, during the period of October 1, 2025, to September 30, 2026. The total cost of the Agreement is $321,217, of which $270,558 would be contributed by MDWS and $50,659 would be contributed by USGS.

The purpose of the water-resource monitoring program is to collect data needed to evaluate the status and trends of surface-water and groundwater resources in the County of Maui. Since the 1980s, water-resource data has been collected at selected rainfall, streamflow, and groundwater monitoring stations. The Joint Funding Agreement is attached as Exhibit "1."

Section 2.20.020, Maui County Code, provides, "Unless authorized by ordinance, the Mayor shall not enter into any intergovernmental agreement or any amendment thereto which places a financial obligation upon the County or any department or agency thereof."

SECTION 2. Under Section 2.20.020, Maui County Code, the

Council authorizes the Mayor, or his authorized representative, to execute the Joint Funding Agreement and any amendments consistent with the purpose and scope of the Joint Funding Agreement that do not increase the County's financial obligation or the agreement's duration.

SECTION 3. This ordinance takes effect on approval.

APPROVED AS TO FORM
AND LEGALITY:

CALEB P. ROWE
Deputy Corporation Counsel
County of Maui
LF# 2025-1352

INTRODUCED BY:

Upon the request of the Mayor.

EXHIBIT "1"

Form 9-1366 **(May 2018)**	**U.S. Department of the Interior** **U.S. Geological Survey** **Joint Funding Agreement** **FOR** **Water Resource Investigations**	**Customer #: 6000001187** **Agreement #: 26ZHJFA00000011** **Project #: ZH00GSN** **TIN #: 99-6000618**

Fixed Cost Agreement YES[X] NO[ ]

THIS AGREEMENT is entered into as of October 1, 2025, by the U.S. GEOLOGICAL SURVEY, Pacific Islands Water Science Center, UNITED STATES DEPARTMENT OF THE INTERIOR, party of the first part, and the County of Maui - Department of Water Supply party of the second part.

1. The parties hereto agree that subject to the availability of appropriations and in accordance with their respective authorities there shall be maintained in cooperation for negotiated deliverables (see attached), herein called the program. The USGS legal authority is 43 USC 36C; 43 USC 50, and 43 USC 50b.

2. The following amounts shall be contributed to cover all of the cost of the necessary field and analytical work directly related to this program. 2(b) include In-Kind-Services in the amount of $0.00

(a) $50,659 by the party of the first part during the period October 1, 2025 to September 30, 2026

(b) $270,558 by the party of the second part during the period October 1, 2025 to September 30, 2026

(c) Contributions are provided by the party of the first part through other USGS regional or national programs, in the amount of: $0

Description of the USGS regional/national program:

(d) Additional or reduced amounts by each party during the above period or succeeding periods as may be determined by mutual agreement and set forth in an exchange of letters between the parties.

(e) The performance period may be changed by mutual agreement and set forth in an exchange of letters between the parties.

3. The costs of this program may be paid by either party in conformity with the laws and regulations respectively governing each party.

4. The field and analytical work pertaining to this program shall be under the direction of or subject to periodic review by an authorized representative of the party of the first part.

5. The areas to be included in the program shall be determined by mutual agreement between the parties hereto or their authorized representatives. The methods employed in the field and office shall be those adopted by the party of the first part to insure the required standards of accuracy subject to modification by mutual agreement.

6. During the course of this program, all field and analytical work of either party pertaining to this program shall be open to the inspection of the other party, and if the work is not being carried on in a mutually satisfactory manner, either party may terminate this agreement upon 60 days written notice to the other party.

7. The original records resulting from this program will be deposited in the office of origin of those records. Upon request, copies of the original records will be provided to the office of the other party.

8. The maps, records or reports resulting from this program shall be made available to the public as promptly as possible. The maps, records or reports normally will be published by the party of the first part. However, the party of the second part reserves the right to publish the results of this program, and if already published by the party of the first part shall, upon request, be furnished by the party of the first part, at cost, impressions suitable for purposes of reproduction similar to that for which the original copy was prepared. The maps, records or reports published by either party shall contain a statement of the cooperative relations between the parties. The Parties acknowledge that scientific information and data developed as a result of the Scope of Work (SOW) are subject to applicable USGS review, approval, and release requirements, which are available on the USGS Fundamental Science Practices website (https://www.usgs.gov/office-of-science-quality-and-integrity/fundamental-science-practices).

U.S. Department of the Interior
U.S. Geological Survey
Joint Funding Agreement
FOR
Water Resource Investigations

Customer #: 6000001187
Agreement #: 26ZHJFA00000011
Project #: ZH00GSN
TIN #: 99-6000618

9. Billing for this agreement will be rendered **quarterly**. Invoices not paid within 60 days from the billing date will bear Interest, Penalties, and Administrative cost at the annual rate pursuant the Debt Collection Act of 1982, (codified at 31 U.S.C. § 3717) established by the U.S. Treasury.

USGS Technical Point of Contact

Name:	Christopher Laveau Supervisory Hydrologist
Address:	934 Broadway Suite 300 Tacoma, WA 98402
Telephone:	(701) 213-8694
Fax:	(n/a)
Email:	cdlaveau@usgs.gov

Customer Technical Point of Contact

Name:	Eva Blumenstein Planning Program Manager
Address:	200 South High Street Wailuku, Hawaii 96793
Telephone:	(808) 463-3102
Fax:	(n/a)
Email:	eva.blumenstein@co.maui.hi.us

USGS Billing Point of Contact

Name:	Sharbra Gordon-scott Budget Analyst
Address:	934 Broadway Suite 300 Tacoma, WA 98402
Telephone:	(253) 552-1698
Fax:	(253) 552-1581
Email:	sgordon-scott@usgs.gov

Customer Billing Point of Contact

Name:	Robert De Robles Planner VI
Address:	2200 Main Street, Ste 102 Wailuku, HI 96793
Telephone:	(808) 463-3113
Fax:	(n/a)
Email:	robert.derobles@co.maui.hi.us

U.S. Geological Survey
United States
Department of Interior

Signature

By____________________ **Date: 8/03/2025**
Name: Scott VanderKooi
Title: Acting Center Director

County of Maui - Department of Water Supply

Signatures*

By____________________ **Date:** ________
Name:
Title:

By____________________ **Date:** ________
Name:
Title:

By____________________ **Date:** ________
Name:
Title:

*Department of Water Supply Signature page to follow

COUNTY: COUNTY OF MAUI

By ______________________________
RICHARD T. BISSEN, JR.
Mayor

APPROVAL RECOMMENDED:

____
LESLEY MILNER
Budget Director

____
MARCY MARTIN
Director of Finance

____
JOHN STUFFLEBEAN, P.E.
Director of Water Supply

APPROVED AS TO FORM AND LEGALITY:

____
CALEB P. ROWE
Deputy Corporation Counsel
County of Maui

STATE OF HAWAII

SS.

COUNTY OF MAUI

On this ____ day of ______________, 20__ , before me personally appeared **RICHARD T. BISSEN, JR.,** to me personally known, who, being by me duly sworn or affirmed, did say that he is the Mayor of the County of Maui, a political subdivision of the State of Hawaii, and that the seal affixed to the foregoing instrument is the lawful seal of the said County of Maui, and that the said instrument was signed and sealed on behalf of said County of Maui by authority of its Charter; and the said **RICHARD T. BISSEN JR.** acknowledged the said instrument to be the free act and deed of said County of Maui.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal.

[Stamp or Seal]

____
Notary Public, State of Hawaii

Print Name: ______________________

My commission expires: ____________

NOTARY PUBLIC CERTIFICATION

Doc. Date: ______________________ **# Pages:** __________

Notary Name: ______________________ **Judicial Circuit:** __________

Doc. Description: ______________________

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____

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[Stamp or Seal]

Notary Signature: ______________________

Date:

APPENDIX A

County of Maui - Department of Water Supply

Attachment for 26ZHJFA00000011
2025-10-01 to 2026-09-30

SURFACE WATER

SITE / Collection Description	USGS	COOP	TOTAL
16400000 Halawa Stream near Halawa, Molokai, HI — Full Range Streamflow Station	$4,002	$23,478	$27,480
16415600 Kawela Gulch near Moku, Molokai, HI — Full Range Streamflow Station	$2,643	$15,497	$18,140
16527000 Honomanu Stream near Keanae, Maui, HI — Full Range Streamflow Station	$4,002	$23,478	$27,480
16536000 Haipuaena Stream abv Spreckels Ditch, Maui, HI — Full Range Streamflow Station	$4,002	$23,478	$27,480
16552800 Waikamoi Str abv Kula PL intake nr Olinda, Maui,HI — Full Range Streamflow Station	$4,002	$23,478	$27,480
16636000 Kanaha Str ab Pipeline Intake nr Lahaina, Maui, HI — Full Range Streamflow Station	$4,918		$4,918
16636005 Kanaha Ditch intake from Kanaha Str, Maui, HI — Full Range Streamflow Station	$5,125		$5,125
Total:	**$28,694**	**$109,409**	**$138,103**

CLIMATE

SITE / Collection Description	USGS	COOP	TOTAL
204952156111401 348.5 Honomanu Rain Gage near Keanae, Maui, HI — Precipitation, Continuous		$7,520	$7,520
205327156351102 380.0 Puu Kukui Rain Gage at alt 5,771 ft, Maui,HI — Precipitation, Continuous	$2,241	$13,149	$15,390
Total:	**$2,241**	**$20,669**	**$22,910**

SEDIMENT

SITE / Collection Description	USGS	COOP	TOTAL
16415600 Kawela Gulch near Moku, Molokai, HI — Sedimentation, Continuous		$21,510	$21,510
Total:		**$21,510**	**$21,510**

GROUND WATER

SITE / Collection Description	USGS	COOP	TOTAL
205154156303801 6-5130-02 Waikapu 2, Maui, HI — Groundwater level, Continuous	$1,181	$6,930	$8,111
205437156310501 6-5431-01 TH-B, Waiehu, Maui, HI — Groundwater level, Continuous	$1,181	$6,930	$8,111
205705156312401 6-5731-05 Kanoa TH, Maui, HI — Groundwater level, Continuous	$1,181	$6,930	$8,111
210825157004301 4-0800-01 Kualapuu Deep Monitor Well, Molokai, HI — Groundwater level, Continuous	$1,181	$6,930	$8,111
Total:	**$4,724**	**$27,720**	**$32,444**

WATER QUALITY

SITE / Collection Description	USGS	COOP	TOTAL
205405156305401 6-5430-05 Waiehu Deep Monitor Well, Maui, HI — Water Quality, Measurement		$16,250	$16,250
Total:		**$16,250**	**$16,250**

	USGS	COOP	TOTAL
GRAND TOTAL:	**$35,659**	**$195,558**	**$231,217**

APPENDIX B

Groundwater Availability in the Launiupoko Aquifer System, West Maui, Hawai'i: Phase 1—Siting a Deep Monitor Well

U.S. Geological Survey
Pacific Islands Water Science Center
September 2024
(updated funding August 2025)

SUMMARY

Demand for water from the Launiupoko aquifer system of west Maui is expected to increase in the future. However, direct information on the thickness of the freshwater lens in the area is lacking, which creates a void in understanding the current status of the groundwater resource. A deep monitor well in the area would help to fill the current information void and provide data to track changes in the freshwater lens over time as groundwater development in the area increases, which will help water managers evaluate whether the resource is being developed in a sustainable manner.

This U.S. Geological Survey (USGS) study of groundwater availability in west Maui will be divided into three phases. The objectives of Phase 1 are to develop criteria for siting a deep monitor well in or near the Launiupoko area, select sites that potentially meet the criteria, conduct field reconnaissance of potential sites, select a suitable site, and develop monitoring well specifications. The deep monitor well will be contracted by either the Maui Department of Water Supply or the Hawai'i Commission on Water Resource Management, depending on the availability and source of funds. USGS involvement with overseeing drilling activities is not included in Phase 1 but can be considered following completion of Phase 1. Phase 2 will be to monitor the water level and freshwater thickness in the deep monitor well and other wells in the area and to evaluate the need for additional wells. Phase 3 will be to drill additional wells and collect additional data as deemed necessary and to refine an existing numerical groundwater model of west Maui to evaluate groundwater availability in the Launiupoko and nearby aquifer systems.

Deliverables of Phase 1 of the study will be in the form of meetings and presentations to the Maui Department of Water Supply and other stakeholders. Travel for one or two trips to Maui for reconnaissance and a meeting is included in Phase 1. Phase 1 is anticipated to take about a year from the time the project is initiated. Estimated cost for Phase 1 is $90,000. The approach for Phase 2 of the overall study will be provided separately following completion of Phase 1 and drilling of the deep monitor well. The approach for Phase 3 will be developed following completion of phase 2. The USGS anticipates contributing to the total cost pending the availability of Federal matching funds.

PROBLEM

The resident population on the island of Maui, Hawai'i, increased from 38,691 in 1970 to 154,100 in 2020, which represents an increase of almost 300 percent (State of Hawai'i, 2023). Because of the increase in population, the groundwater demand for public water supply also has increased and groundwater withdrawals likely will continue to increase in the future.

In a typical freshwater-lens system, increased withdrawals from the freshwater lens will, in the long term, result in a decline in water levels, a rise in the transition zone between freshwater and saltwater, and a reduction of natural groundwater discharge to the ocean, springs, or streams. Wells penetrating the freshwater lens will commonly have increased salinity if withdrawal rates are high or the well is deep. Streamflow will only be reduced where the groundwater table intersects the stream, and this generally occurs near the coast where groundwater discharges to streams at low altitudes. Coastal wetlands can be reduced in area or disappear if groundwater withdrawals cause water levels to decline in the vicinity of the wetlands. Furthermore, the wetland water quality, in terms of salinity, can be affected by groundwater withdrawals, which could affect habitat for wetland flora and fauna.

The proposed USGS study of groundwater availability in the Launiupoko and nearby aquifer systems of west Maui will be divided into three phases. Phase 1, the subject of this proposal, is related to the siting of a deep monitor well in or near the Launiupoko aquifer system. The objectives of Phase 1 are to develop criteria for siting a deep monitor well in or near the Launiupoko area, select sites that potentially meet the criteria, conduct field reconnaissance of potential sites, select a suitable site, and develop monitoring well specifications. The deep monitor well will be contracted by either the Maui Department of Water Supply or the Hawaiʻi Commission on Water Resource Management, depending on the availability and source of funds. Phase 2 will be to monitor the water level and freshwater thickness in the well and other wells in the area and to evaluate the need for additional wells. Phase 3 will be to drill additional wells and collect additional data as deemed necessary and to refine an existing numerical groundwater model of west Maui to evaluate groundwater availability in the Launiupoko and nearby aquifer systems. The approach to Phases 2 and 3 will be developed at a later date, following drilling of the deep monitor well.

DESCRIPTION OF STUDY AREA

The main study area is the Launiupoko aquifer system (fig. 1), although adjacent areas to the north and south are relevant and considered for this study. The study area lies on the western flank of the West Maui volcano, which forms the western part of the island of Maui, the second largest island in the Hawaiian archipelago. The Island of Maui located between longitude 155°55′ W and 156°45′ W and between latitude 20°30′ N and 21°05′ N, is composed of two shield volcanoes, the older West Maui volcano that rises to an altitude of 5,788 feet (ft) at Puʻukukui, and the younger Haleakalā that rises to an altitude of 10,023 ft. The two volcanoes are separated by an isthmus, generally at altitudes less than 300 ft, which is covered with terrestrial and marine sedimentary deposits that are as much as 5 miles wide (Stearns and Macdonald, 1942). The study area, covering about 21 mi^2, extends from the western coastline of Maui to the summit area of West Maui volcano.

Between the late 1800s to 1999, sugarcane was grown extensively on the western slopes of West Maui volcano, including within the study area, typically below an altitude of about 1,500 ft. Areas inland of sugarcane cultivation were typically used for grazing, and inland of that were forested areas extending to the summit area (Territorial Planning Board, 1939; Harland Bartholomew and Associates, 1957). Following the 1999 cessation of sugarcane cultivation in the area, much of the former lands that were cultivated remained largely unused. Some of the areas in the northern part of the study area above an altitude of 600 ft to about 2,000 ft were used for grazing (U.S. Department of Agriculture, 1983) and other areas at lower altitudes were used for pasture, diversified crops, and tropical fruits (Melrose, 2016). The Launiupoko aquifer-system area also contains much of Lahaina town that was affected by a wildfire in August 2023.

Mean annual rainfall in the Launiupoko aquifer-system area ranges from less than 15 in. near the coast in the west to greater than 360 in. above an altitude of 5,600 ft toward the summit area in the east (Giambelluca and others, 2013). The prevailing trade-wind direction is from the northeast and controls the distribution of rainfall throughout much of the Hawaiian Islands. Rainfall is generally greatest where the prevailing northeasterly trade winds encounter the flank of a volcano, forcing warm, moist air into the cool, higher altitudes. The study area lies on the drier, leeward side of the West Maui volcano.

Geology.—The geology of Maui was described in detail by Stearns and Macdonald (1942), and some of the geologic units were subsequently reclassified by Langenheim and Clague (1987) and Sherrod and others (2021). West Maui volcano is formed primarily by lava flows and dike- and caldera-complex tholeiitic basalt of the shield-stage Wailuku Basalt. The shield stage represents the most voluminous phase of eruptive activity of the West Maui volcano, during which more than 95 percent of the volcano was formed, mainly by thousands of relatively thin basalt lava flows. These flows emanated from a central caldera area near the heads of stream valleys and from fissures and vents radiating outward from the central caldera (Stearns and Macdonald, 1942). Individual lava flows of the shield-stage Wailuku Basalt range in thickness from about 1 to 100 ft, averaging about 15 ft, and dip from 5 to 20 degrees away from their sources (Stearns and Macdonald, 1942). The shield-stage lavas form the main aquifer within the Launiupoko aquifer system. Post-shield stage benmoreite and trachyte of the Honolua Volcanics overlies Wailuku Basalt in places, mainly on the northern and southwestern flanks of West Maui volcano. The postshield stage is marked by a change in lava chemistry and character that led to the formation of massive lava flows. A thin red soil as much as 5 ft thick separates older shield-stage Wailuku Basalt from postshield-stage Honolua Volcanics in places. In the Launiupoko aquifer-system area, Honolua Volcanics is limited to a few places in the northern and southern parts. Limited rejuvenated-stage basanite of the Lahaina Volcanics, named after the town where the most extensive lava flows are mapped, occur in or near the study area.

The central part of West Maui volcano contains numerous intrusive volcanic dikes that generally trend radially outward from the caldera area. Dikes associated with rift zones are the dominant intrusive rocks in Hawaiian volcanoes. Two main rift zones trending nearly north and south-southeastward from the central caldera are marked by numerous volcanic vents and dikes (Stearns and Macdonald, 1942; Sherrod and others, 2007), and the trends of these two rift zones are generally consistent with measured gravity anomalies (Kinoshita and Okamura, 1965). Macdonald and others (1983) indicated that the rift zones of West Maui are less well defined than those of most Hawaiian volcanoes, and that two additional rift zones (trending northeastward and southwestward) might exist. The dikes are visible where they have been exposed by erosion in valleys. Dikes of the Wailuku Basalt generally are less than 10 ft wide and average about 1.5 ft, whereas dikes of the Honolua Volcanics range from about 8 to 25 ft wide (Stearns and Macdonald, 1942). Cinder and spatter cones or other vent-related deposits (fig. 2) are the surface expression of subsurface dikes. Dikes are hydrologically important because they have low permeability and tend to impound groundwater to high altitudes within inter-dike compartments. The boundary separating the dike-intruded and dike-free volcanic rocks is about 2.5 mi inland from the coast in the Launiupoko aquifer system (Yamanaga and Huxel, 1969) (fig. xx).

Within the Launiupoko aquifer-system area, sedimentary deposits of recent alluvium cover the coastal area in a zone that extends about 500 to 3,000 ft inland at altitudes mainly below about 40 ft. Inland from the alluvium are coastal deposits of older alluvium generally extending 1,000 to 7,000 ft farther inland, although older alluvium extends even farther inland in stream valleys. The sedimentary coastal deposits in the Launiupoko aquifer system potentially impede the discharge of groundwater from the volcanic rocks.

Surface Water.—The drainage pattern of the stream valleys on west Maui is radial from the summit of area of West Maui volcano near Pu‘ukukui to the ocean. The streams in the Launiupoko aquifer-system area drain to the west and southwest. Streams have carved steep-sided valleys in the interior parts of the Launiupoko aquifer-system area, where volcanic dikes are exposed.

Streamflow consists of direct runoff, base flow, and flow added to some streams from the network of irrigation ditches that cross the study area. Base flow is presumed to represent groundwater discharge. As of 2024, the USGS maintains two continuous-record streamgaging stations within the Launiupoko aquifer-system area: one on Kaua‘ula Stream (16641000) and one on Kahoma Stream (16638500) (fig. 2). The USGS has also historically maintained other stream- and ditch-gaging stations in the area, although the periods of record for some gages are limited (Fontaine, 1996).

Perennial streams mainly exist where they intersect the groundwater table or where rainfall is persistent. Where streambeds are higher than the underlying groundwater table, infiltration of streamflow is potentially a source of recharge to the aquifer. Cheng (2014) made same-day discharge measurements in Kaua‘ula Stream that indicated the presence of losing reaches and dry reaches that could potentially lose water over both the dike-impounded groundwater area and the freshwater lens.

Groundwater.— Groundwater recharge by direct infiltration of rainfall occurs over nearly the entire study area. Estimates of groundwater recharge in west Maui for selected periods, land-cover conditions, and climate conditions have been published in recent years (Johnson and others, 2018; Izuka and others, 2018; Mair and others, 2019; Kane and others, 2024; and Mair and others, 2024). Groundwater recharge in the Launiupoko aquifer-system area is generally greatest in wet mountainous areas and least in drier coastal areas, although irrigation can greatly enhance recharge in dry areas. Estimated groundwater recharge in the Launiupoko aquifer-system area ranges from 16.83 Mgal/d for a future drought condition with 100 percent of shrubland and forest areas within the cloud zone converted to grassland (Mair and others, 2024) to 42.68 Mgal/d for 1978–2007 rainfall and 2017 land-cover conditions (Mair and others, 2019).

On the basis of available information, groundwater in the Launiupoko aquifer system occurs in two main forms: (1) as dike-impounded groundwater in inland areas, and (2) as a freshwater lens floating on denser, underlying saltwater in coastal areas (Gingerich and Engott, 2012). The freshwater-lens system is mainly dike free. However, numerous volcanic vents or vent-related features in coastal areas where a freshwater lens is expected were fed through dikes that could affect groundwater conditions.

Dike-Impounded Groundwater.—Within the study area, volcanic dikes have been mapped in stream valleys where they have been exposed by erosion. Volcanic vents at the surface also indicate the presence of subsurface dikes. Dikes are hydrologically important because they have low permeability and can compartmentalize and impound groundwater to higher altitudes than would exist in the absence of dikes. Limited data from wells in the inland part of the Launiupoko aquifer system indicate that groundwater levels are hundreds of feet above sea level in places. The inland area of dike-impounded groundwater was mainly inferred by Yamanaga and Huxel (1969) based on the expectation of high water levels in areas with mapped dikes and possibly from measured groundwater discharge to streams. Gingerich (2008) and Gingerich and Engott (2012) modified the boundary between the dike-impounded groundwater and freshwater lens based on information that became available later (fig. 2).

Groundwater recharge to the dike-impounded area is in the form of infiltration of rainfall and possibly streamflow in stream channels. Groundwater flows from the dike-impounded groundwater area towards the coast and contributes subsurface flow to the freshwater lens system.

Freshwater Lens.—Within the high-permeability rocks of the Wailuku Basalt, a lens of freshwater floats on denser underlying saltwater. The source of freshwater in the lens is groundwater recharge from the upgradient dike-impounded groundwater area, infiltration of rainfall and streamflow, and irrigation water that flows downward below the plant root zone. Fresh groundwater flows from inland recharge areas to the coast where it discharges at springs and by diffuse seepage at and near sea level.

In coastal aquifers, a saltwater-circulation system exists beneath the freshwater lens (Souza and Voss, 1987). Saltwater flows landward in the deeper parts of the aquifer, rises, and then mixes with seaward flowing freshwater. This mixing creates a freshwater-saltwater transition zone. No wells in the Launiupoko aquifer system penetrate the transition zone or underlying saltwater, although a deep monitor well does exist in the adjacent Honokowai aquifer system to the north (Mahinahina deep monitor well 6–5739–003) (fig. 2).

Existing Groundwater Withdrawals.—Reported groundwater withdrawals (Robert Chenet, Hawai‘i Commission on Water Resource Management, written commun., 2024) in the Launiupoko aquifer system varied over time in response to changing irrigation demand and drinking-water needs. Reported withdrawals from all groundwater sources in the Launiupoko aquifer system peaked in 1995 at 16.4 Mgal/d and then dropped to 0.3 Mgal/d in 2000 following the cessation of sugarcane cultivation in west Maui. During 2023, reported withdrawals from the Launiupoko aquifer system were 2.0 Mgal/d.

OBJECTIVES

The objectives of Phase 1 are to develop criteria for siting a deep monitor well in or near the Launiupoko area, select sites that potentially meet the criteria, conduct field reconnaissance of potential sites, select a suitable site, and develop monitoring well specifications. The deep monitor well will be contracted by either the Maui Department of Water Supply or the Hawai‘i Commission on Water Resource Management, depending on the availability and source of funds. USGS involvement with overseeing drilling activities is not included in Phase 1 but can be considered following completion of Phase 1. Phase 2 will be to monitor the water level and freshwater thickness in the deep monitor well and other wells in the area and to evaluate the need for additional wells. Phase 3 will be to drill additional wells and collect additional data as deemed necessary and to refine an existing numerical groundwater model of west Maui to evaluate groundwater availability in the Launiupoko and nearby aquifer systems.

APPROACH

To meet the objectives of this Phase 1 of this study, the USGS will review available hydrogeologic, land-ownership, and infrastructure information, conduct a field reconnaissance, present study results to stakeholders, and develop well specifications for a deep monitor wells. Phase 1 does not cover drilling-related activities.

Criteria for Site Selection.—A number of criteria can be considered in siting a deep monitor well in or near the Launiupoko aquifer system. These criteria are related to (1) hydrogeological setting; (2) land ownership; (3) accessibility; (4) proximity to existing production wells; (5) land-surface altitude; (6) future land or groundwater development.

Hydrogeological setting.—The proposed deep monitor well should be sited in an area that is most representative of relevant conditions. Because the main area of groundwater development is expected to be within the freshwater-lens system, which is nearest areas of water need, the deep monitor well should be sited within the freshwater lens in or near the Launiupoko aquifer system. Areas with dikes might not be desirable from a groundwater-development standpoint because of potential drawdown or water-quality issues. Thus, consideration will be given to the location of volcanic-vent-related features that represent the surface expression of subsurface dikes. Also, hydrological and geophysical data that provide insight into the freshwater-lens conditions will be reviewed to potentially facilitate site selection.

Land ownership.—Current land ownership will likely be an important consideration for siting a deep monitor well. Although deep monitor wells have been drilled on privately owned land in other areas of Hawai'i, priority will likely be given to government-owned land for this project. This will best ensure the longevity of and access to the well.

Accessibility.—One of the main considerations for siting the deep monitor well is that the site must be accessible to a drill rig and future monitoring. Thus, locations of existing roads might constrain the location of the well site, unless a new road can be readily constructed.

Altitude.—All other factors being equal, a site at higher altitude will have greater drilling and monitoring costs. In general, a site at higher altitude will also be expected to monitor a thicker part of the freshwater lens and be less affected by tidal mixing of the brackish-water transition zone than a site at lower altitude. The costs and benefits of site altitude will be weighed in siting a deep monitor well.

Proximity to existing production wells.—In general, siting a deep monitor well near production wells can potentially lead to enhanced intraborehole flow within the deep monitor well that obscures interpretation of the thickness of the freshwater lens (Rotzoll, 2010). In some deep monitor wells on O'ahu, for example, upward flow of brackish water within the deep monitor well that is caused by nearby withdrawals can lead to an ostensibly thin freshwater thickness in the deep monitor well. Ideally, the deep monitor well should reflect conditions in the adjacent aquifer and not be overly affected by intraborehole flow. Thus, consideration will be given to locations of existing production wells in site selection for the deep monitor well.

Future urbanization and groundwater development.—Although future conditions in terms of urbanization and groundwater development can be challenging to predict, a review of existing development plans will be undertaken. Areas of planned urban development might be avoided to ensure the longevity of the deep monitor well. In addition, ideal locations for future groundwater development might be avoided to minimize the potential for inducing borehole flow within the deep monitor well that could obscure interpretation of conditions in the adjacent aquifer.

Preliminary Site Selection.—Preliminary sites that meet the site-selection criteria will be identified. Sites will be prioritized based on available information. A virtual meeting will be arranged to discuss the preliminary sites with relevant stakeholders. Adjustments will be made to the site-selection criteria and preliminary sites as deemed appropriate during discussions with stakeholders.

Field Reconnaissance.—A site-reconnaissance investigation will be conducted to evaluate local conditions in the field. Ease of access, site desirability, and logistics will be considered for each site. Staff from the Hawaii Commission on Water Resource Management and Maui Department of Water Supply will be encouraged to participate in the field reconnaissance to assist in final site selection.

Final Site Selection.—Following consideration of the site-selection criteria and field reconnaissance, a final site will be selected for the deep monitor well. The site will likely be within the Launiupoko aquifer system, although sites that are near but outside the Launiupoko aquifer system will also be considered.

Well Specifications.—Once a site has been selected, well specifications can be developed. Well specifications include information related to well location, depth, diameter, casing size, material, and screen type, and surface completion. Because the well will be designed to monitor freshwater-lens thickness over time, sealing of zones below the water table will be avoided.

DELIVERABLES

The anticipated products of this study are (1) meetings (virtual and in person) to discuss site selection, and (2) well specifications in the form of a memorandum or othe suitable outlet.

BUDGET

The cost for Phase 1 of this 1-year study is $90,000 to include $15,000 of USGS Cooperative Matching Funds and $75,000 of partner funding. The cost includes travel, salary, and overhead. No supplies or equipment are anticipated for Phase 1.

WORK PLAN

The major tasks and associated periods of activity for this 1-year study are summarized in table 1. Work will begin as soon as funding becomes available. Preliminary results and meeting will be held throughout the duration of the study.

	Month of study											
Task	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Develop Site-Selection Criteria	x	x	x	x	x							
Preliminary Site Selection			x	x	x							
Field Reconnaissance						x						
Final Site Selection						x	x	x				
Develop Well Specifications								x	x	x		
Meetings				x		x		x		x		

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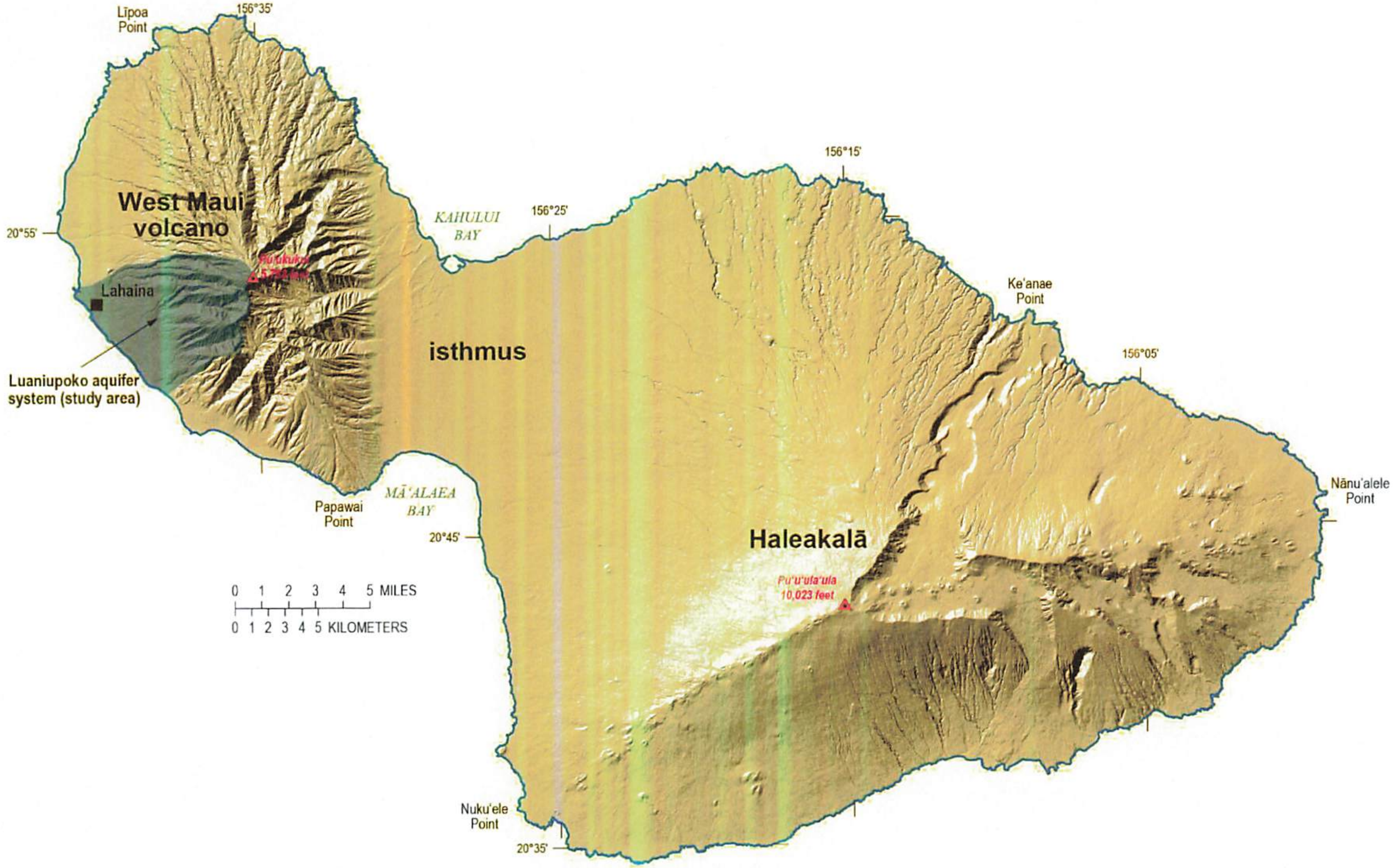

Figure 1. State of Hawai'i Launiupoko aquifer system study area, Island of Maui, Hawai'i.

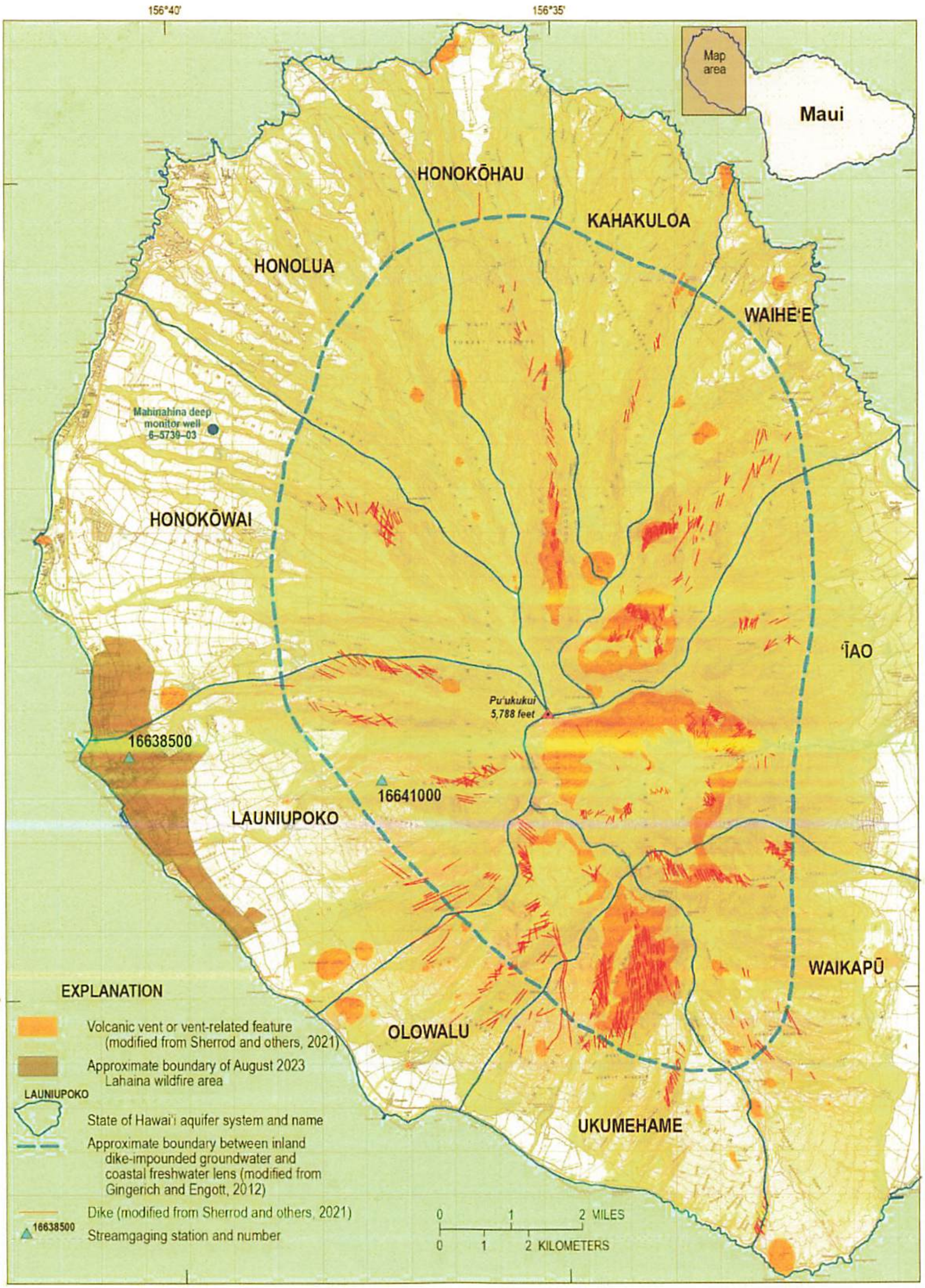

Figure 2. Geologic features, State of Hawai'i aquifer systems, streamgaging stations, and deep monitor well in or near the Launiupoko aquifer system study area, Island of Maui, Hawai'i.