

# Informational Briefing to the Commission On Statewide Drought Conditions

C-3

November 21, 2023

COMMISSION ON WATER RESOURCE MANAGEMENT

Ke Kahuwai Pono

“The trustee who oversees the rightful sharing of water.”



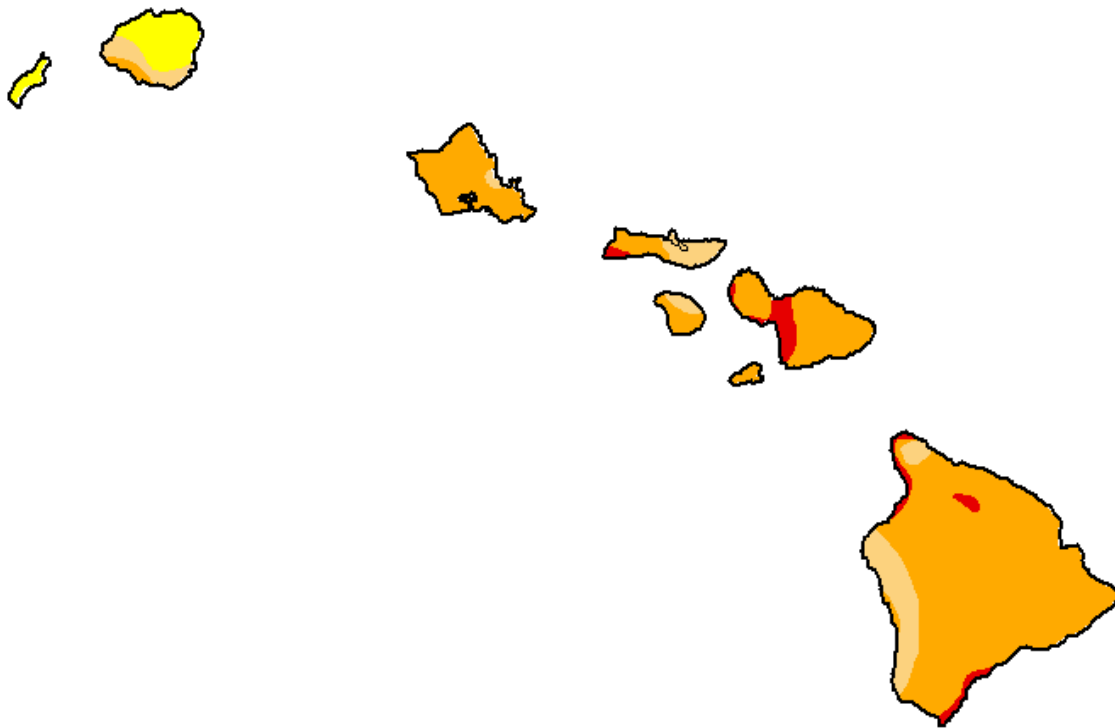


## Overview







- **Drought conditions and outlook**
- **Hawaii Drought Council meeting summary**
- **Surface water conditions**
- **Ground water conditions**

# U.S. Drought Monitor Hawaii

**November 14, 2023**  
(Released Thursday, Nov. 16, 2023)  
Valid 7 a.m. EST



### Intensity:

-  None
-  D0 Abnormally Dry
-  D1 Moderate Drought
-  D2 Severe Drought
-  D3 Extreme Drought
-  D4 Exceptional Drought

*The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <http://droughtmonitor.unl.edu/About.aspx>*

### Author:

Brad Rippey  
U.S. Department of Agriculture



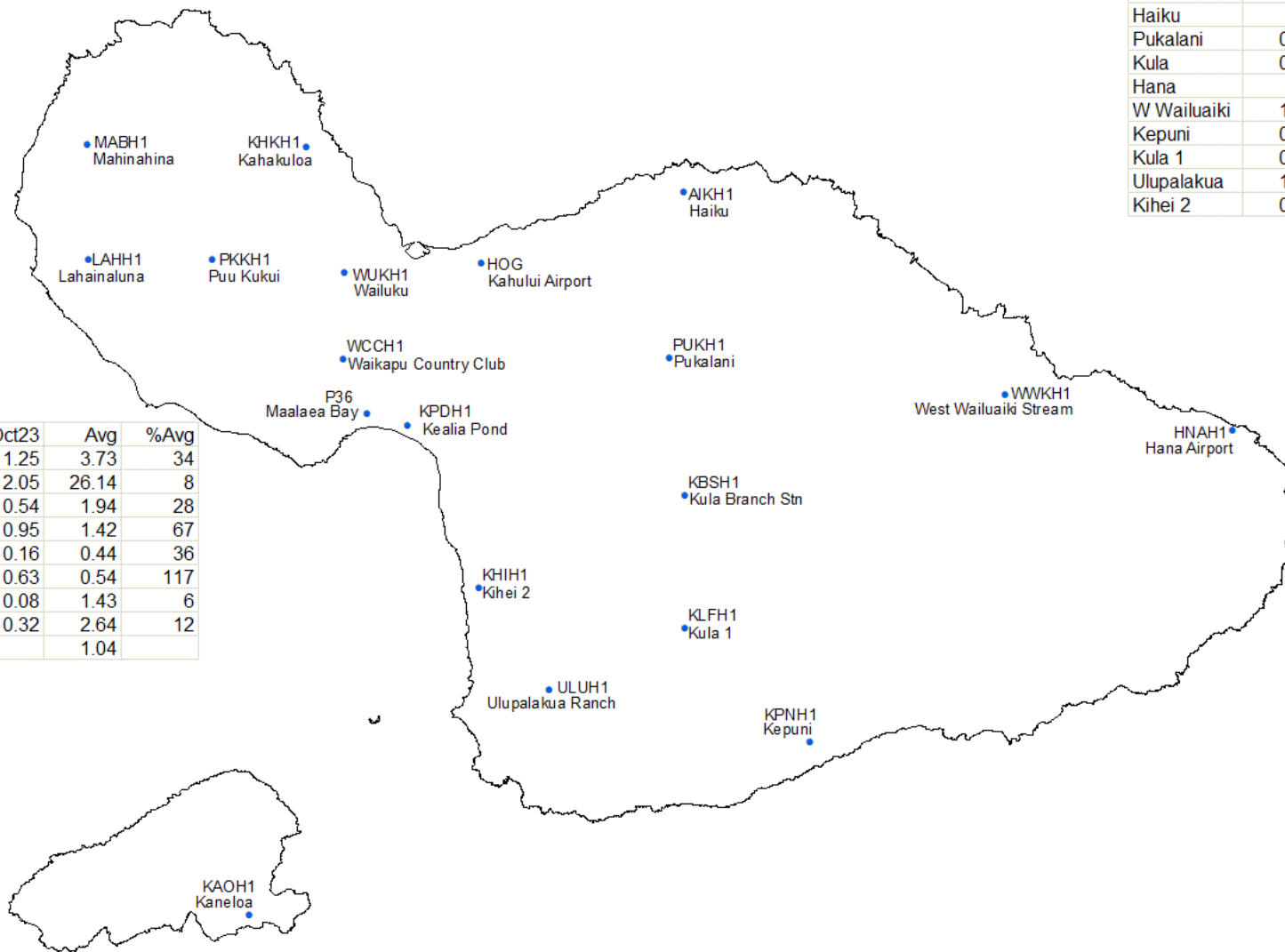
[droughtmonitor.unl.edu](http://droughtmonitor.unl.edu)



**National Weather Service Drought Information  
Statement for the Main Hawaiian Islands valid  
November 8, 2023**

[https://www.weather.gov/media/hfo/DGT/DGT\\_HFO\\_11082023.pdf](https://www.weather.gov/media/hfo/DGT/DGT_HFO_11082023.pdf)

# Maui October 2023 Rainfall Totals

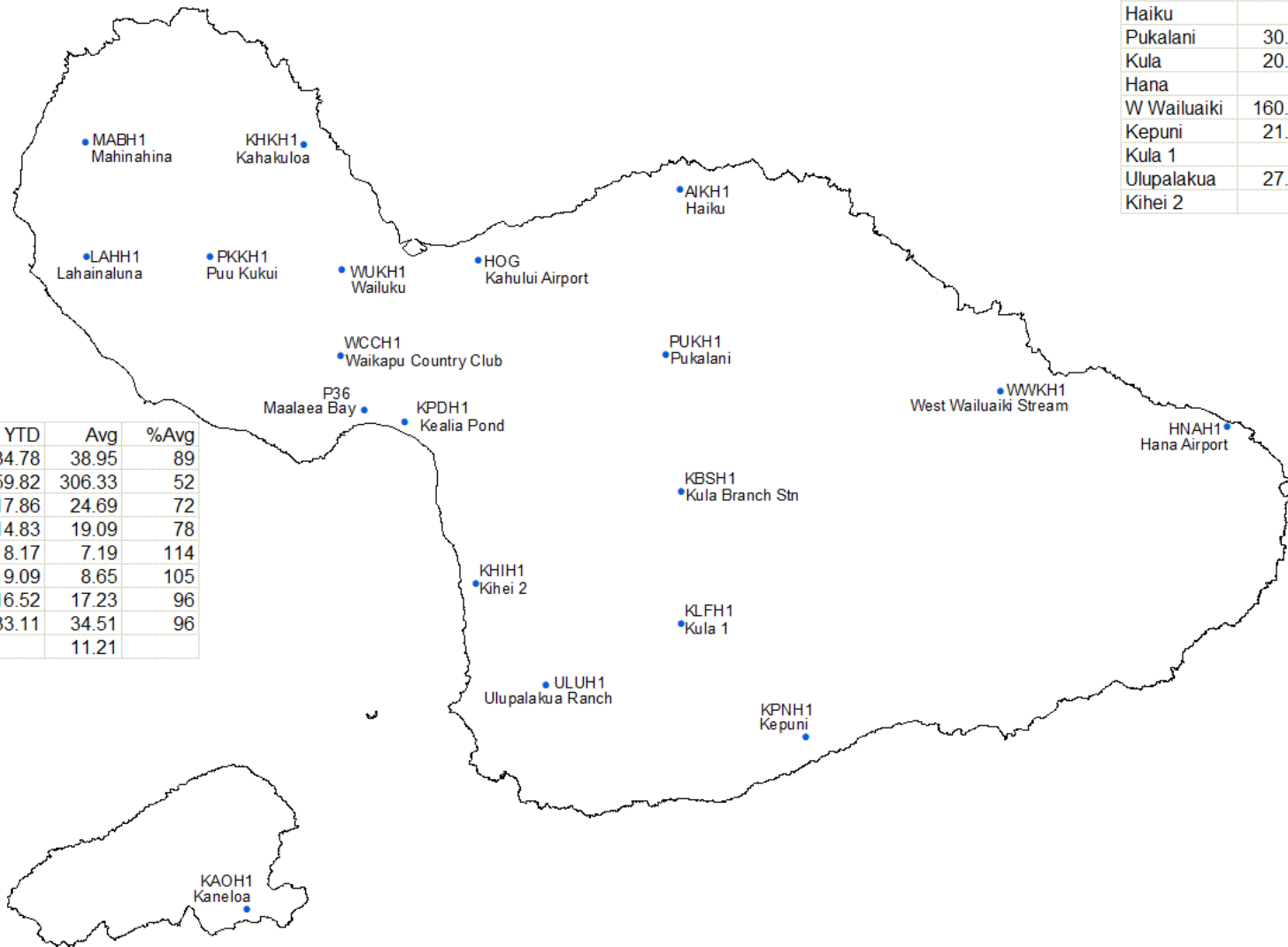


| Location    | Oct23 | Avg   | %Avg |
|-------------|-------|-------|------|
| Kahului AP  | 0.08  | 0.83  | 10   |
| Haiku       |       | 3.31  |      |
| Pukalani    | 0.01  | 2.14  | 0    |
| Kula        | 0.17  | 1.77  | 10   |
| Hana        |       | 6.88  |      |
| W Wailuaiki | 1.73  | 17.18 | 10   |
| Kepuni      | 0.85  | 1.51  | 56   |
| Kula 1      | 0.30  | 2.54  | 12   |
| Ulupalakua  | 1.80  | 2.07  | 87   |
| Kihei 2     | 0.03  | 0.46  | 7    |

| Location    | Oct23 | Avg   | %Avg |
|-------------|-------|-------|------|
| Kahakuloa   | 1.25  | 3.73  | 34   |
| Puu Kukui   | 2.05  | 26.14 | 8    |
| Wailuku     | 0.54  | 1.94  | 28   |
| Waikapu C   | 0.95  | 1.42  | 67   |
| Kealia Pond | 0.16  | 0.44  | 36   |
| Maalaea     | 0.63  | 0.54  | 117  |
| Lahainaluna | 0.08  | 1.43  | 6    |
| Mahinahina  | 0.32  | 2.64  | 12   |
| Kaneloa     |       | 1.04  |      |

# Maui October 2023 Year to Date Rainfall Totals

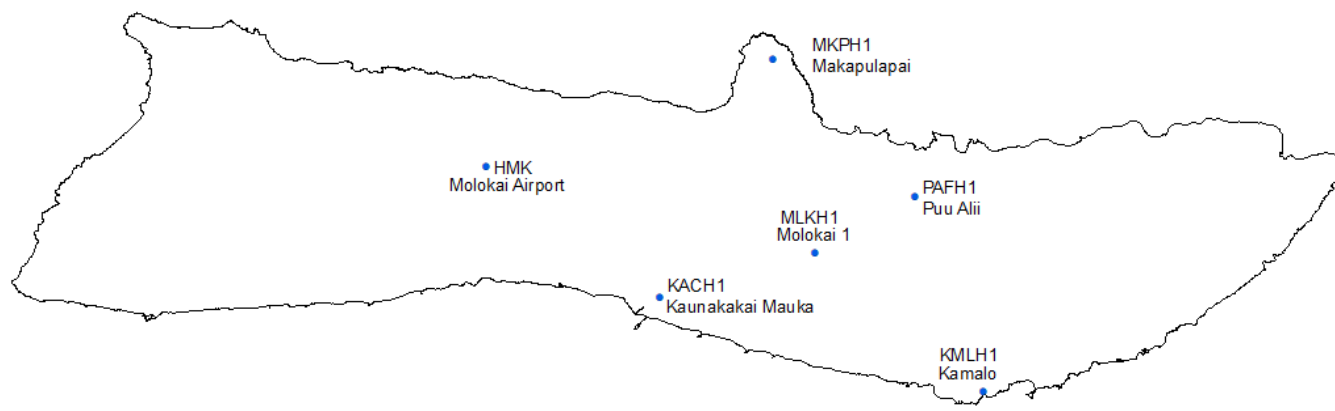
| Location    | YTD    | Avg    | %Avg |
|-------------|--------|--------|------|
| Kahului AP  | 9.67   | 11.60  | 83   |
| Haiku       |        | 39.21  |      |
| Pukalani    | 30.11  | 31.46  | 96   |
| Kula        | 20.26  | 17.08  | 119  |
| Hana        |        | 58.91  |      |
| W Wailuaiki | 160.93 | 189.25 | 85   |
| Kepuni      | 21.17  | 16.23  | 130  |
| Kula 1      |        | 27.70  |      |
| Ulupalakua  | 27.65  | 21.63  | 128  |
| Kihei 2     |        | 8.94   |      |



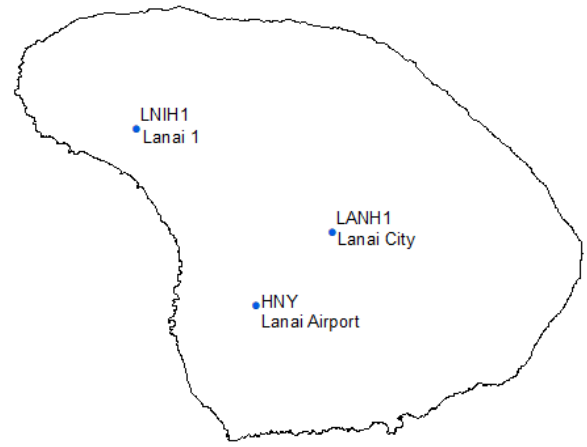
| Location    | YTD    | Avg    | %Avg |
|-------------|--------|--------|------|
| Kahakuloa   | 34.78  | 38.95  | 89   |
| Puu Kukui   | 159.82 | 306.33 | 52   |
| Wailuku     | 17.86  | 24.69  | 72   |
| Waikapu C   | 14.83  | 19.09  | 78   |
| Kealia Pond | 8.17   | 7.19   | 114  |
| Maalaea     | 9.09   | 8.65   | 105  |
| Lahainaluna | 16.52  | 17.23  | 96   |
| Mahinahina  | 33.11  | 34.51  | 96   |
| Kaneloa     |        | 11.21  |      |

Source: [https://www.weather.gov/images/hfo/hydrosun/maui\\_ytd\\_1023.gif](https://www.weather.gov/images/hfo/hydrosun/maui_ytd_1023.gif)

# Molokai and Lanai October 2023 Rainfall Totals

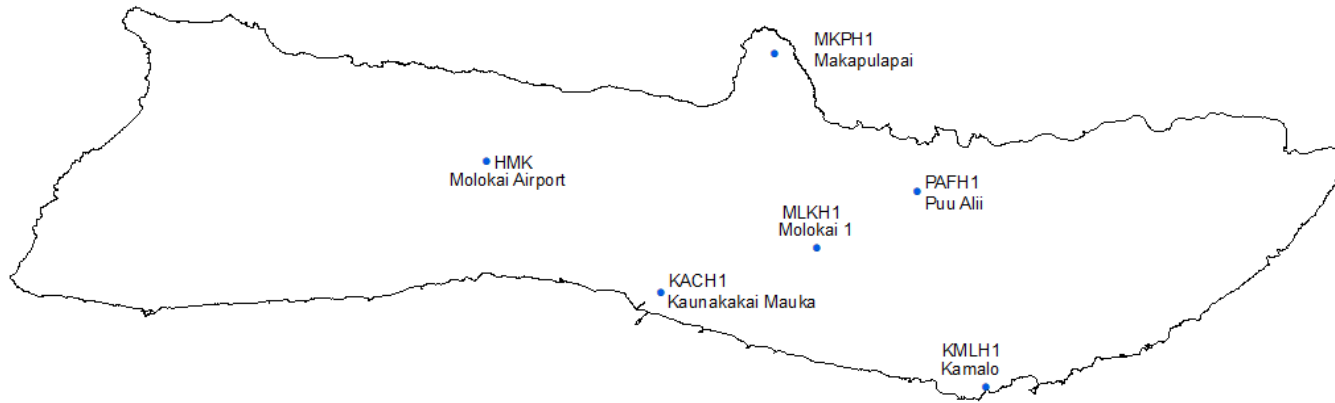


| Location    | Oct23 | Avg  | %Avg |
|-------------|-------|------|------|
| Molokai AP  | 0.79  | 1.54 | 51   |
| Molokai 1   | 1.48  | 3.68 | 40   |
| Puu Alii    | 1.30  | 6.48 | 20   |
| Makapulapai | 0.57  | 3.24 | 18   |
| Kaunakakai  | 0.20  | 0.68 | 29   |
| Kamalo      | 0.69  | 1.33 | 52   |
| Lanai City  | 0.99  | 2.99 | 33   |
| Lanai AP    | 0.19  | 1.56 | 12   |
| Lanai 1     | 0.18  | 1.91 | 9    |

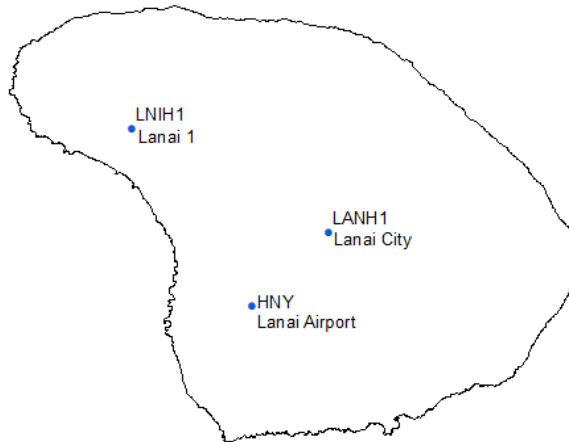


Source: [https://www.weather.gov/images/hfo/hydrosum/molan\\_1023.gif](https://www.weather.gov/images/hfo/hydrosum/molan_1023.gif)

# Molokai and Lanai October 2023 Year to Date Rainfall Totals



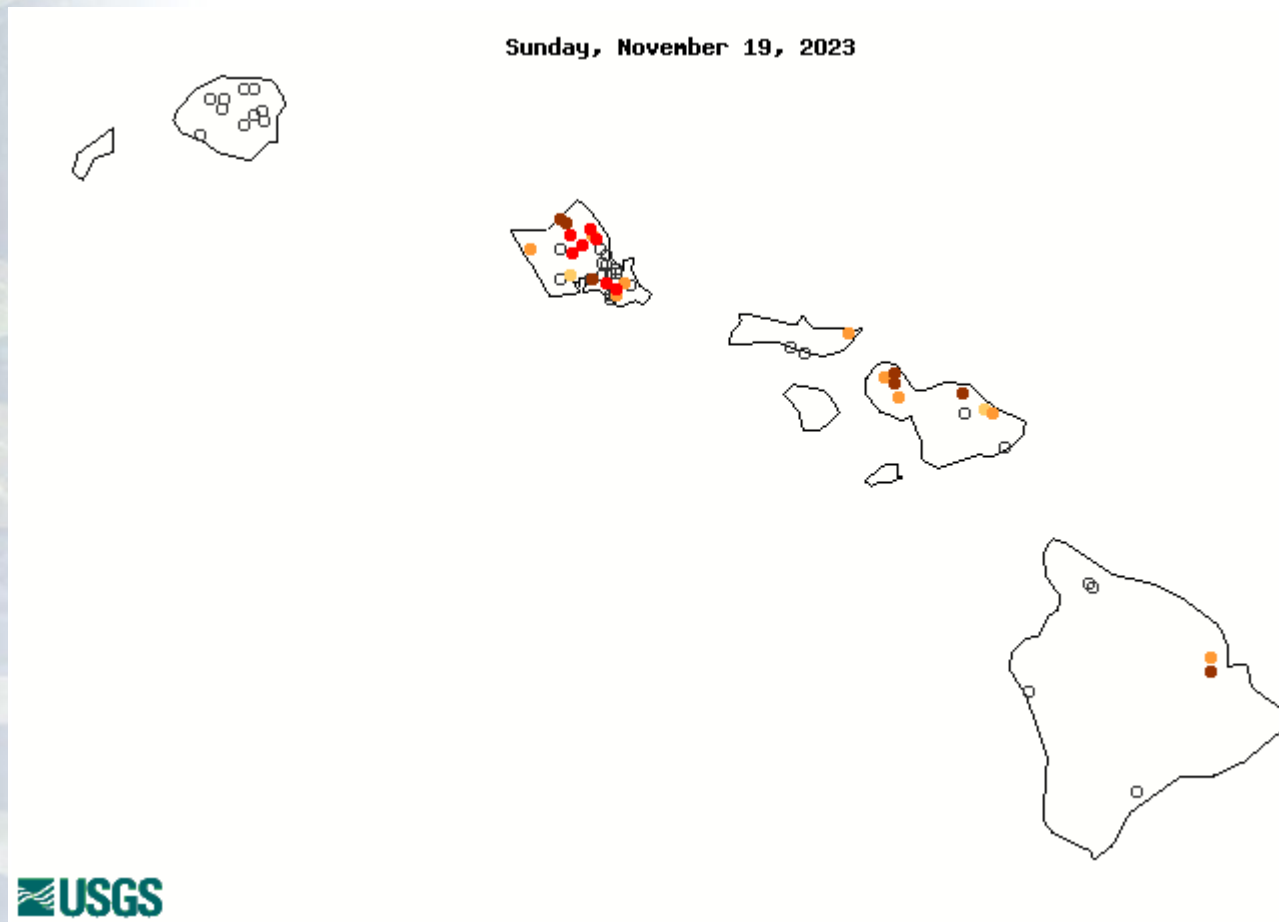
| Location    | YTD    | Avg   | %Avg |
|-------------|--------|-------|------|
| Molokai AP  | 18.54  | 16.18 | 115  |
| Molokai 1   | 39.89  | 62.72 | 64   |
| Puu Alii    | 100.24 | 80.91 | 124  |
| Makapulapai | 20.11  | 29.45 | 68   |
| Kaunakakai  | 12.99  | 10.40 | 125  |
| Kamalo      | 35.40  | 15.12 | 234  |
| Lanai City  | 27.88  | 21.45 | 130  |
| Lanai AP    | 12.14  | 14.36 | 85   |
| Lanai 1     | 15.51  | 15.98 | 97   |








Source: [https://www.weather.gov/images/hfo/hydrosum/molan\\_ytd\\_1023.gif](https://www.weather.gov/images/hfo/hydrosum/molan_ytd_1023.gif)



# USGS Map of below normal 28-day average streamflow compared to historical streamflow for the day of year



| Explanation - Percentile classes  |   |  |   |   |
|---|---|--|---|---|
|  |  |  |  |  |
| New low   | <=5   | 6-9  | 10-24   | Not ranked  |
| Extreme hydrologic drought  | Severe hydrologic drought   | Moderate hydrologic drought  | Below normal  |   |

Source: [https://waterwatch.usgs.gov/index.php?r=hi&id=pa28d\\_dry](https://waterwatch.usgs.gov/index.php?r=hi&id=pa28d_dry)

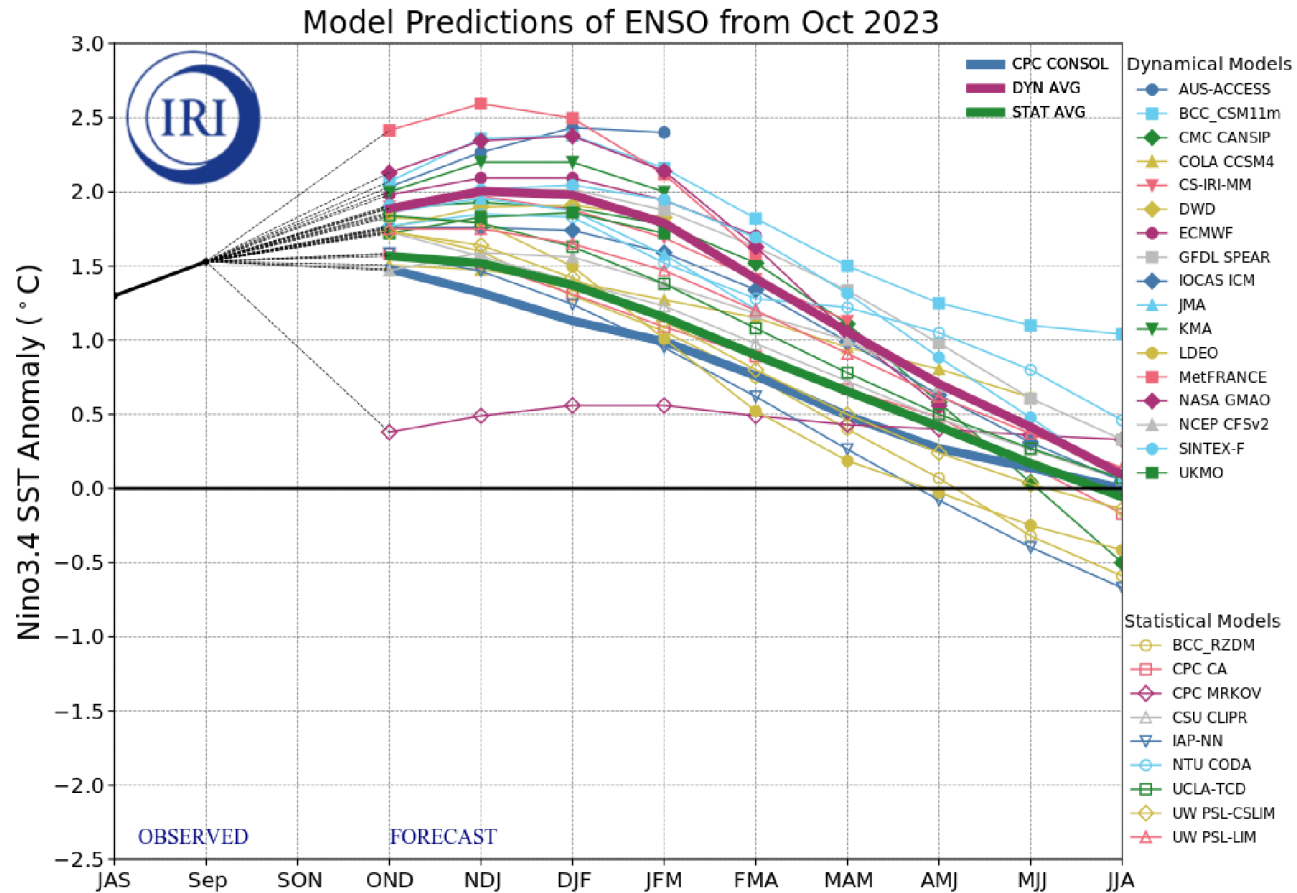


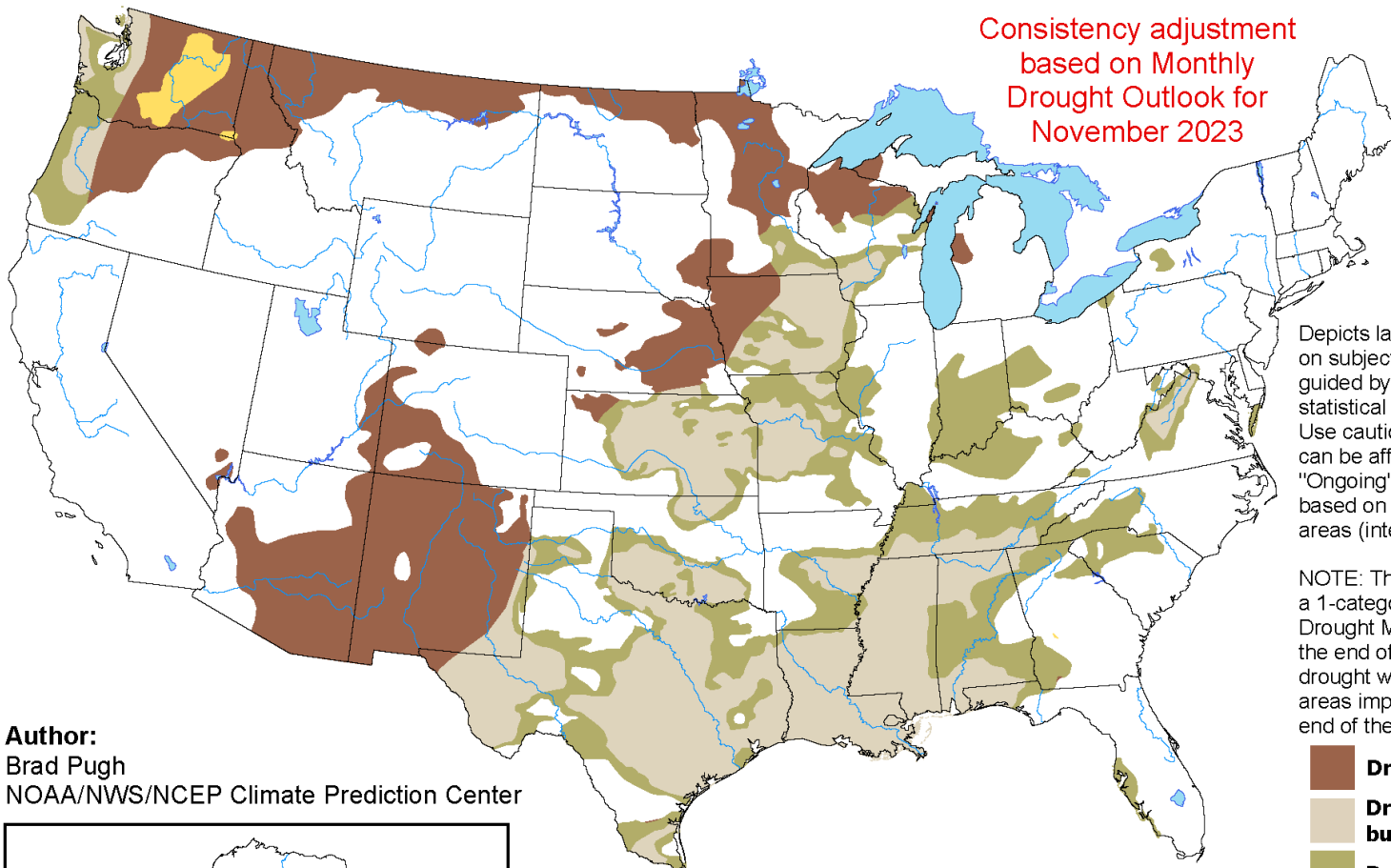
Figure 6. Forecasts of sea surface temperature (SST) anomalies for the Niño 3.4 region (5°N-5°S, 120°W-170°W). Figure updated 19 October 2023 by the International Research Institute (IRI) for Climate and Society.

# U.S. Seasonal Drought Outlook

## Drought Tendency During the Valid Period

Valid for November 1, 2023 - January 31, 2024  
Released October 31, 2023

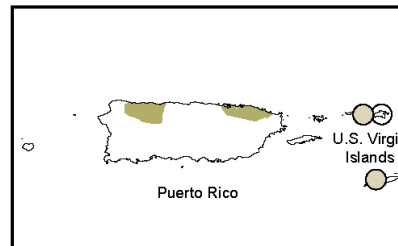
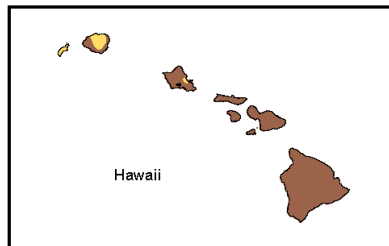
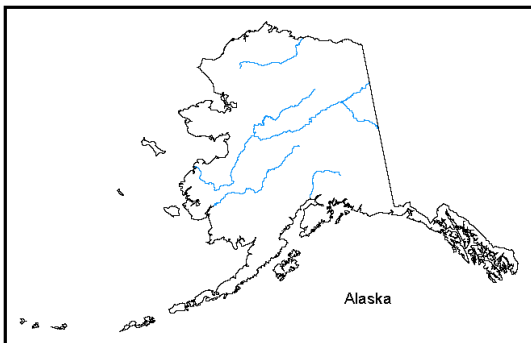
Consistency adjustment  
based on Monthly  
Drought Outlook for  
November 2023



Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

**Author:**  
Brad Pugh  
NOAA/NWS/NCEP Climate Prediction Center



-  **Drought persists**
-  **Drought remains, but improves**
-  **Drought removal likely**
-  **Drought development likely**
-  **No drought**



<https://go.usa.gov/3eZ73>

# Hawaii Drought Council Meeting Summary

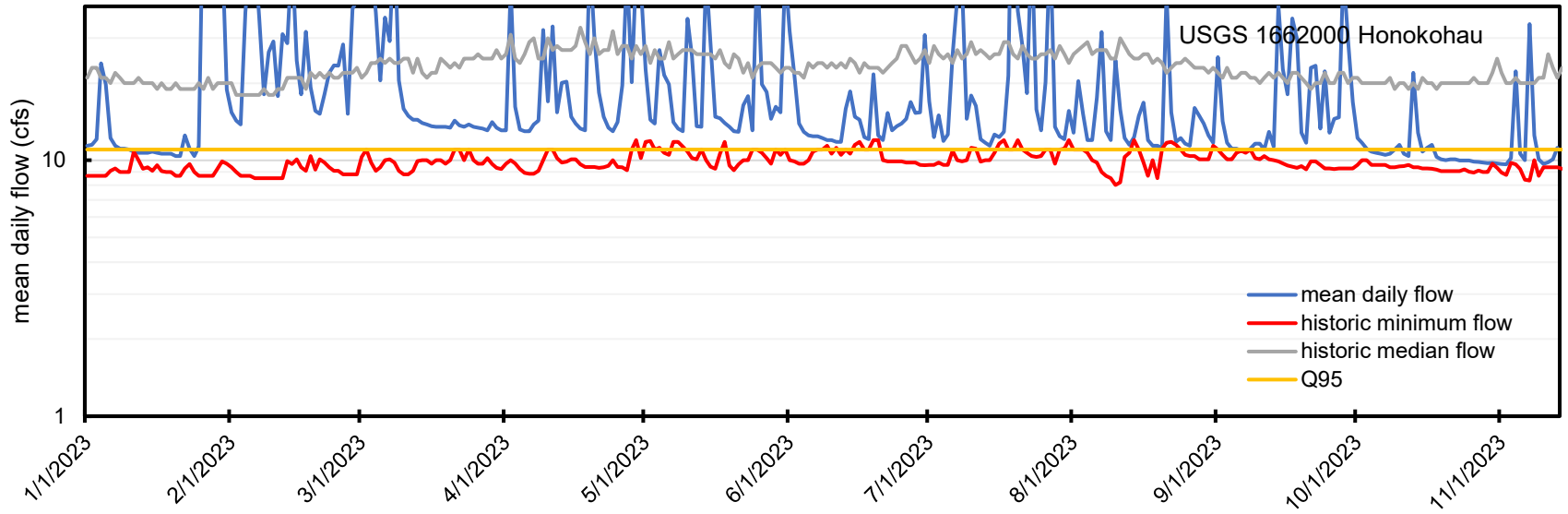
- DLNR, HDOA, HDWS, MDWS, Hawaii Farm Bureau, EMI
- Guests NWS, CWRM, Hawaii Tourism Authority, ADC, UH Office of Sustainability, Sierra Club
- Briefing from NWS on current drought and drought outlook
- Report from MDWS, HDWS, current USDA drought programs
- Proposed coordinated drought / water conservation campaign public and private sectors
- Potential for Governor's drought proclamation
- Legislative proposals, Legislative Wildfire Prevention Working Group

# CWRM Drought Messaging

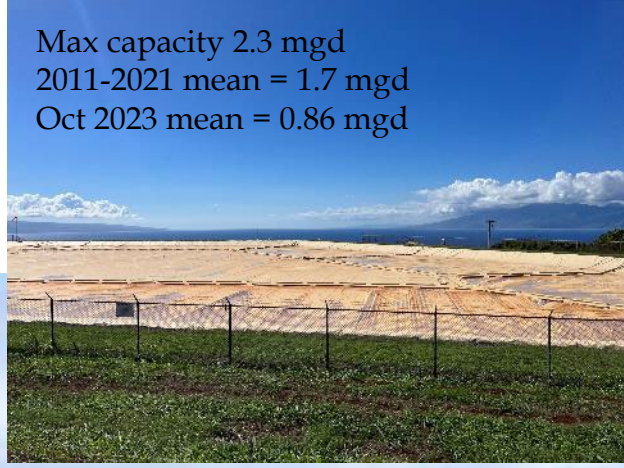
- **Developing message and requests**
  - **Expect prolonged drought and possibly no relief until 2024 wet season**
  - **Water Conservation**
  - **Public and private water systems, agricultural water, commercial & industrial**
  - **Equitable kuleana for preserving water resources**
- **Will coordinate with government, public, and private sector**
- **Rollout with Governor's drought message**

# West Maui- Honokōhau

1912-present



# West Maui- Mahinahina Water Treatment Facility

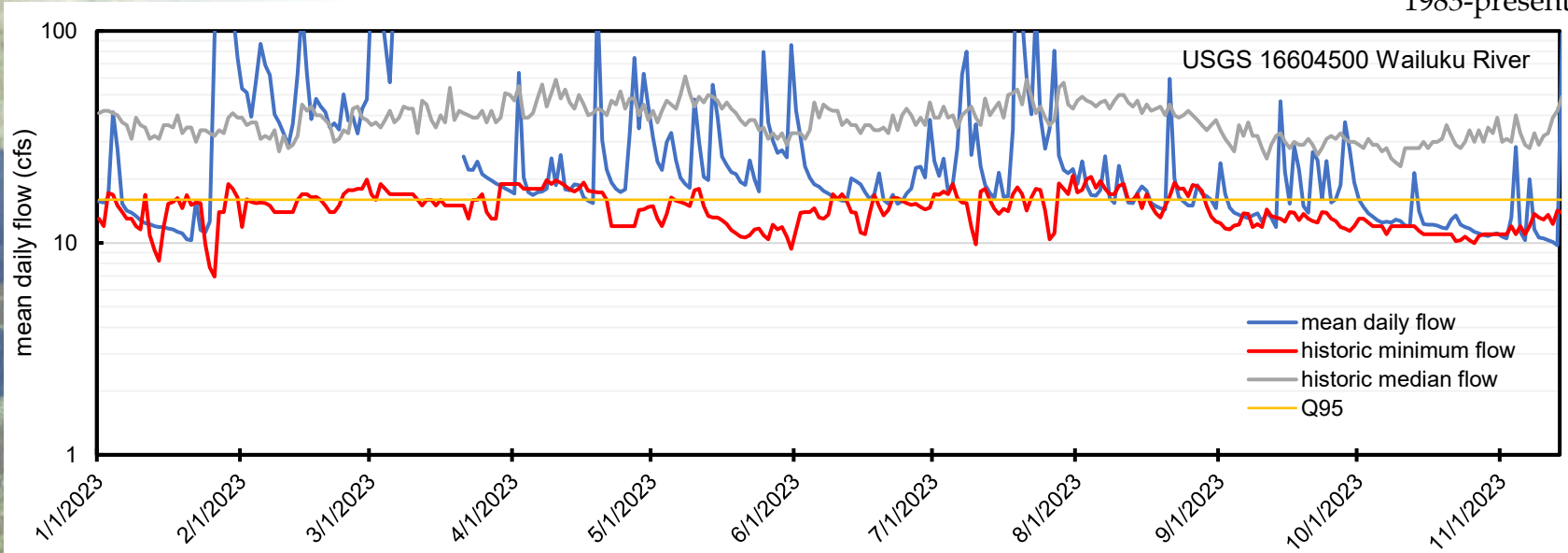


Max capacity 2.3 mgd  
2011-2021 mean = 1.7 mgd  
Oct 2023 mean = 0.86 mgd



# West Maui- Wailuku

1983-present





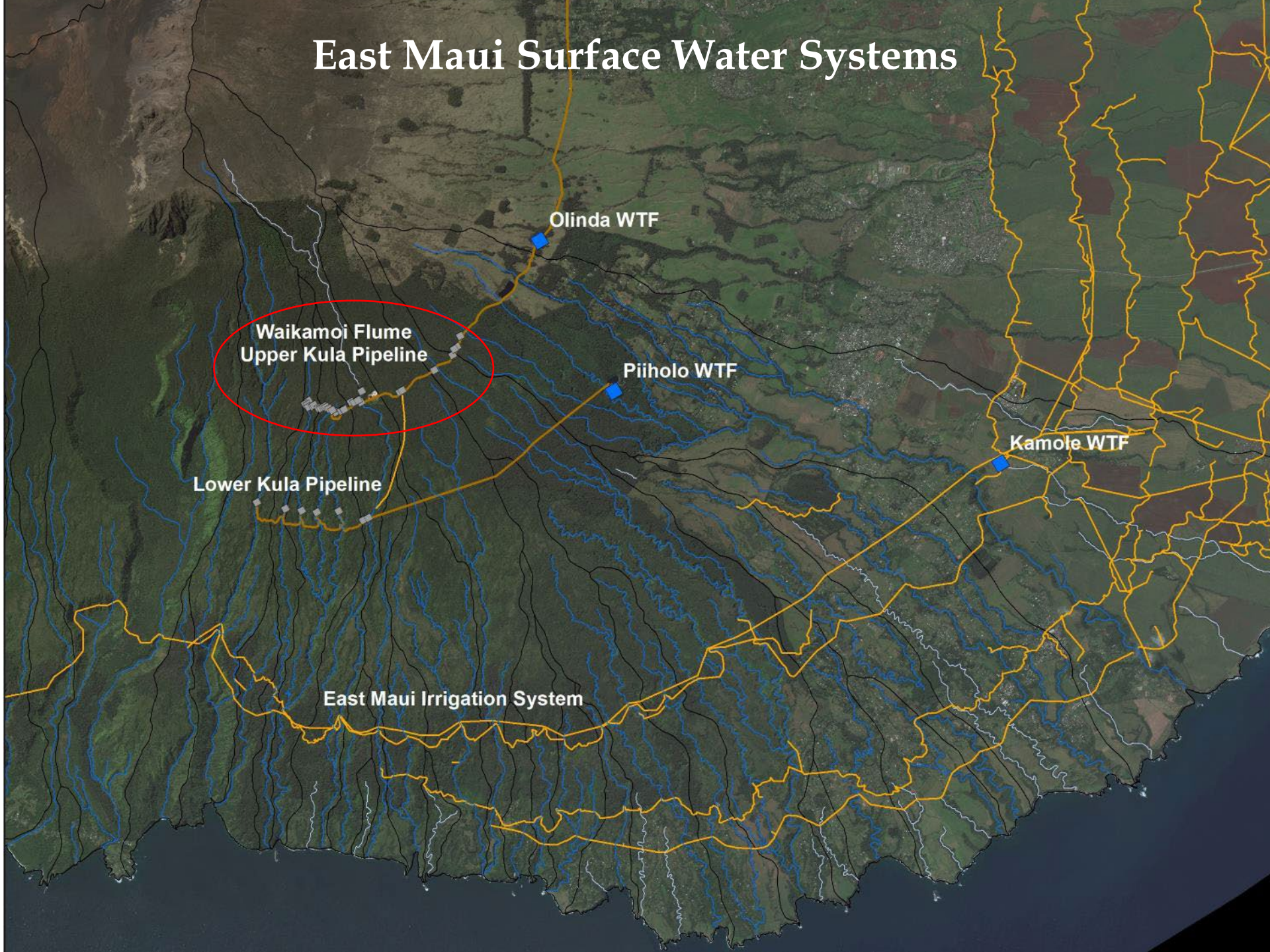
# West Maui- 'Īao Water Treatment Facility



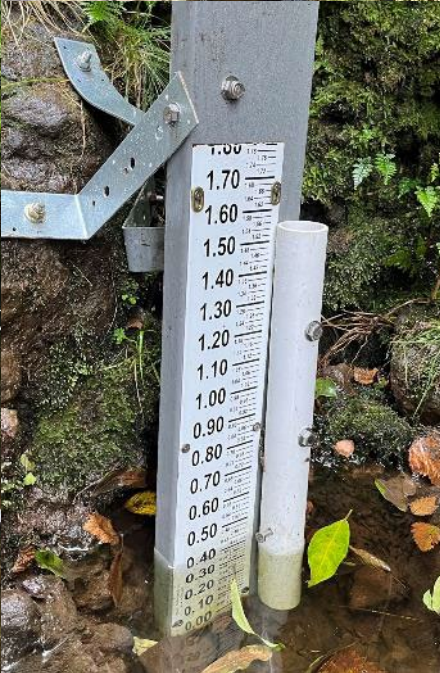
Max capacity 3.2 mgd  
WUP = 3.2 mgd  
Oct 2023 mean = 2.65 mgd



# East Maui Surface Water Systems



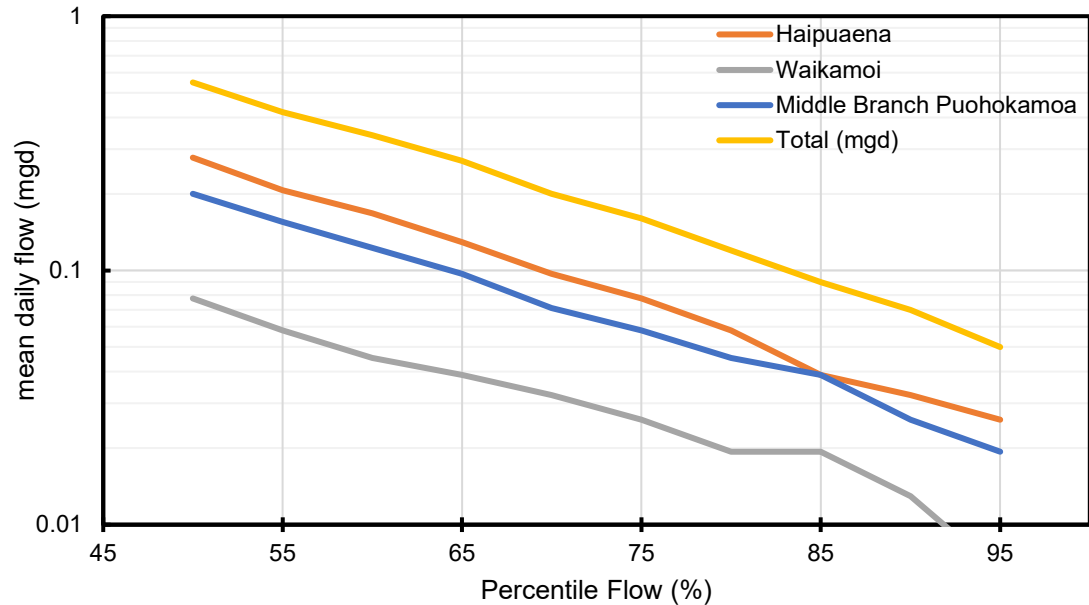
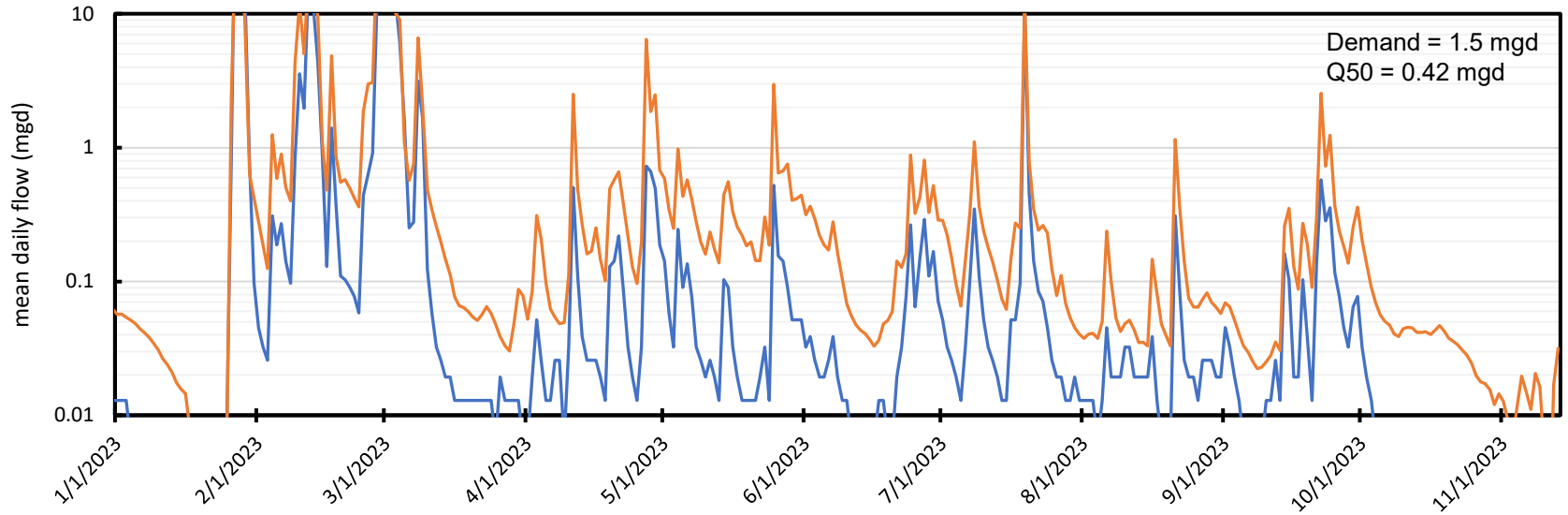
# East Maui- Waikamoi Flume/Upper Kula Pipeline



# East Maui- Waikamoi Flume/Upper Kula Pipeline



# Streamflow Available at Waikamoi Flume/Upper Kula Pipeline Reservoirs for Olinda Water Treatment Facility



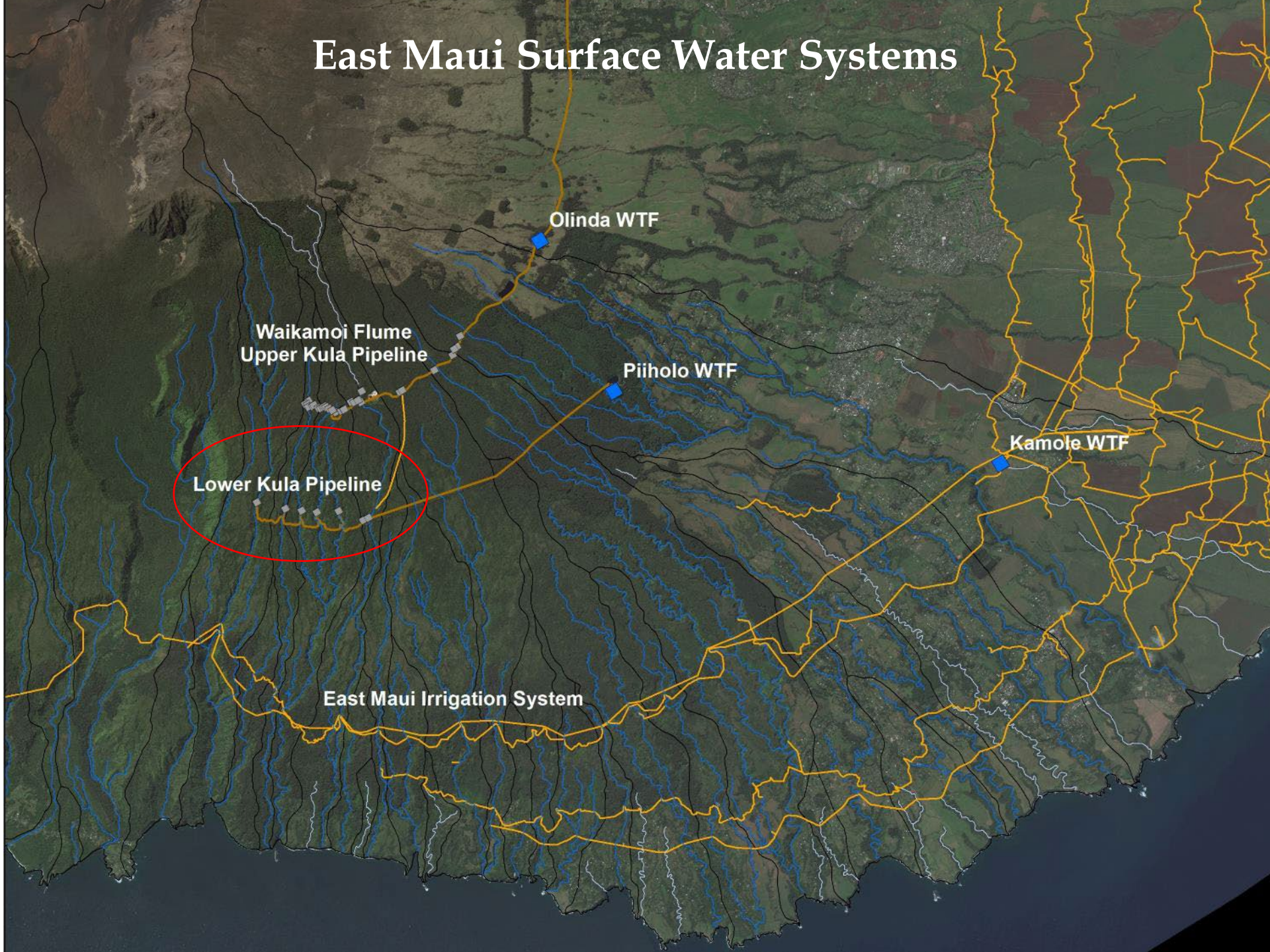
# East Maui- Waikamoi Flume/Upper Kula Pipeline



# Upcountry-Olinda Water Treatment Facility



# East Maui Surface Water Systems



Waikamoi Flume  
Upper Kula Pipeline

Lower Kula Pipeline

Olinda WTF

Piiholo WTF

Kamole WTF

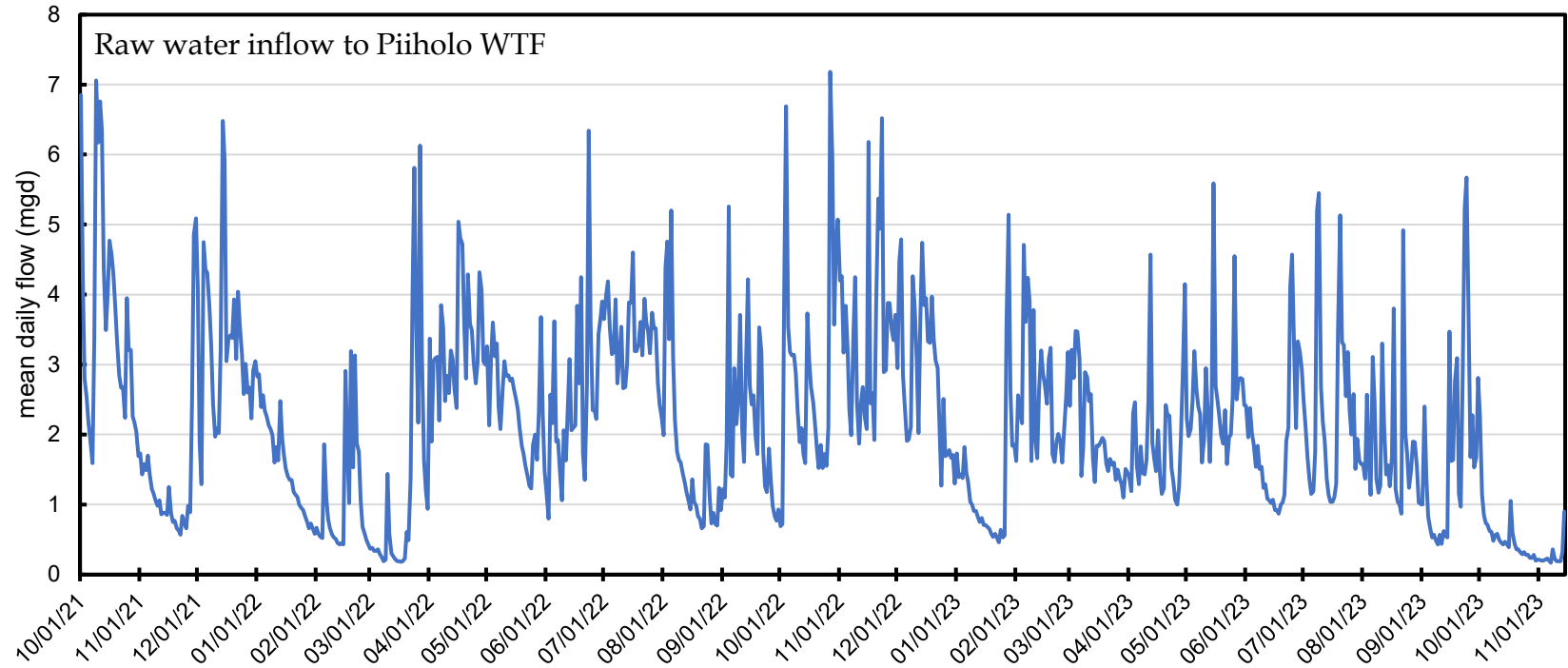
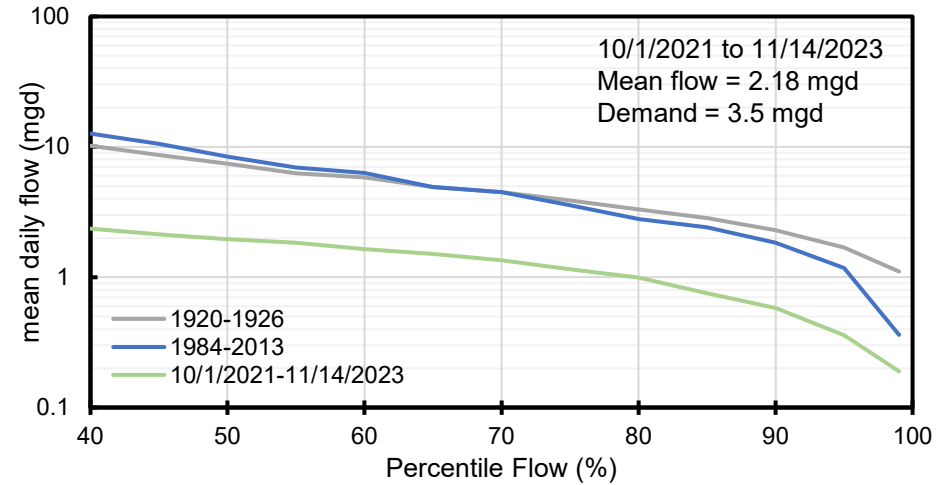
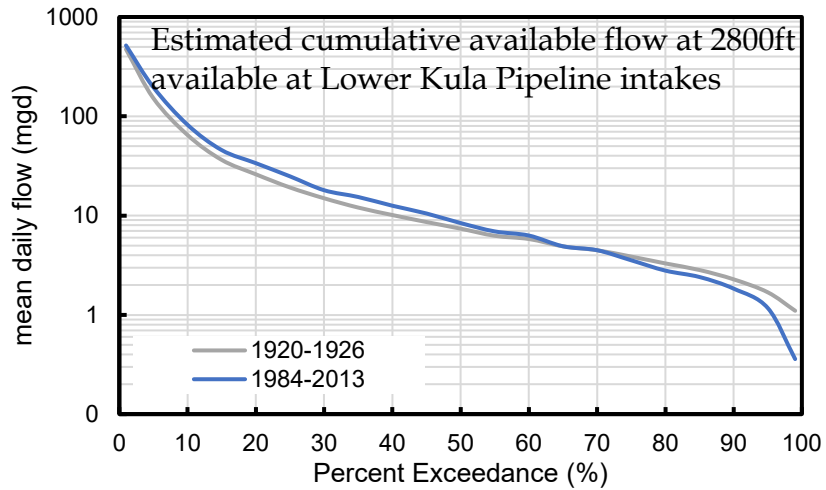
East Maui Irrigation System



# Upcountry-Piiholo Water Treatment Facility



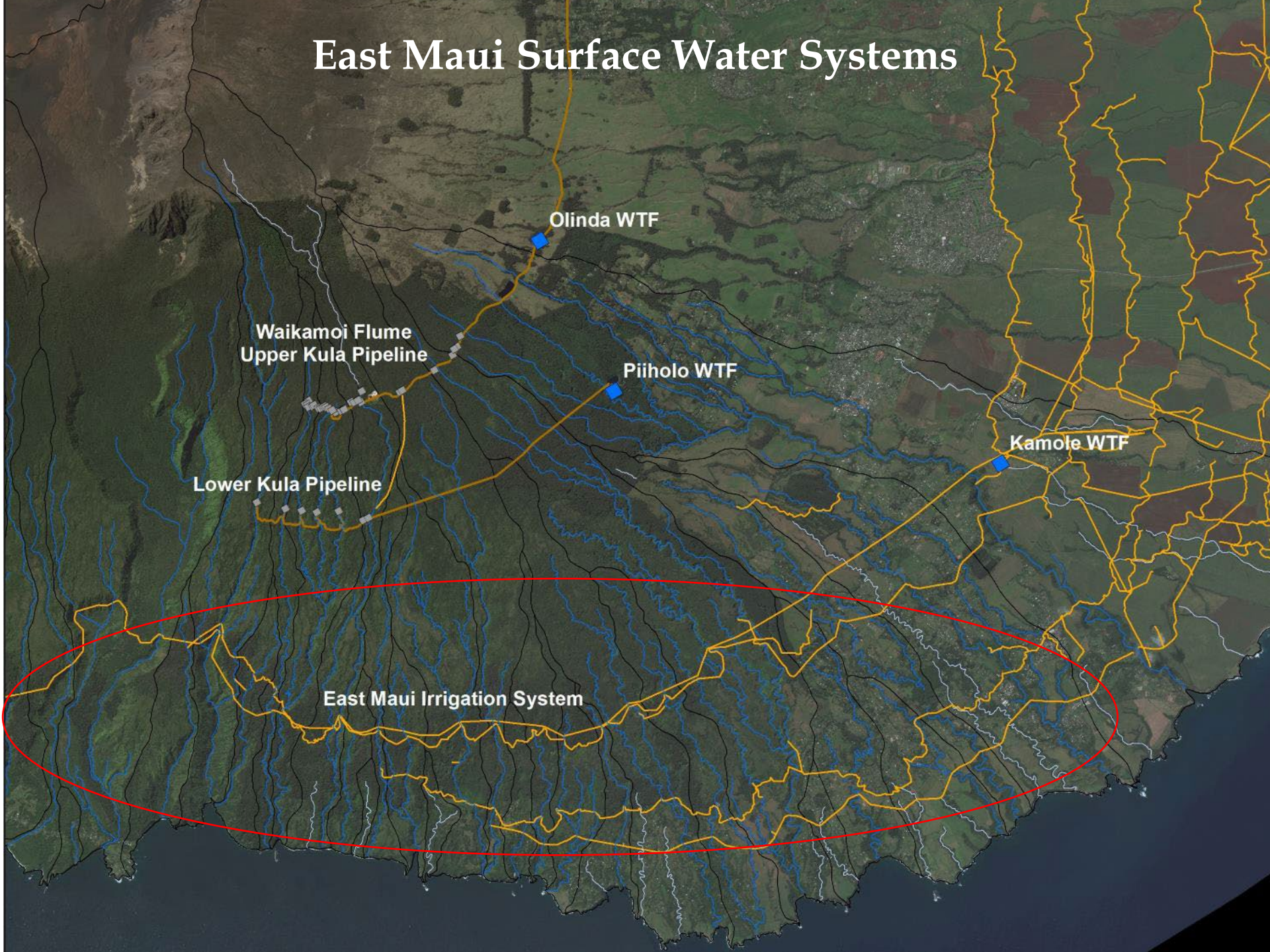
# Upcountry-Piiholo Water Treatment Facility



# Upcountry-Piiholo Water Treatment Facility



# East Maui Surface Water Systems



Olinda WTF

Waikamoi Flume  
Upper Kula Pipeline

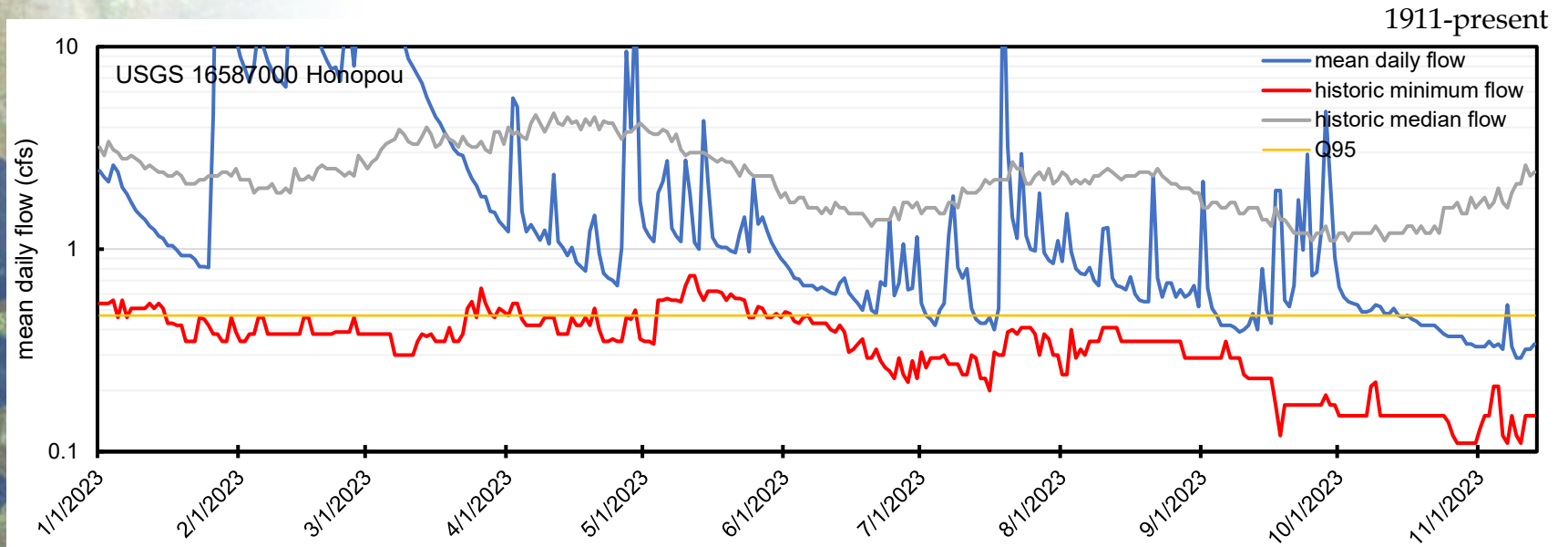
Piiholo WTF

Kamole WTF

Lower Kula Pipeline

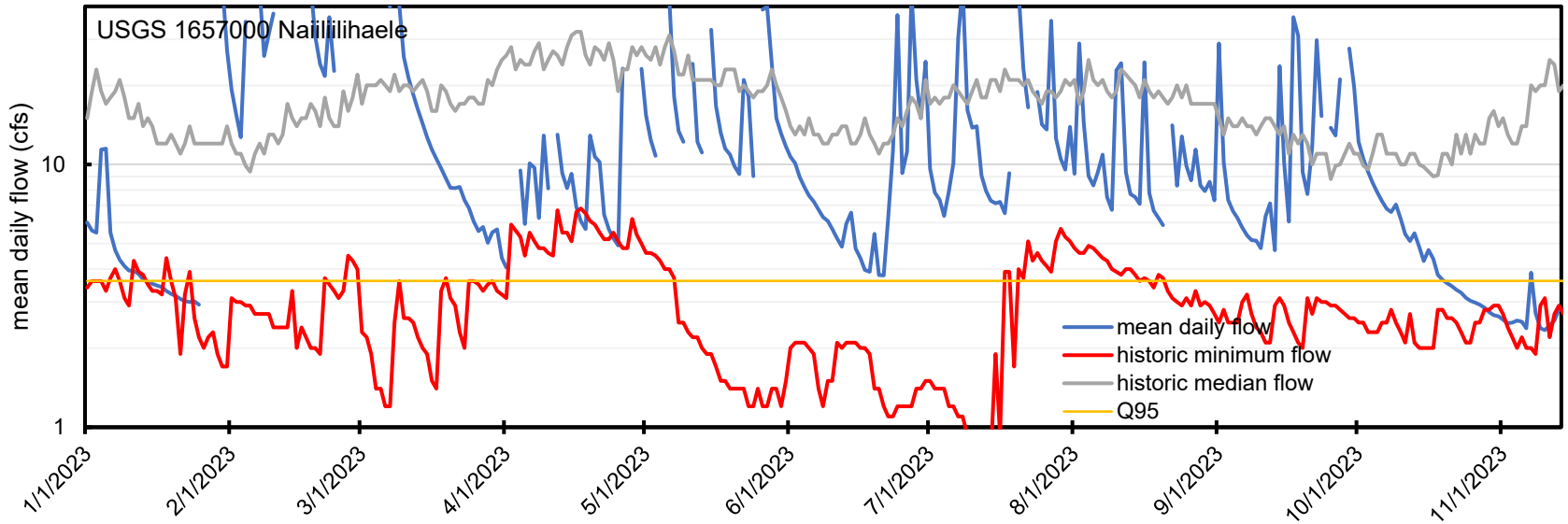
East Maui Irrigation System

# East Maui- Honopou



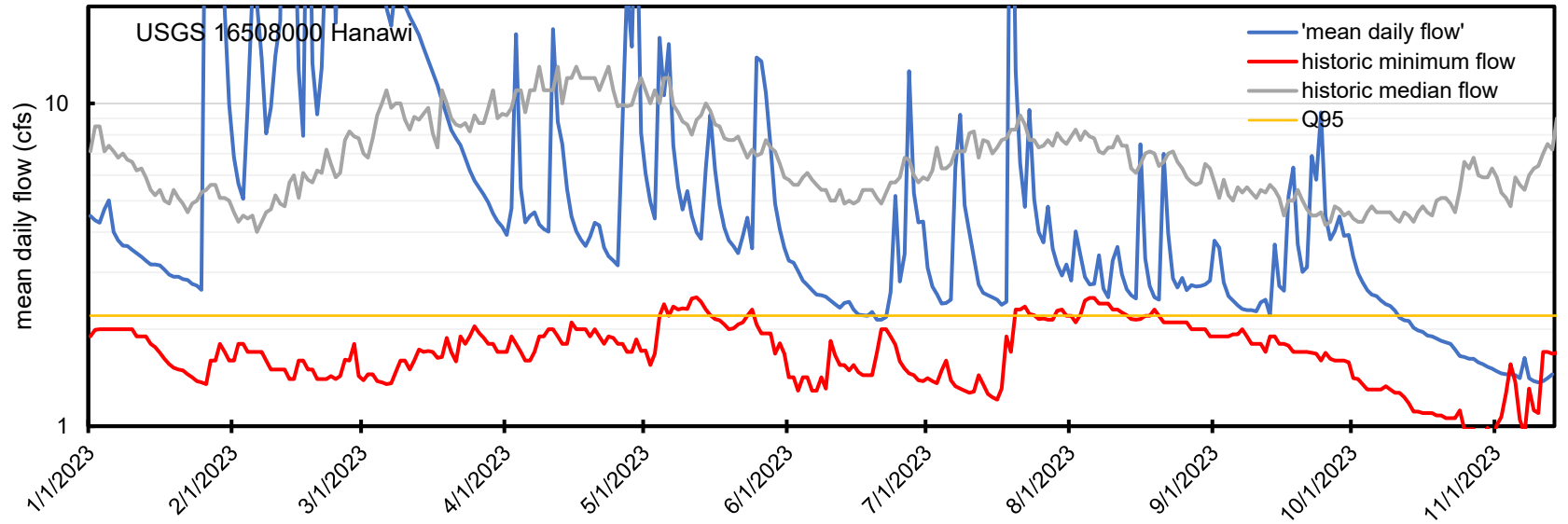
# East Maui- Naiiliilihaele

1911-present

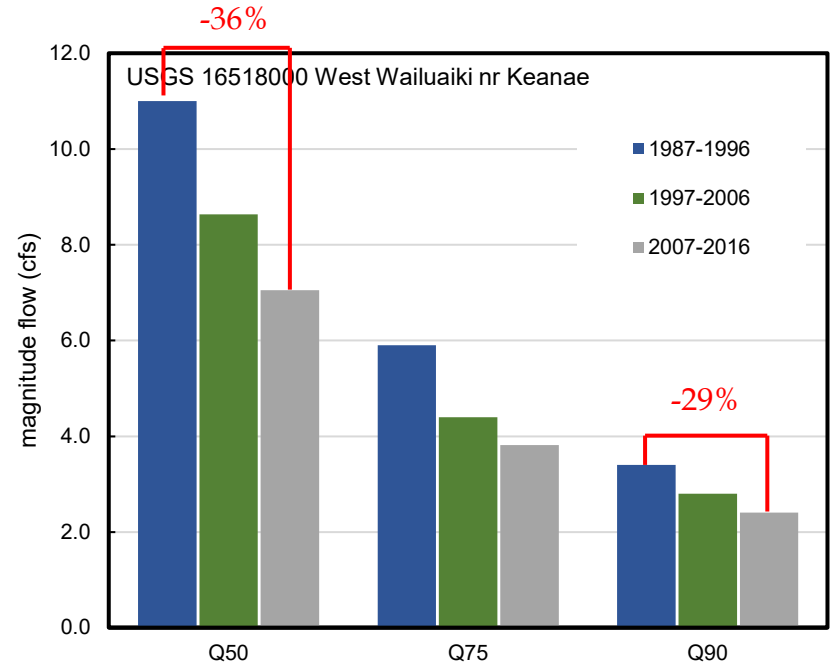
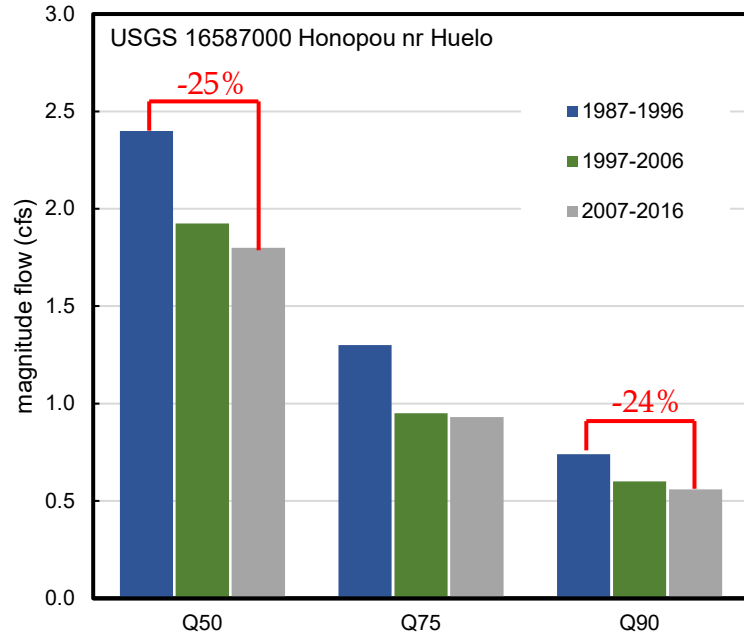


# East Maui- Hanawā

1914-present



# Change in Hydrology Over Time





# Low-Flow Characteristics and Surface Water Availability in East Maui, Hawai‘i

June 2022

PR-2022-01



**State of Hawaii**  
Department of Land and Natural Resources  
Commission on Water Resource Management



# Low-Flow Characteristics and Surface Water Availability in East Maui, Hawai‘i

June 2022

PR-2022-01

**Table 16.** Estimated natural low-flow duration discharges at partial-record (PR) and short-term continuous record (CR) sites and seepage gains at selection stream locations in the Huelo region, East Maui, Hawai‘i.  
[ID, identifier; USGS station number if a USGS station was historically operated at the given location; abv, above]

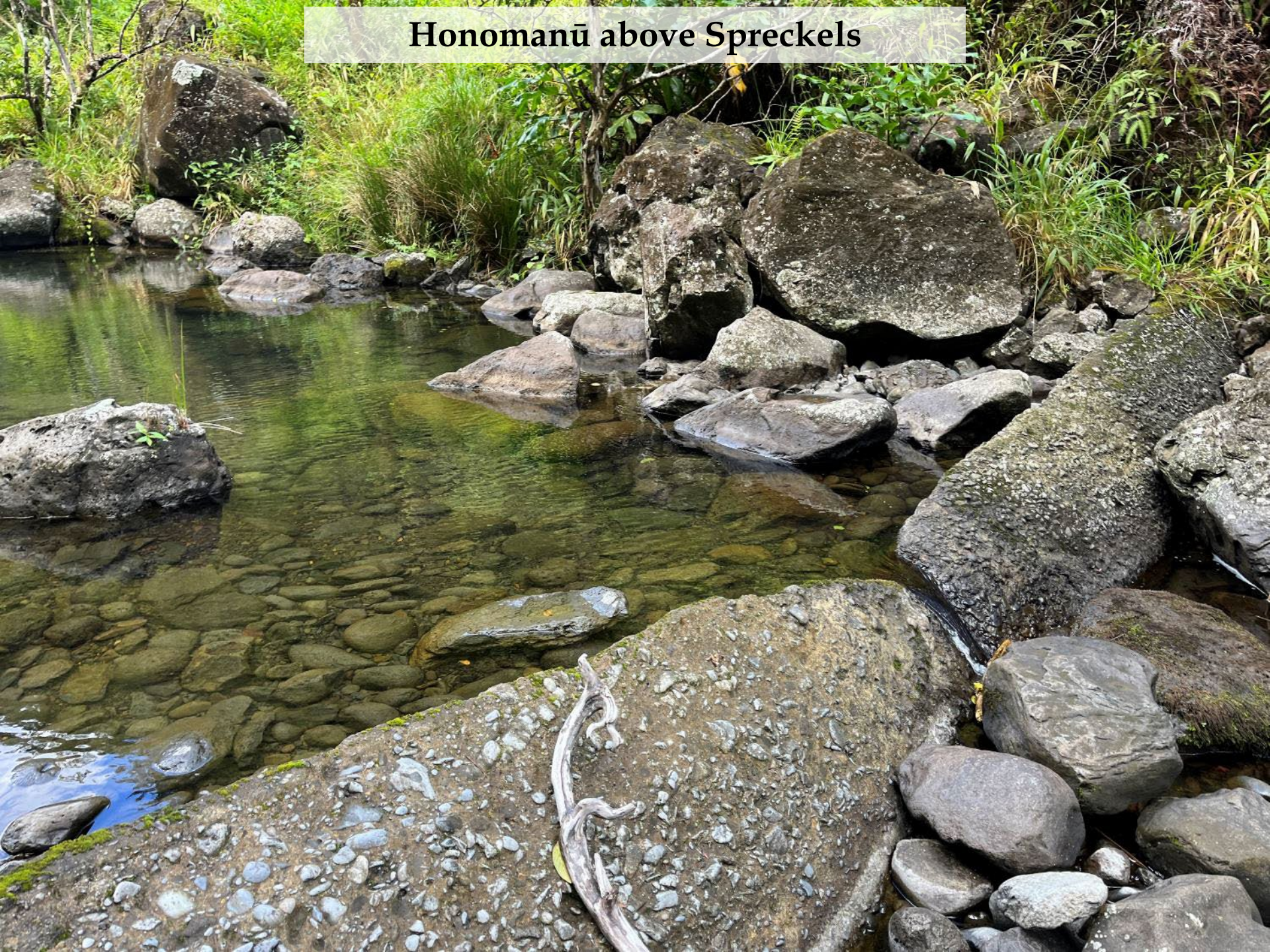
| USGS ID  | Station ID | station name                           | Discharge, in ft <sup>3</sup> /s, for selected percentages of time (from 50 to 95 percent) the indicated discharge was equaled or exceeded |                 |                 |                 |                 |                 |                 |                 |                 |                 |
|----------|------------|--|--|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|          |            |  | Q <sub>50</sub>  | Q <sub>55</sub> | Q <sub>60</sub> | Q <sub>65</sub> | Q <sub>70</sub> | Q <sub>75</sub> | Q <sub>80</sub> | Q <sub>85</sub> | Q <sub>90</sub> | Q <sub>95</sub> |
|          | PR-1       | East Kōlea abv Wailoa Ditch            | 0.30   | 0.26            | 0.23            | 0.19            | 0.16            | 0.14            | 0.12            | 0.10            | 0.08            | 0.06            |
|          | PR-2       | West Kōlea abv Wailoa Ditch            | 0.65   | 0.56            | 0.48            | 0.41            | 0.35            | 0.29            | 0.25            | 0.21            | 0.17            | 0.13            |
|          | PR-3       | Punalu‘u abv Center Ditch              | 0.48   | 0.43            | 0.37            | 0.30            | 0.27            | 0.22            | 0.19            | 0.15            | 0.12            | 0.09            |
| 16565000 | PR-4       | Ka‘aiea abv Wailoa Ditch               | 3.8  | 3.2             | 2.7             | 2.2             | 1.8             | 1.5             | 1.2             | 1.0             | 0.79            | 0.57            |
|          | PR-5       | Makanali abv Wailoa Ditch              | 0.28   | 0.26            | 0.23            | 0.20            | 0.18            | 0.15            | 0.13            | 0.11            | 0.08            | 0.05            |
| 16566000 | PR-6       | ‘O‘opuola abv Wailoa Ditch             | 1.0  | 0.92            | 0.82            | 0.72            | 0.63            | 0.55            | 0.48            | 0.42            | 0.35            | 0.28            |
|          | PR-7       | ‘O‘opuola Tributary abv Wailoa Ditch   | 0.24   | 0.21            | 0.19            | 0.16            | 0.14            | 0.12            | 0.11            | 0.09            | 0.08            | 0.06            |
|          | PR-8       | West ‘O‘opuola abv Wailoa Ditch        | 0.36   | 0.32            | 0.29            | 0.26            | 0.23            | 0.21            | 0.19            | 0.17            | 0.14            | 0.12            |
| 16570000 | CR-1       | Nailiilihale abv Wailoa Ditch          | 13   | 11              | 9.9             | 8.5             | 7.3             | 6.2             | 5.3             | 4.5             | 3.7             | 2.8             |
|          | PR-9       | Oanui abv Wailoa Ditch                 | 1.7  | 1.5             | 1.3             | 1.1             | 0.89            | 0.72            | 0.58            | 0.46            | 0.32            | 0.18            |
| 16577000 | *PR-10     | Kaihua abv Lowrie Ditch                | 0.55   | 0.48            | 0.42            | 0.33            | 0.30            | 0.24            | 0.20            | 0.16            | 0.13            | 0.10            |
|          | PR-11      | Hanawana abv Lowrie Ditch              | 0.44   | 0.39            | 0.34            | 0.27            | 0.25            | 0.21            | 0.17            | 0.14            | 0.12            | 0.09            |
|          | PR-12      | Hoahua abv Wailoa Ditch                | 1.3  | 1.1             | 1.0             | 0.94            | 0.85            | 0.76            | 0.68            | 0.61            | 0.53            | 0.44            |
|          | PR-13      | East Hoahua Tributary abv Wailoa Ditch | 1.1  | 0.98            | 0.87            | 0.76            | 0.67            | 0.58            | 0.51            | 0.44            | 0.37            | 0.29            |
|          | *PR-14     | Hoahua abv Lowrie Ditch                | 1.5  | 1.3             | 1.2             | 0.88            | 0.79            | 0.63            | 0.51            | 0.41            | 0.32            | 0.23            |
|          | PR-15      | Waipi‘o abv Wailoa Ditch               | 0.73   | 0.52            | 0.39            | 0.30            | 0.23            | 0.19            | 0.14            | 0.11            | 0.09            | 0.06            |
| 16585000 | PR-16      | Hoolawaliūliū abv Wailoa Ditch         | 3.3  | 3.1             | 2.8             | 2.5             | 2.3             | 2.1             | 1.9             | 1.7             | 1.5             | 1.2             |
| 16586000 | PR-17      | Ho‘olawamui abv Wailoa Ditch           | 3.0  | 2.7             | 2.4             | 2.0             | 1.8             | 1.5             | 1.3             | 1.1             | 0.91            | 0.71            |
|          | PR-18      | West Ho‘olawamui abv Wailoa Ditch      | 0.26   | 0.23            | 0.21            | 0.17            | 0.16            | 0.13            | 0.12            | 0.10            | 0.08            | 0.07            |
|          | *PR-19     | Hoolawaliūliū abv Lowrie Ditch         | 1.2  | 1.1             | 1.0             | 0.88            | 0.83            | 0.74            | 0.67            | 0.60            | 0.53            | 0.45            |
|          | PR-20      | Mokupapa abv Haiku Ditch               | <0.72  | <0.72           | <0.72           | <0.72           | <0.72           | <0.72           | <0.72           | <0.72           | <0.72           | <0.72           |

\*represents seepage gains below Wailoa/New Hāmākua Ditches

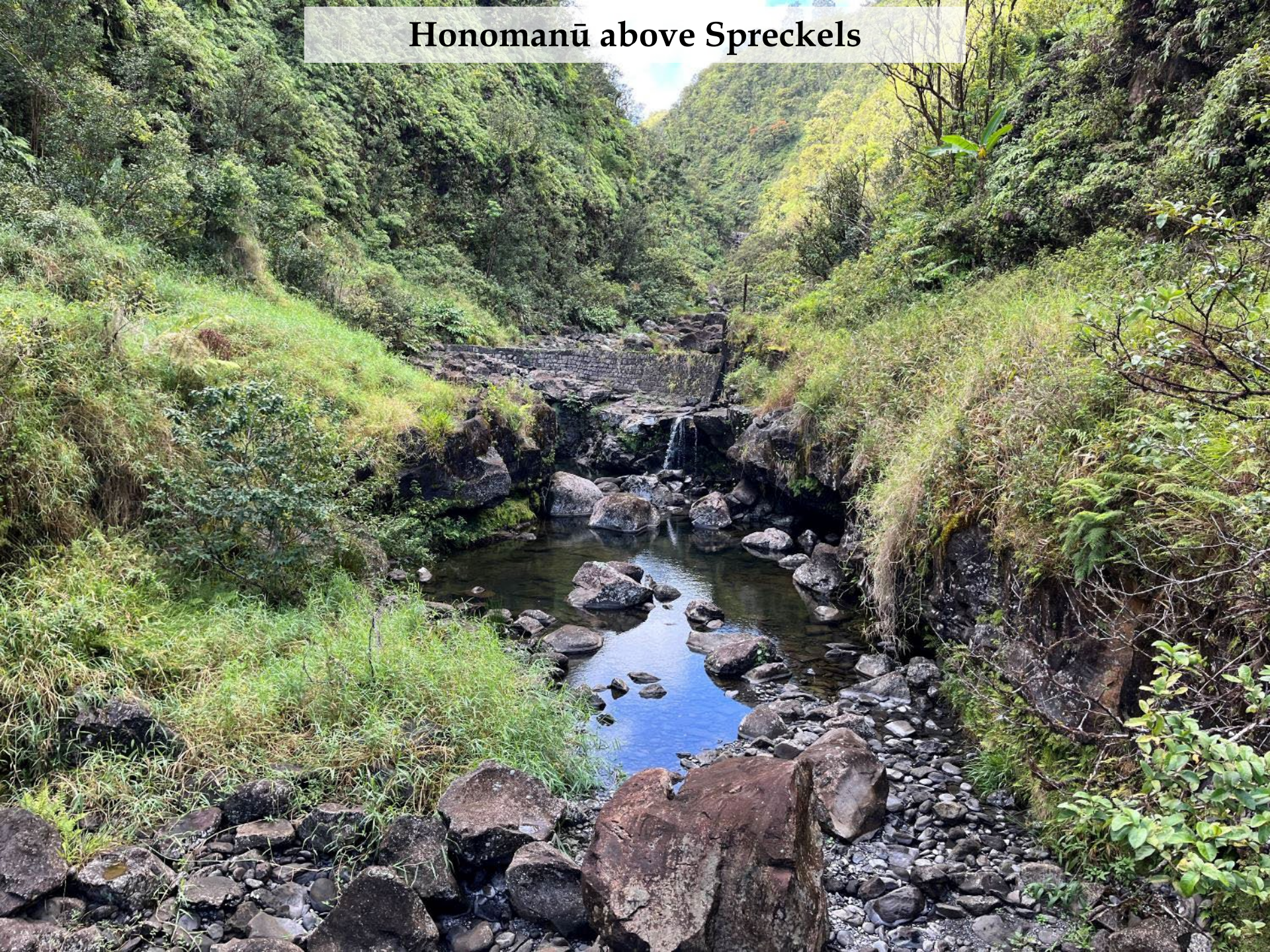
State of Hawaii  
Department of Land and Natural Resources  
Commission on Water Resource Management



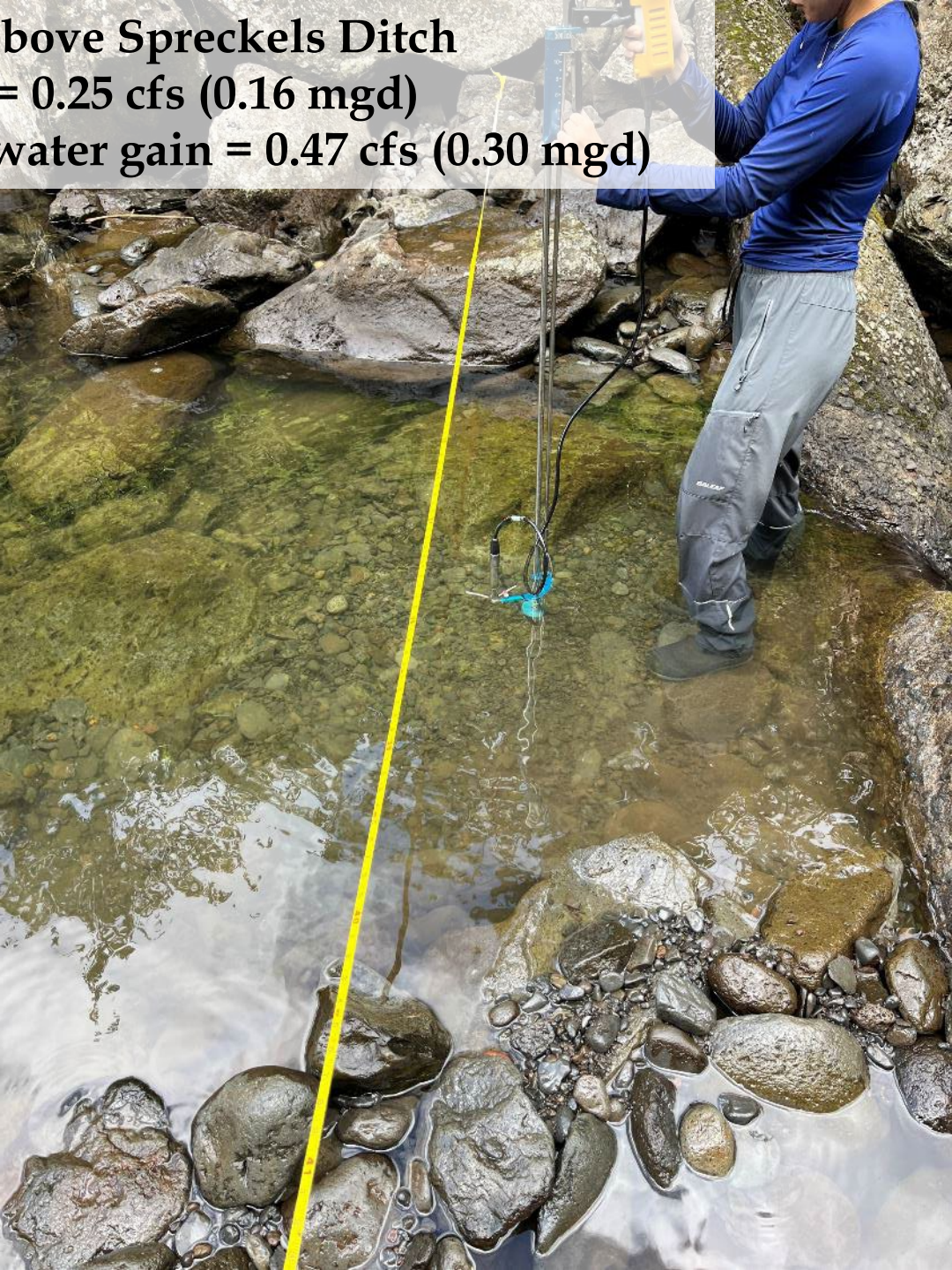
# Honomanū above Spreckels



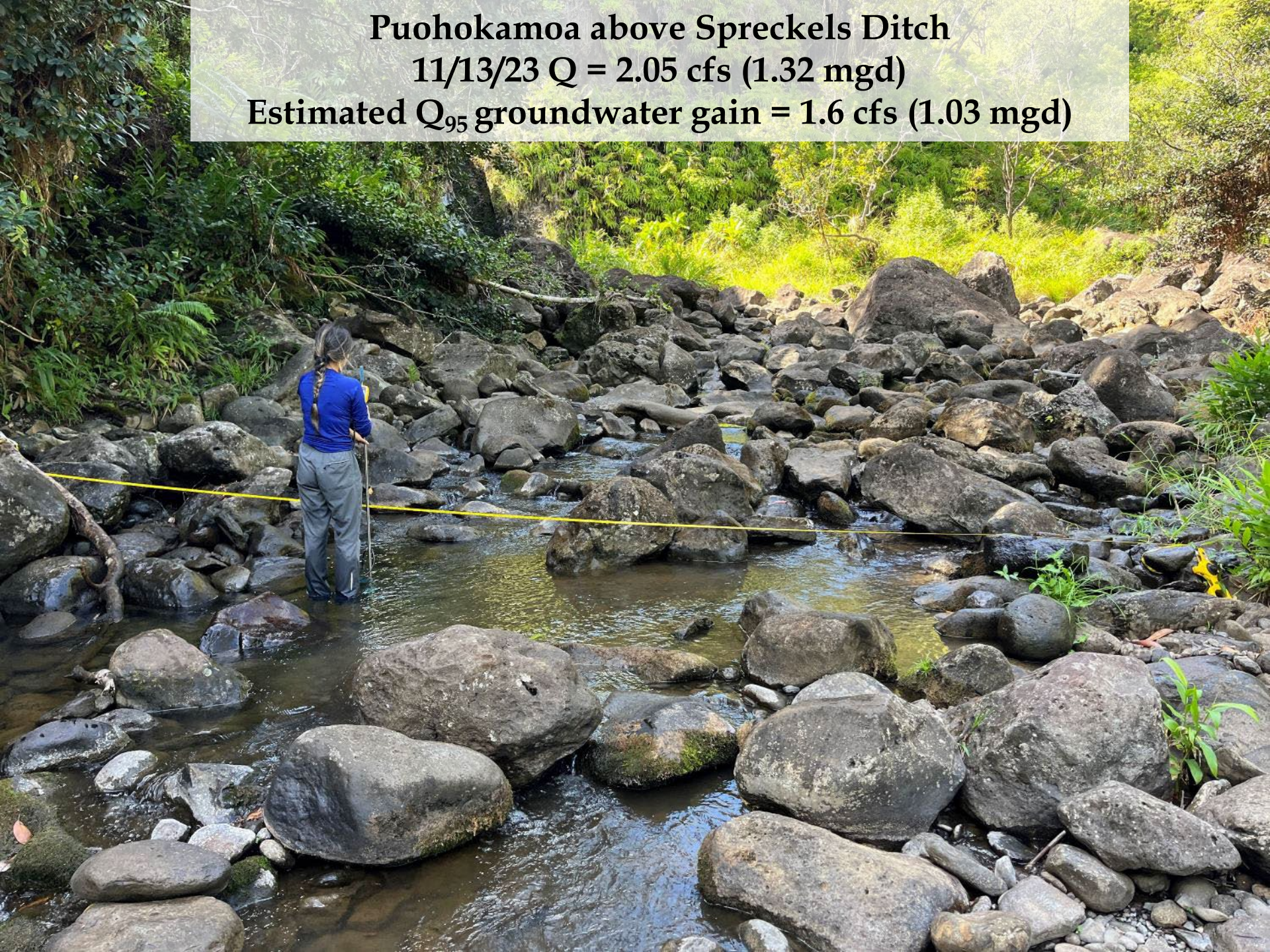
# Honomanū above Spreckels



**Honomanū above Spreckels Ditch**  
**11/13/23  $Q = 0.25$  cfs (0.16 mgd)**  
**Estimated  $Q_{95}$  groundwater gain = 0.47 cfs (0.30 mgd)**



**Puohokamoa above Spreckels Ditch**  
**11/13/23 Q = 2.05 cfs (1.32 mgd)**  
**Estimated Q<sub>95</sub> groundwater gain = 1.6 cfs (1.03 mgd)**



Puohokamo  
11/13/23 C  
Estimated  $Q_{95}$  grou



# **Puohokamoa above Spreckels Ditch**

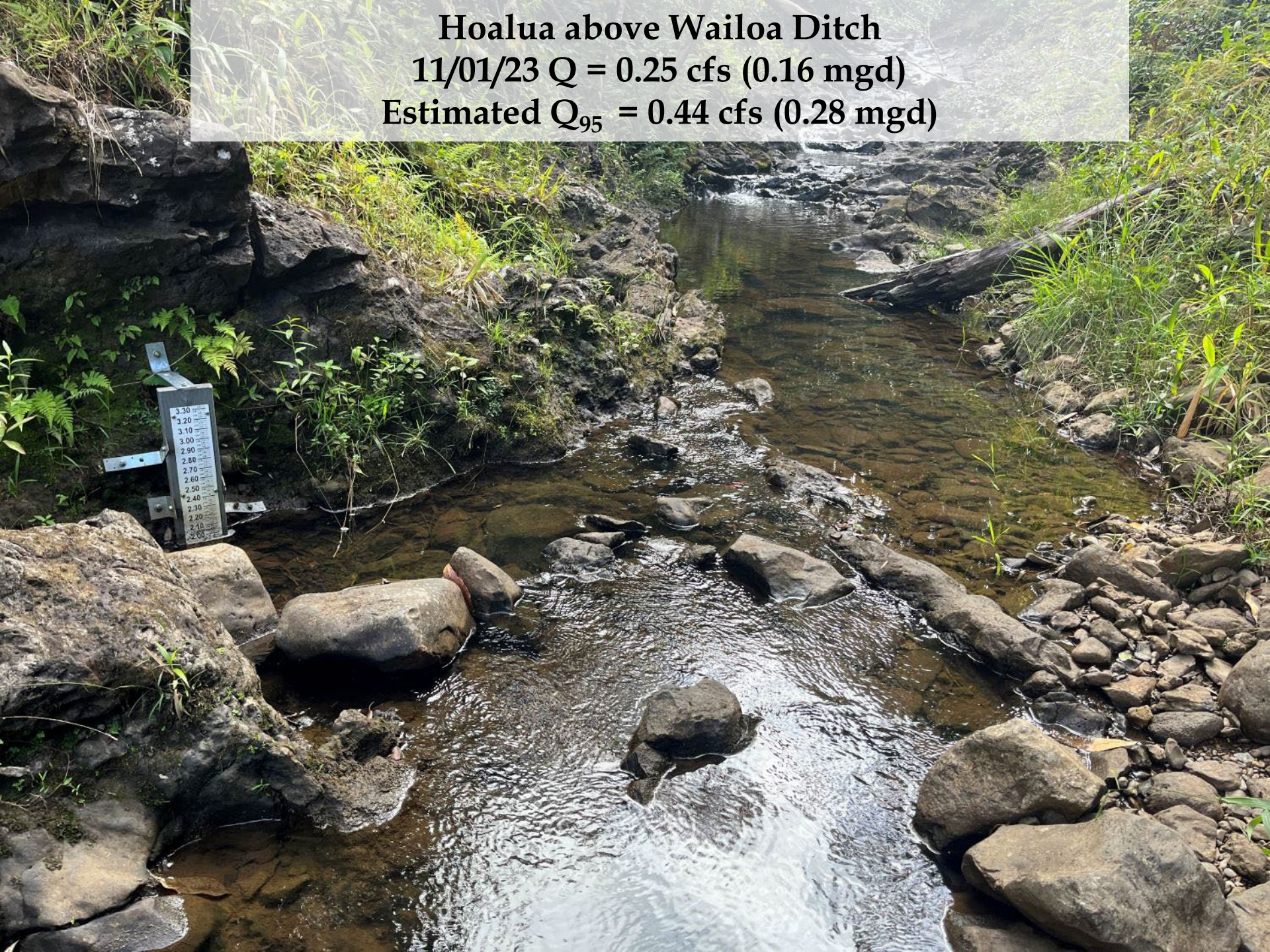
**11/13/23 Q = 2.05 cfs (1.32 mgd)**

**Estimated Q<sub>95</sub> groundwater gain = 1.6 cfs (1.03 mgd)**

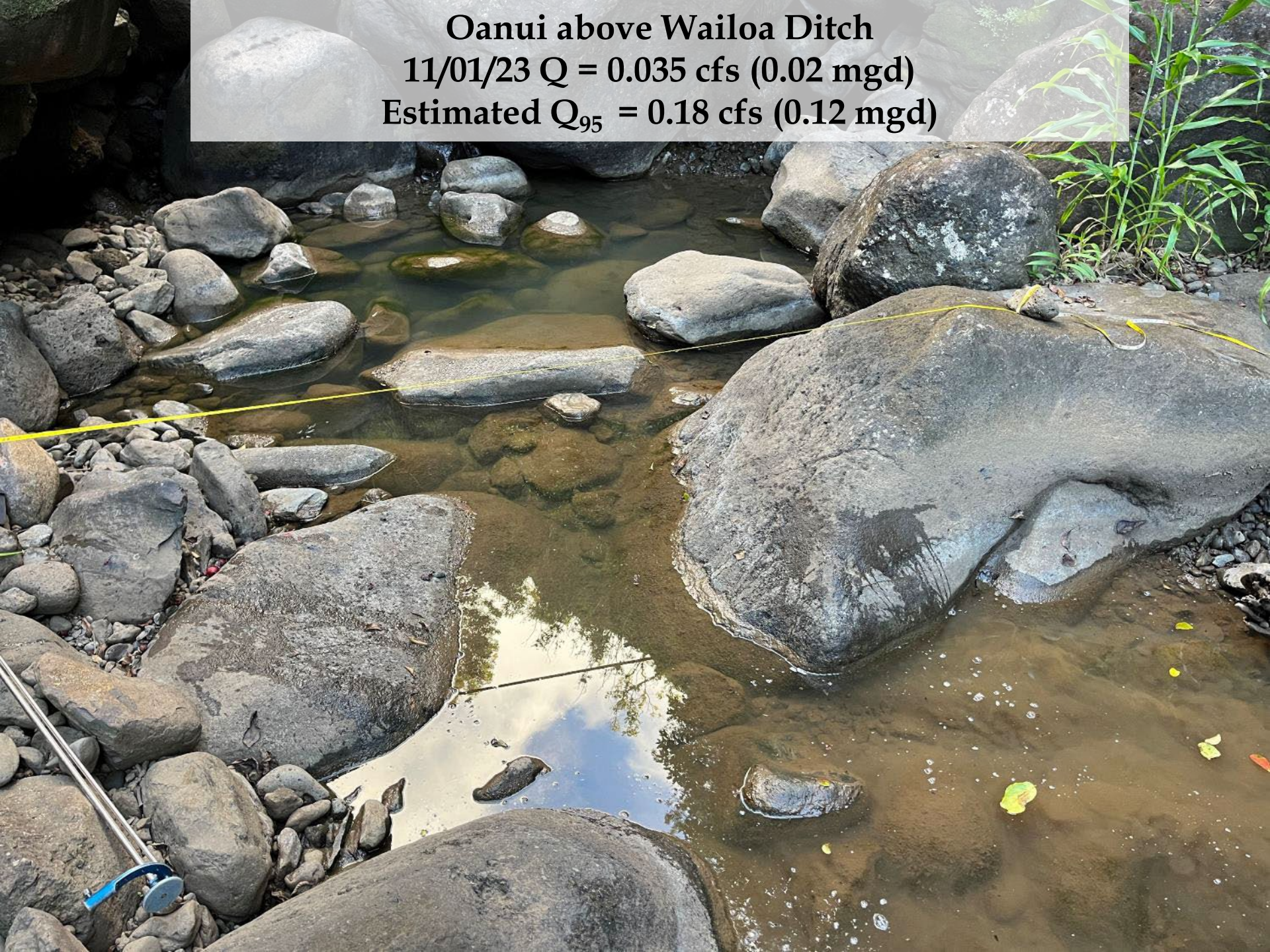




**Hoalua above Wailoa Ditch**  
**11/01/23 Q = 0.25 cfs (0.16 mgd)**  
**Estimated Q<sub>95</sub> = 0.44 cfs (0.28 mgd)**



Oanui above Wailoa Ditch  
11/01/23 Q = 0.035 cfs (0.02 mgd)  
Estimated  $Q_{95}$  = 0.18 cfs (0.12 mgd)



# Upcountry-Kamole Water Treatment Facility Dependent on Wailoa Ditch (EMI system)

Max capacity 5.2 mgd  
Oct 2023 mean = 4.08 mgd  
Nov 2023 mean = 4.93 mgd



Wailoa Ditch  
Sept 2023 mean ~ 26 mgd  
Oct-Nov mean ~ 10 mgd



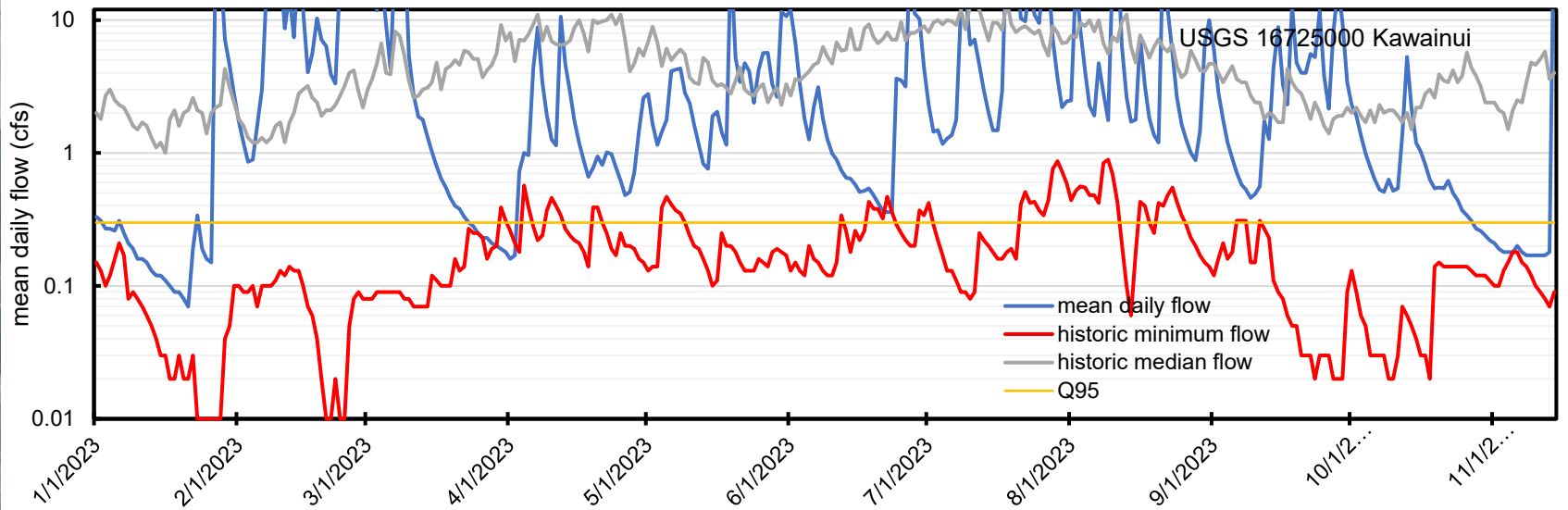
# How much water is available from East Maui streams in total?

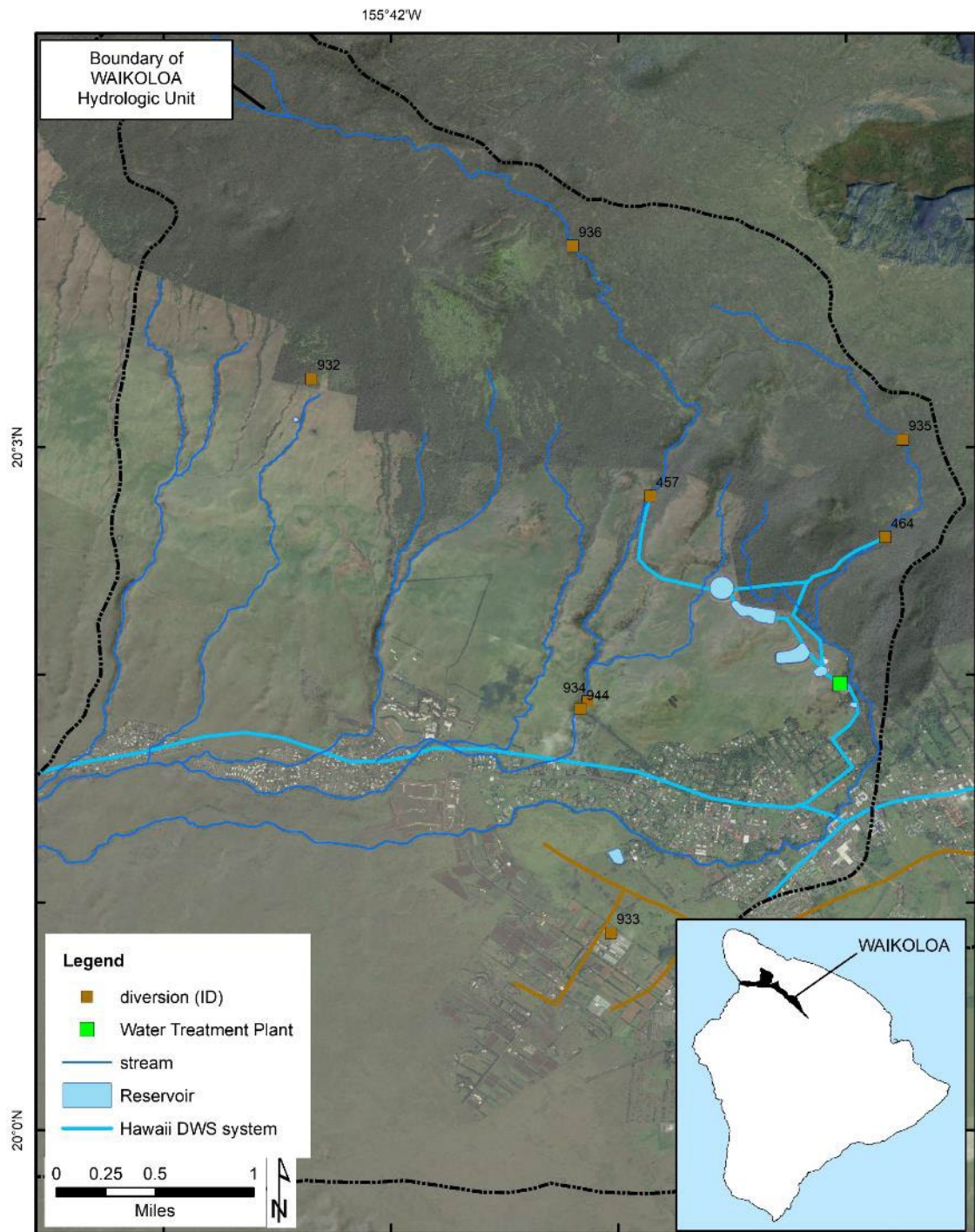
| location  | Discharge in ft <sup>3</sup> s <sup>-1</sup> (mgd) for selected percentages of time (from 50 to 95 percent) the indicated discharge was equaled or exceeded |                 |                 |                 |                 |                 |                 |                 |                 |                 |
|---|---|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|   | Q <sub>50</sub>   | Q <sub>55</sub> | Q <sub>60</sub> | Q <sub>65</sub> | Q <sub>70</sub> | Q <sub>75</sub> | Q <sub>80</sub> | Q <sub>85</sub> | Q <sub>90</sub> | Q <sub>95</sub> |
| 1984-2013 estimated water available in EMI system                                       | 168<br>(109)  | 143<br>(92)     | 126<br>(81)     | 110<br>(71)     | 98<br>(63)      | 85<br>(55)      | 73<br>(47)      | 63<br>(41)      | 53<br>(34)      | 41<br>(27)      |
| 1984-2013 estimated water available after 2018 D&O IIFS implementation                  | 107<br>(69)   | 88<br>(57)      | 75<br>(48)      | 64<br>(41)      | 56<br>(36)      | 48<br>(31)      | 39<br>(25)      | 33<br>(21)      | 27<br>(17.5)    | 20<br>(13)      |
| 1984-2013 estimated water available after 2022 Huelo recommendations are implementation | 86<br>(56)  | 68<br>(44)      | 56<br>(36)      | 47<br>(30)      | 40<br>(26)      | 33<br>(21)      | 30<br>(19)      | 25<br>(16)      | 20<br>(13)      | 15<br>(10)      |
| Maui DWS<br>Kamole Water Treatment Facility*  | 4.8<br>(3.12)   | 4.9<br>(3.17)   | 5.0<br>(3.21)   | 5.1<br>(3.27)   | 5.2<br>(3.36)   | 6.0<br>(3.86)   | 6.4<br>(4.16)   | 6.6<br>(4.26)   | 6.7<br>(4.32)   | 6.8<br>(4.41)   |
| DHHL's potential water reservation  | 17.3<br>(11.18)   | 17.3<br>(11.18) | 17.3<br>(11.18) | 17.3<br>(11.18) | 17.3<br>(11.18) | 17.3<br>(11.18) | 17.3<br>(11.18) | 17.3<br>(11.18) | 17.3<br>(11.18) | 17.3<br>(11.18) |
| Total non-instream public trust use   | 22.1<br>(14.3)  | 22.2<br>(14.4)  | 22.3<br>(14.4)  | 22.4<br>(14.5)  | 22.5<br>(14.5)  | 23.3<br>(15.1)  | 23.7<br>(15.3)  | 23.9<br>(15.5)  | 24<br>(15.5)    | 24.1<br>(15.6)  |

\*assuming Maui DWS Olinda and Piiholo facilities can meet their demands

# Hawai'i Island- Kawainui

1964-present





# Hawaii DWS Diversion on Waikoloa Stream



# Hawaii DWS Diversion on Kohakohau Stream







# Proposal: Repair Existing Pipeline to Upper Hamakua Ditch; Repair Unused Reservoir

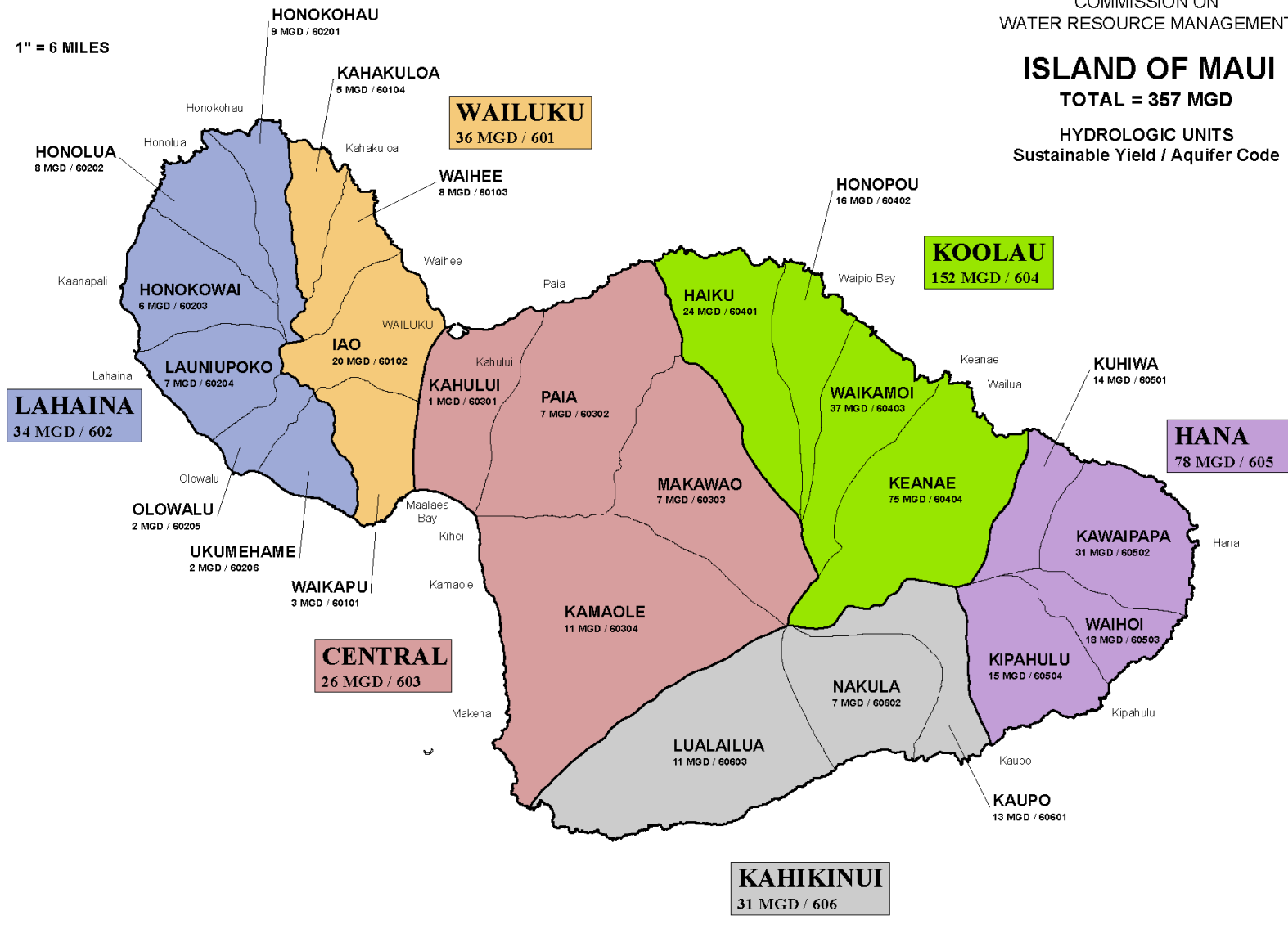


# ISLAND OF MAUI

TOTAL = 357 MGD

HYDROLOGIC UNITS  
 Sustainable Yield / Aquifer Code

1" = 6 MILES



# Lahaina ASEA Pumping as of 9-30-2023



**Commission on Water  
Resource Management**  
Information Management System

**Monthly Pumpage Chart  
12 Month Moving Average**

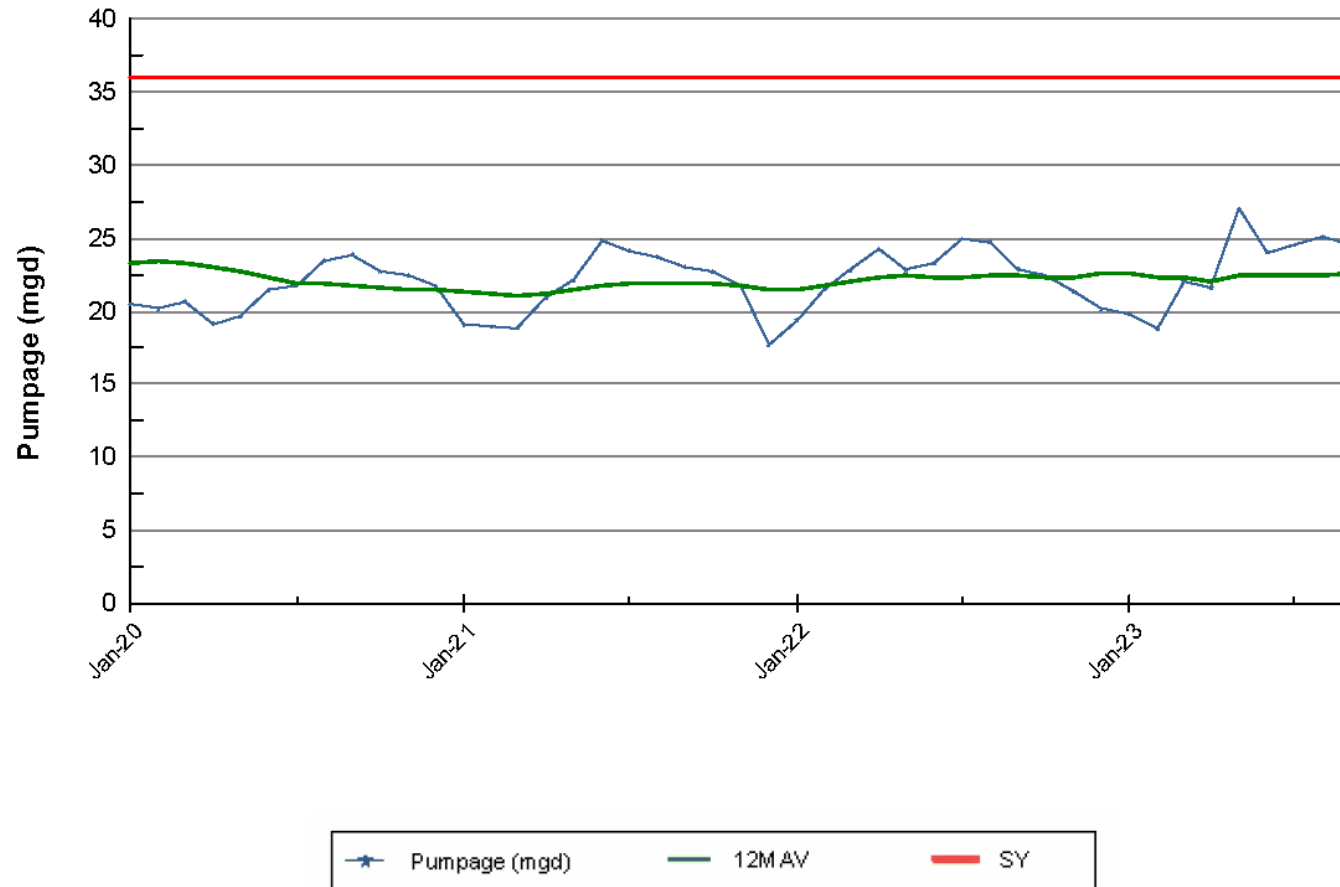


# Wailuku ASEA Pumping as of 9-30-2023

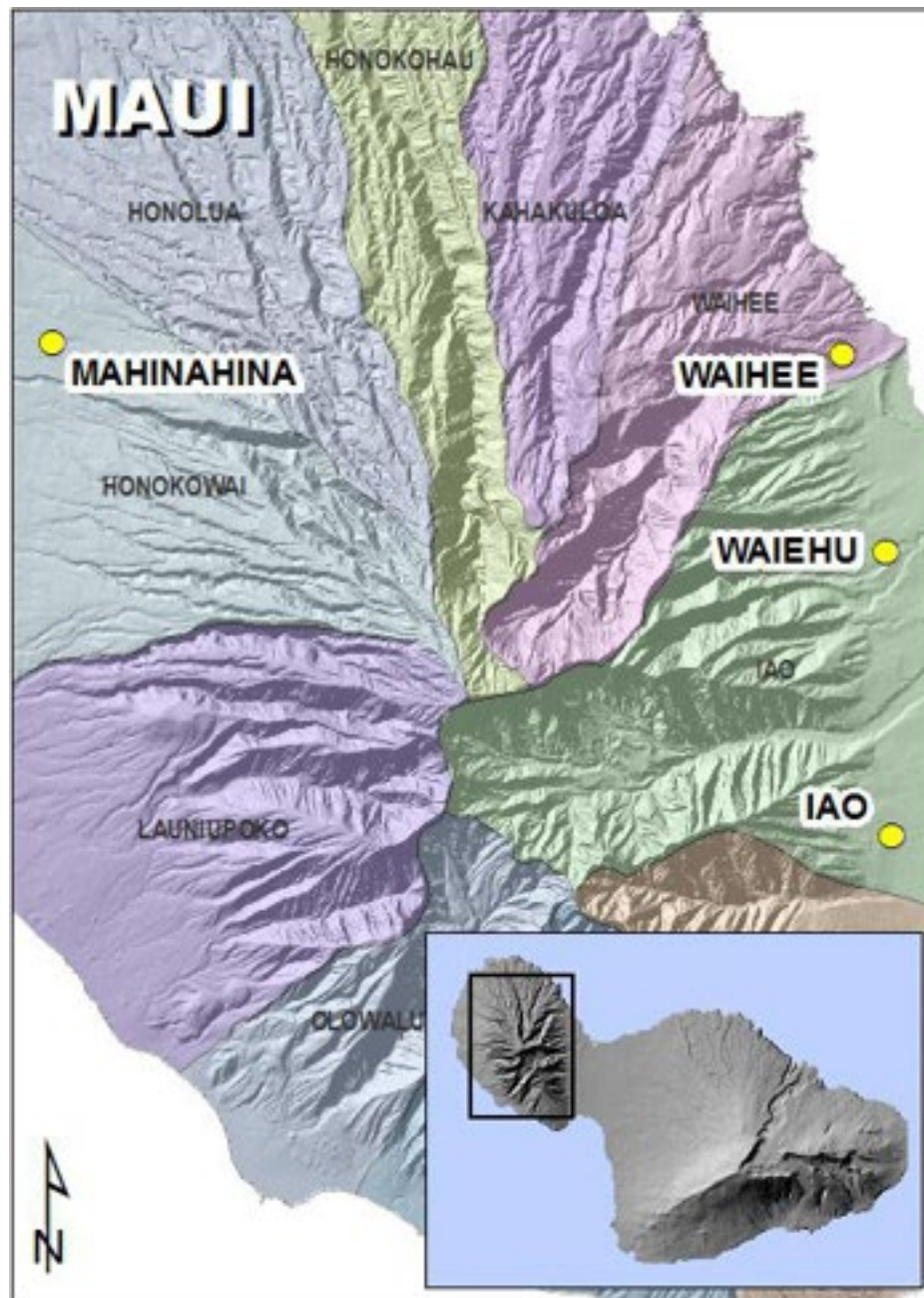


Commission on Water  
Resource Management  
Information Management System

## Monthly Pumpage Chart 12 Month Moving Average

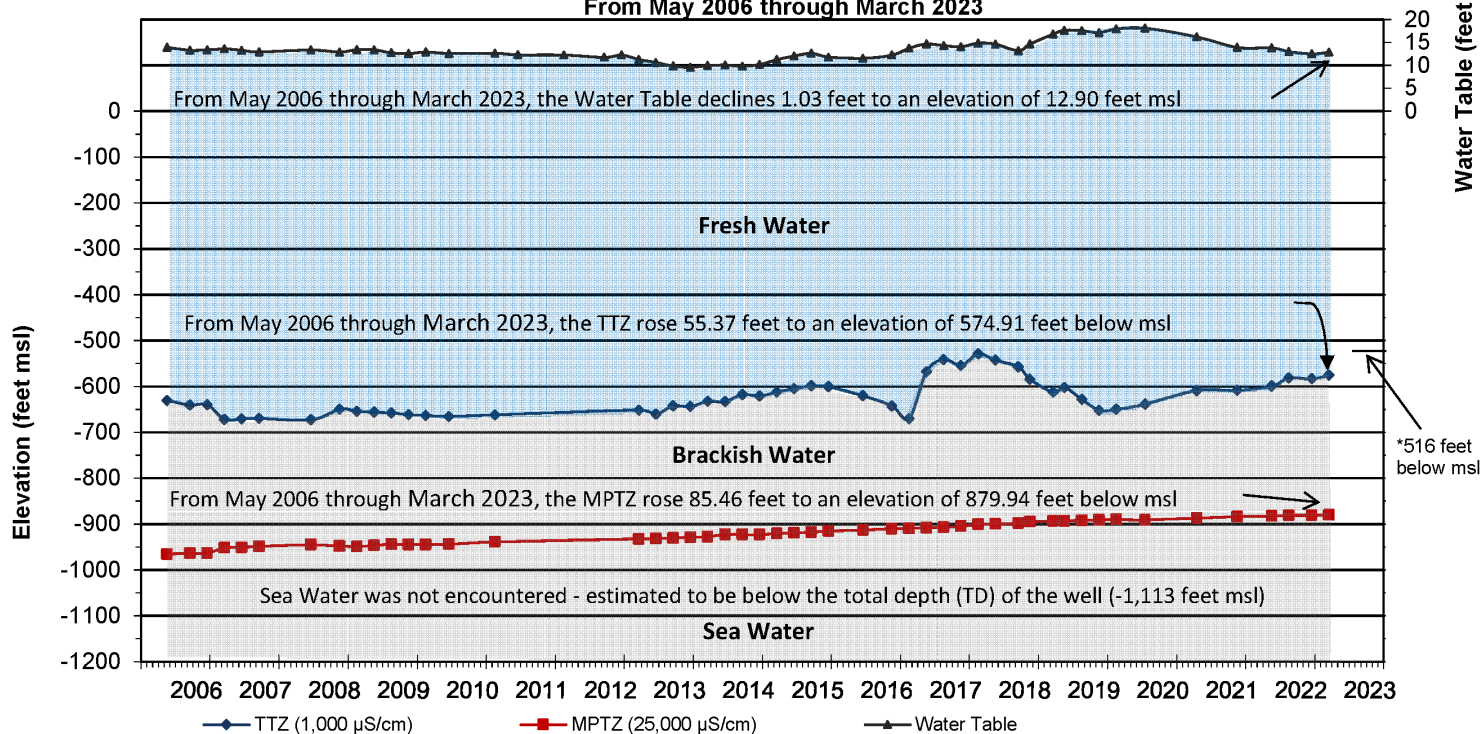


# CWRM Deep Monitor Wells Maui



## Iao Deep Monitor Well, Maui (6-5230-002)

### Fluctuations in the Water Table, Top of Transition Zone (TTZ), and Midpoint of Transition Zone (MPTZ) From May 2006 through March 2023

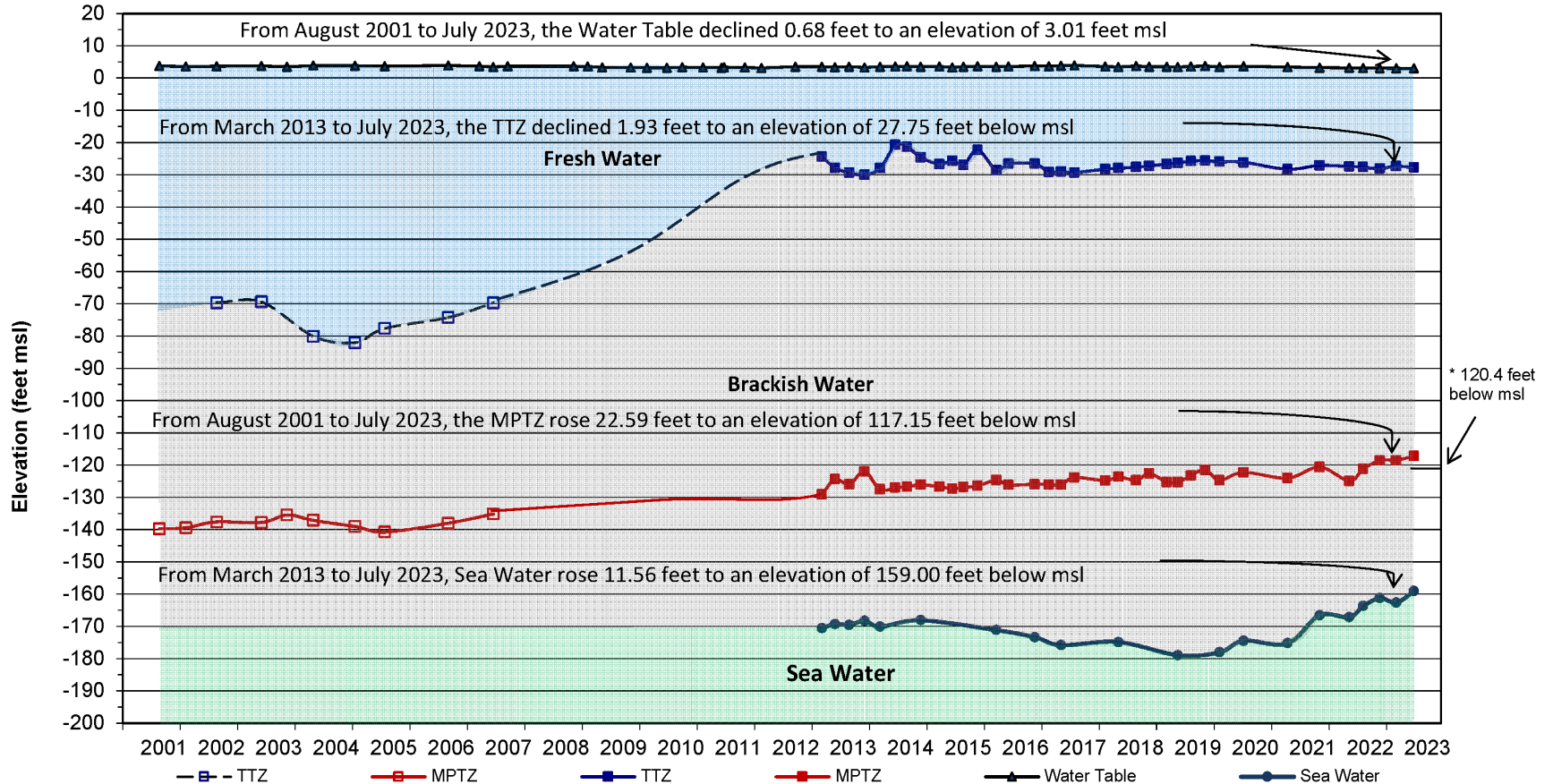


Notes: (1) TTZ = 1,000  $\mu\text{S/cm}$  (~ 220 mg/L  $\text{Cl}^-$ ); MPTZ = 25,000  $\mu\text{S/cm}$  (~ 8,500 mg/L  $\text{Cl}^-$ ) (2) Fresh Water < 220 mg/L  $\text{Cl}^-$ , Brackish Water 220 mg/L  $\text{Cl}^-$  to 19,399 mg/L  $\text{Cl}^-$ , Sea Water  $\geq$  19,400 mg/L  $\text{Cl}^-$ ; (3) OS 421/425 = Ocean Sensors CTD (absolute conductivity); (4) RBR 12895 = RBR Global CTD (Specific Conductivity); (5) msl = mean sea level.

\* Since the year 2006, the MPTZ rose 85.46 feet, below a calculated Ghyben-Herzberg equilibrium elevation of approximately 516 feet below msl, relative to the Water Table measured at 12.9 feet above msl.

## Mahinahina Deep Monitor Well, Maui (6-5739-003)

**Fluctuations in the Water Table, Top of Transition Zone (TTZ), and Midpoint of Transition Zone (MPTZ) from August 2001 through July 2023**



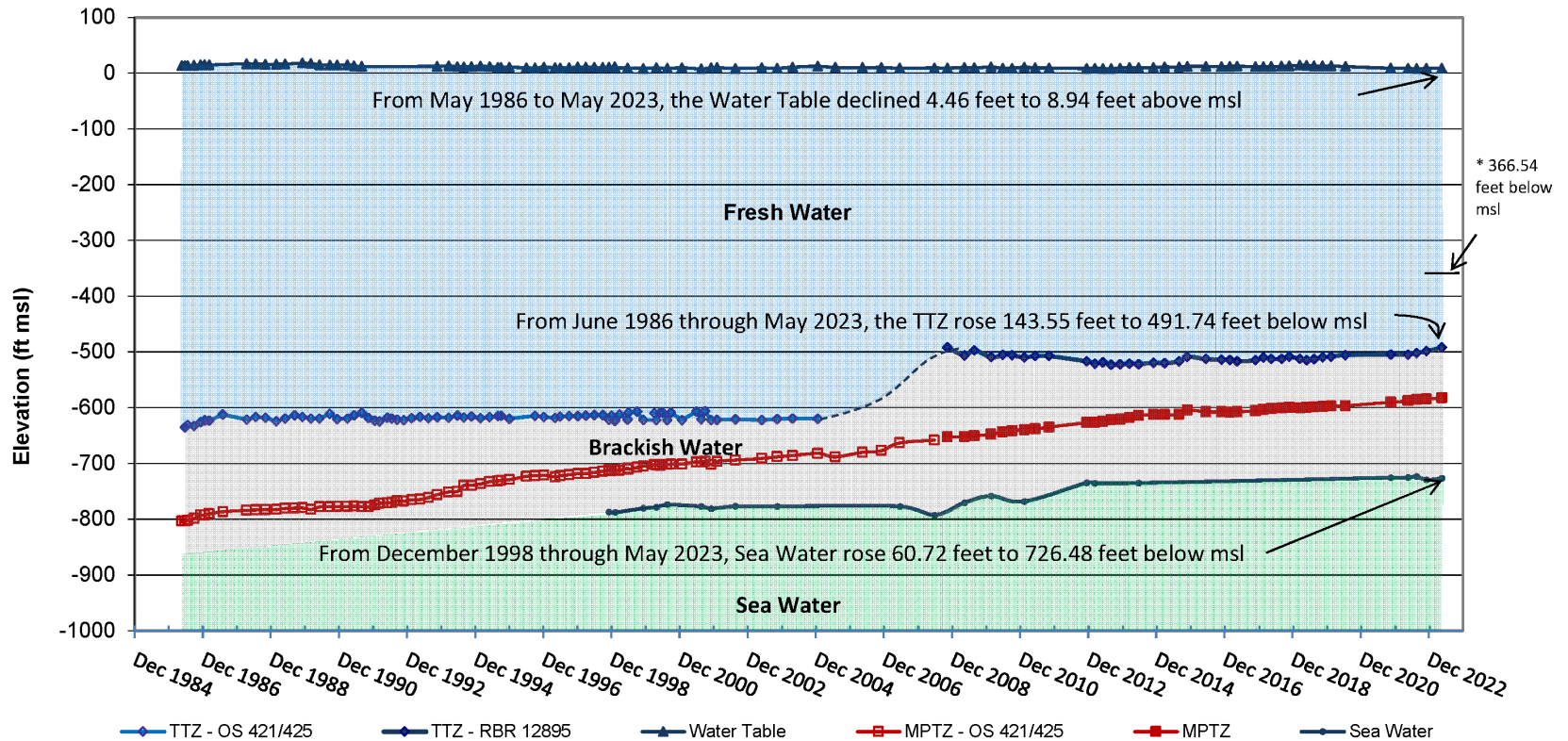
**Notes :** (1) TTZ = 1,000  $\mu\text{S}/\text{cm}$  (~ 220 mg/L  $\text{Cl}^-$ ); MPTZ = 25,000  $\mu\text{S}/\text{cm}$  (~ 8,500 mg/L  $\text{Cl}^-$ ) (2) Fresh Water < 220 mg/L  $\text{Cl}^-$ , Brackish Water 220 mg/L  $\text{Cl}^-$  to 19,399 mg/L  $\text{Cl}^-$ , Sea Water  $\geq$  19,400 mg/L  $\text{Cl}^-$ ; (3) OS 421/425 = Ocean Sensors CTD (absolute conductivity); (4) RBR 12895 = RBR Global CTD (Specific Conductivity); (5) msl = mean sea level. Conditions inside the well prevented successful CTD deployment from 2006 through 2012, CTD profiling of this well was resumed 3-13-2013. CTD used prior to 2007 had a suspected calibration issue, therefore TTZ values from 2002 to 2006 are suspect, and are shown for comparative purposes.

\* Since the year 2001, the MPTZ rose 22.59 feet, to an elevation of 117.15 feet below msl, where it is above a calculated Ghyben-Herzberg equilibrium elevation of 120.4 feet below msl, relative to the Water Table, measured at 3.01 feet above msl.



## Waiehu Deep Monitor Well, Maui (6-5430-005)

### Fluctuation in the Water Table, Top of Transition Zone (TTZ), and Midpoint of Transition Zone (MPTZ) August 1985 through May 2023

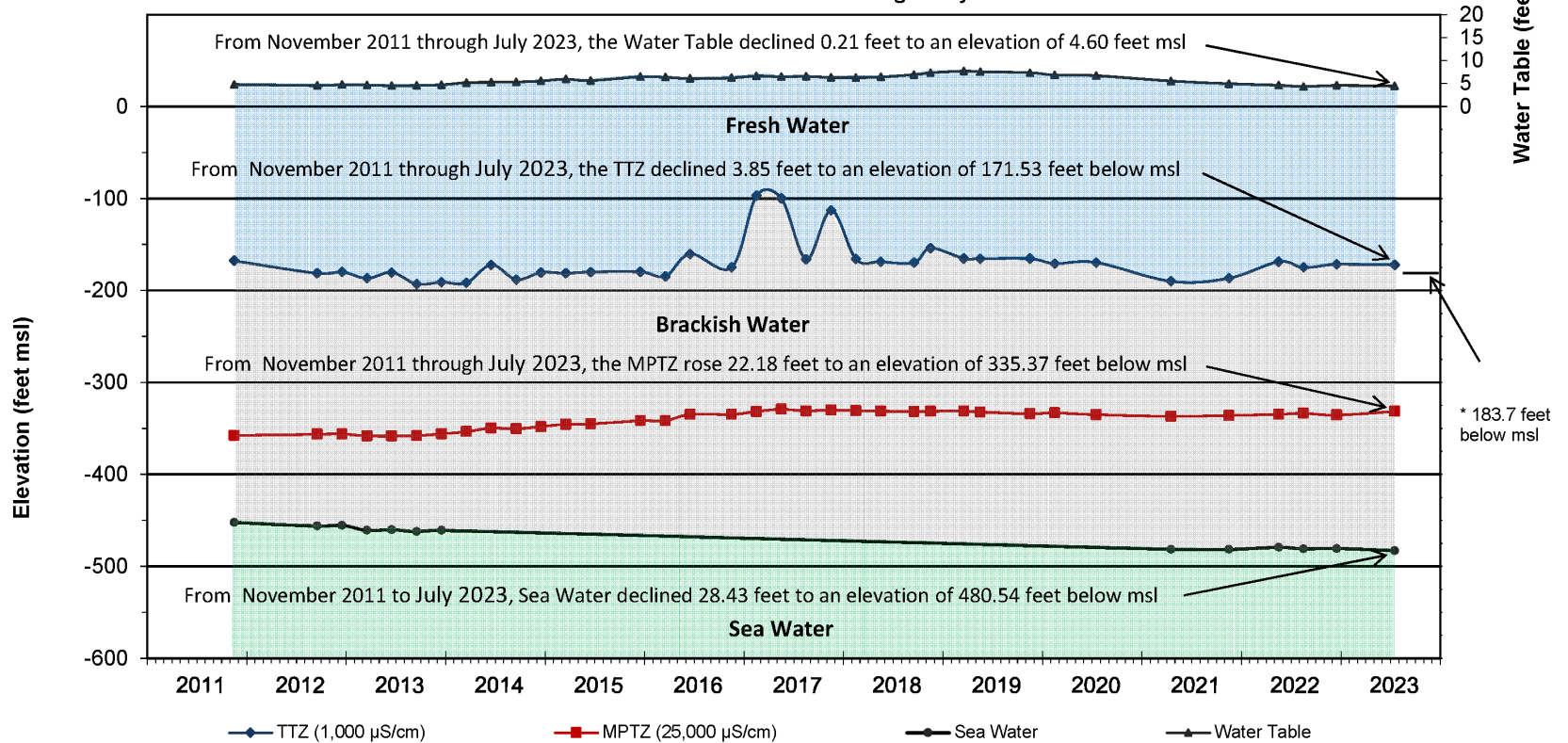


Notes: (1) TTZ = 1,000  $\mu\text{S}/\text{cm}$  ( $\sim 220 \text{ mg}/\text{L Cl}^-$ ); MPTZ = 25,000  $\mu\text{S}/\text{cm}$  ( $\sim 8,500 \text{ mg}/\text{L Cl}^-$ ) (2) Fresh Water  $< 220 \text{ mg}/\text{L Cl}^-$ , Brackish Water  $220 \text{ mg}/\text{L Cl}^-$  to  $19,399 \text{ mg}/\text{L Cl}^-$ , Sea Water  $\geq 19,400 \text{ mg}/\text{L Cl}^-$ ; (3) OS 421/425 = Ocean Sensors CTD (absolute conductivity); (4) RBR 12895 = RBR Global CTD (Specific Conductivity); (5) msl = mean sea level

\* Since the year 1985, the MPTZ has risen 221.45 feet, rising to below a calculated Ghyben-Herzberg equilibrium elevation of 366.54 feet below msl, relative to the Water Table measured at 8.94 feet above msl.

## Waihee Deep Monitor Well, Maui (6-5631-009)

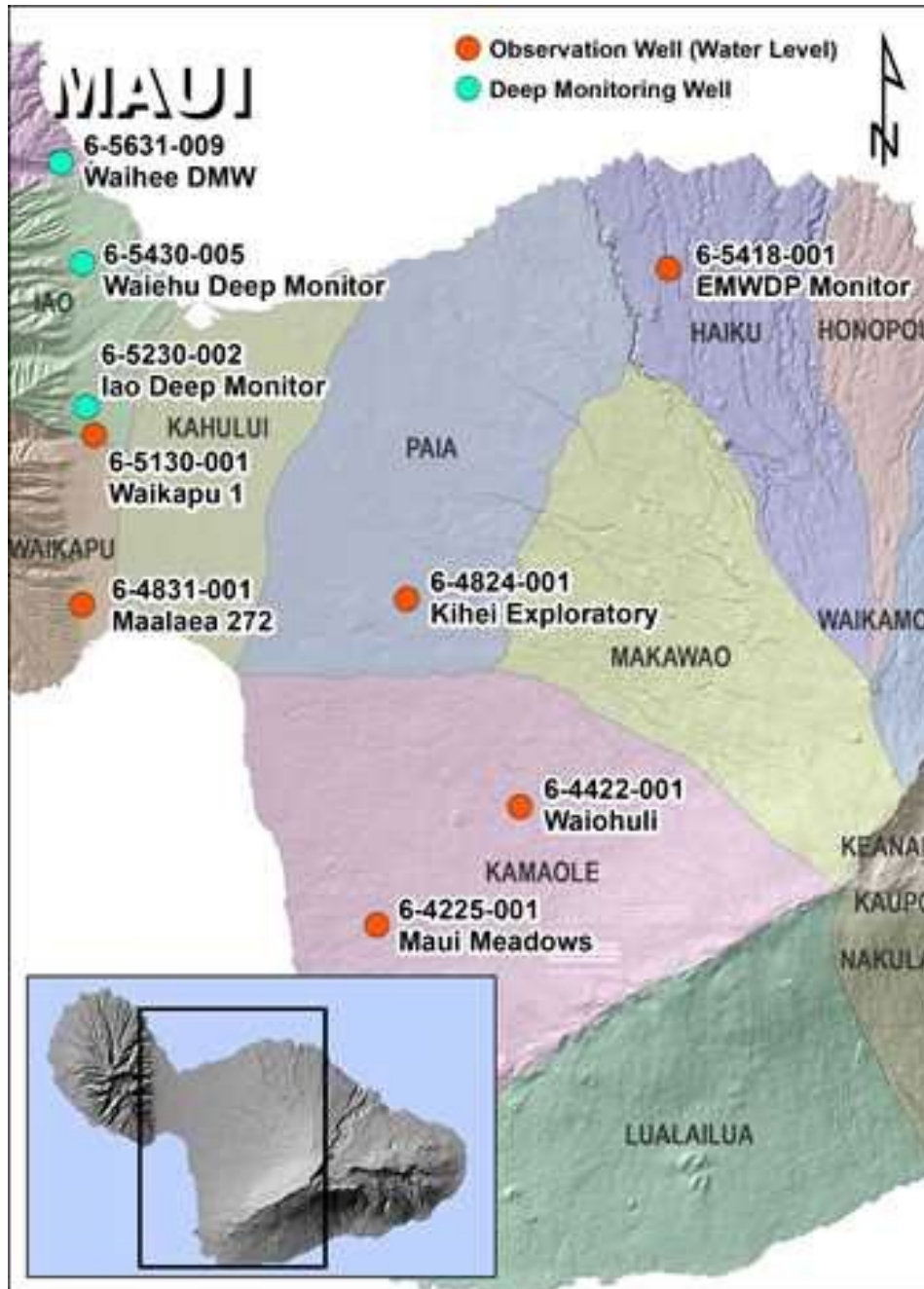
### Fluctuations in the Water Table, Top of Transition Zone (TTZ), and Midpoint of Transition Zone (MPTZ) From November 2011 through July 2023



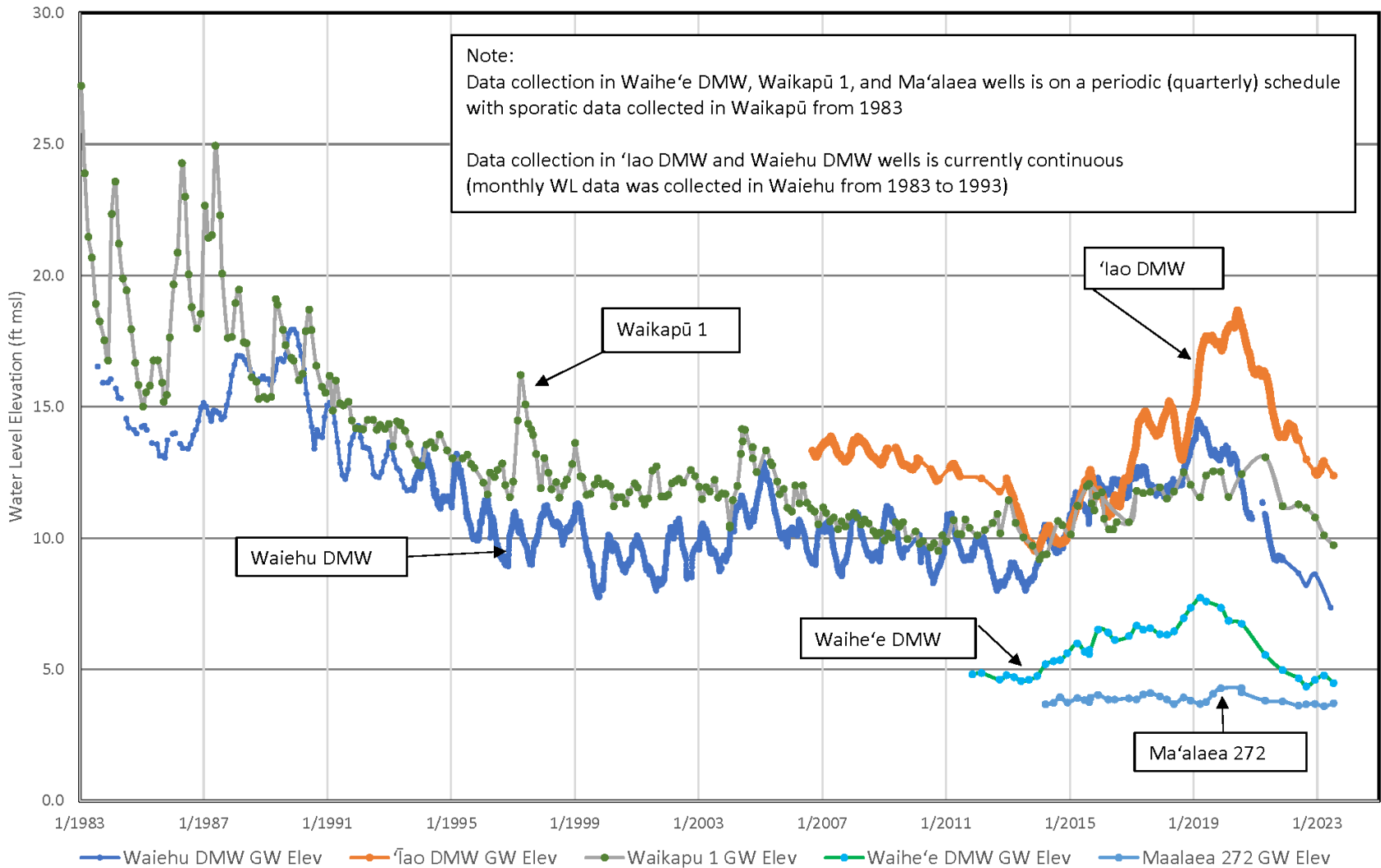
Notes : (1) TTZ = 1,000  $\mu\text{S}/\text{cm}$  (~ 220 mg/L  $\text{Cl}^-$ ); MPTZ = 25,000  $\mu\text{S}/\text{cm}$  (~ 8,500 mg/L  $\text{Cl}^-$ ) (2) Fresh Water < 220 mg/L  $\text{Cl}^-$ , Brackish Water 220 mg/L  $\text{Cl}^-$  to 19,399 mg/L  $\text{Cl}^-$ , Sea Water  $\geq$  19,400 mg/L  $\text{Cl}^-$ ; (3) msl = mean sea level.

\* Since the year 2011, the MPTZ rose 26.21 feet towards a calculated Ghyben-Herzberg equilibrium elevation of approximately 183.7 feet below msl, relative to the Water Table measured at 4.48 feet above msl.

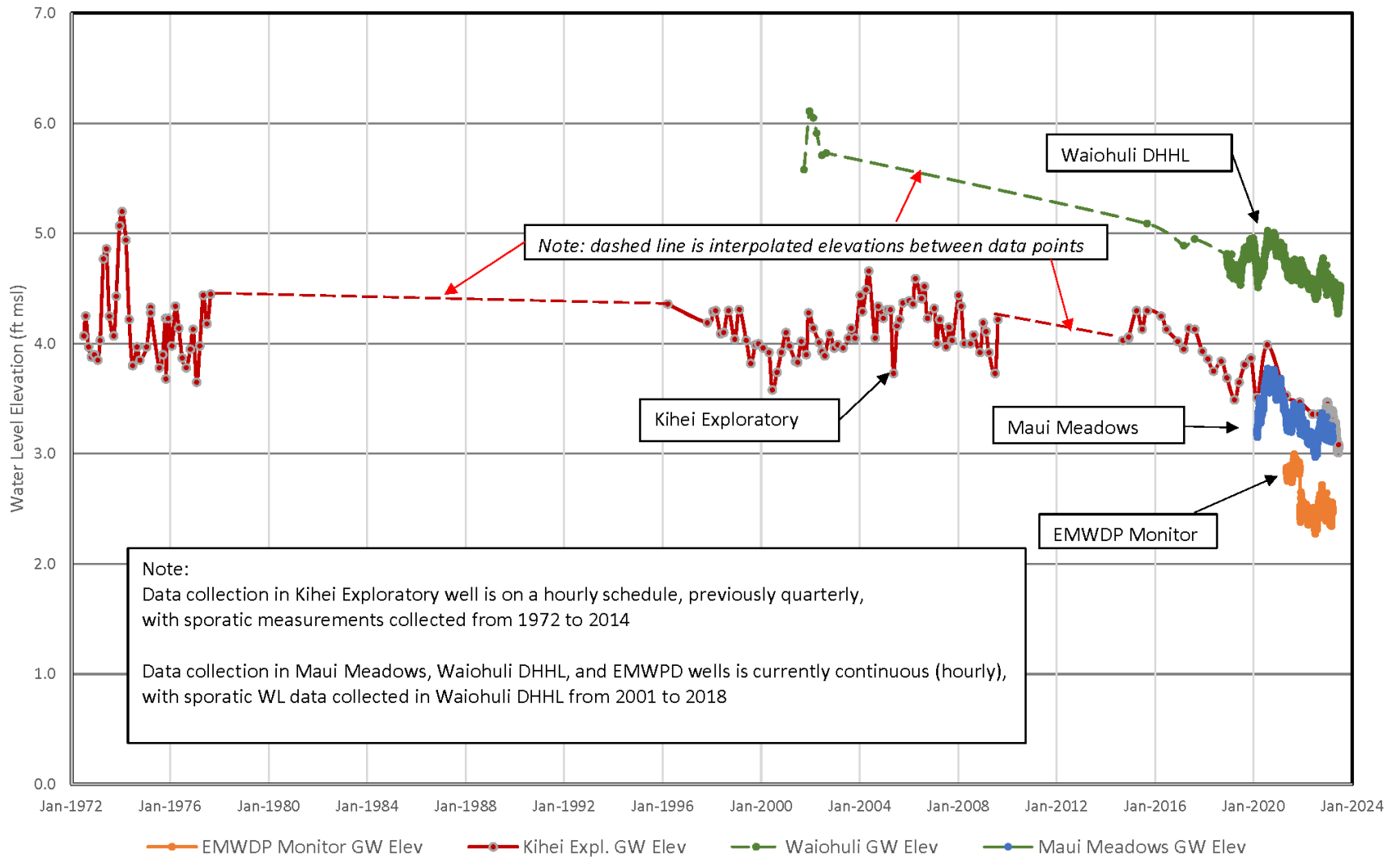
# CWRM Deep Monitor Wells Maui



## West Maui Monitoring Well Water Level Elevations



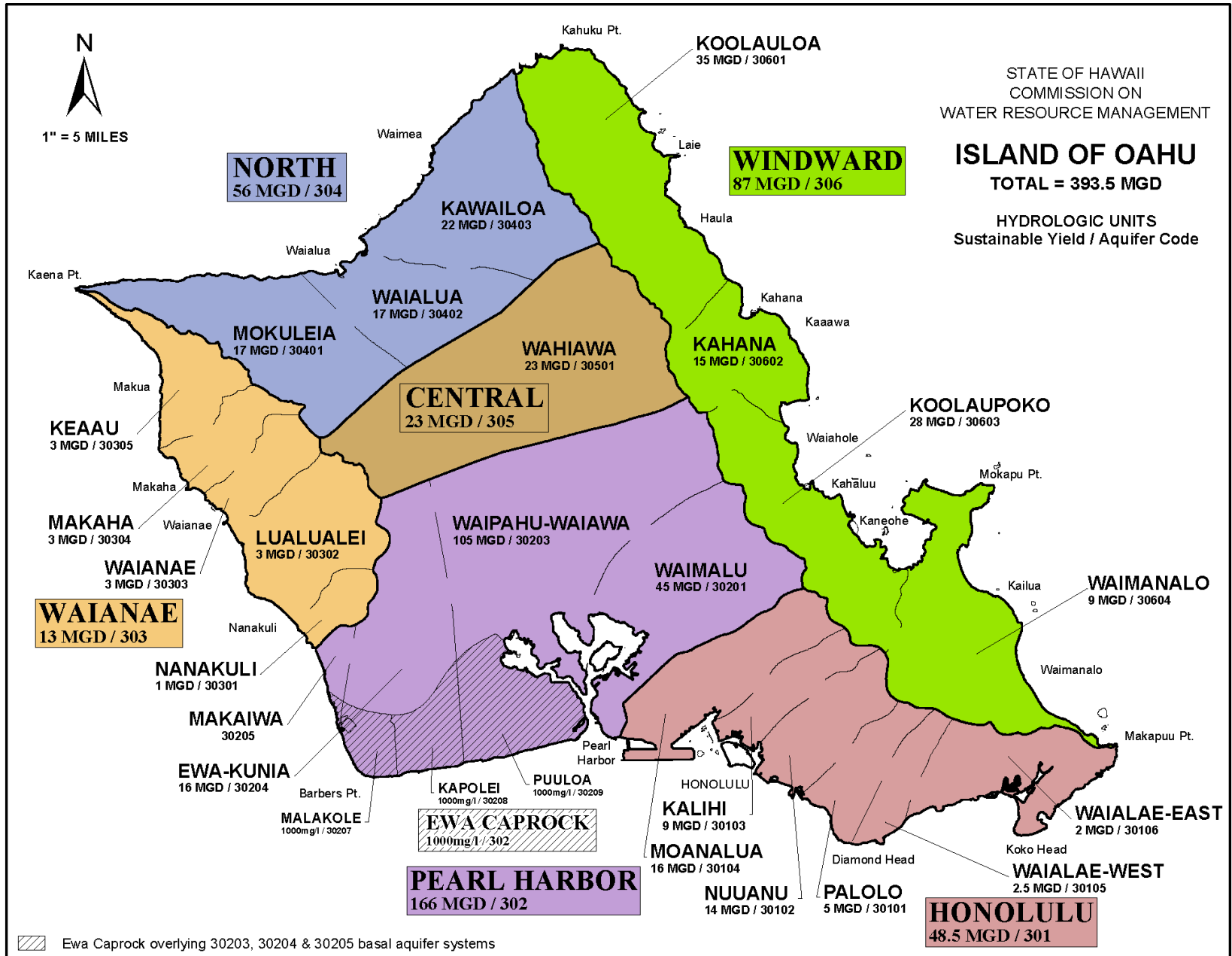
## East Maui Monitoring Well Water Level Elevations



STATE OF HAWAII  
COMMISSION ON  
WATER RESOURCE MANAGEMENT

**ISLAND OF OAHU**  
TOTAL = 393.5 MGD

HYDROLOGIC UNITS  
Sustainable Yield / Aquifer Code

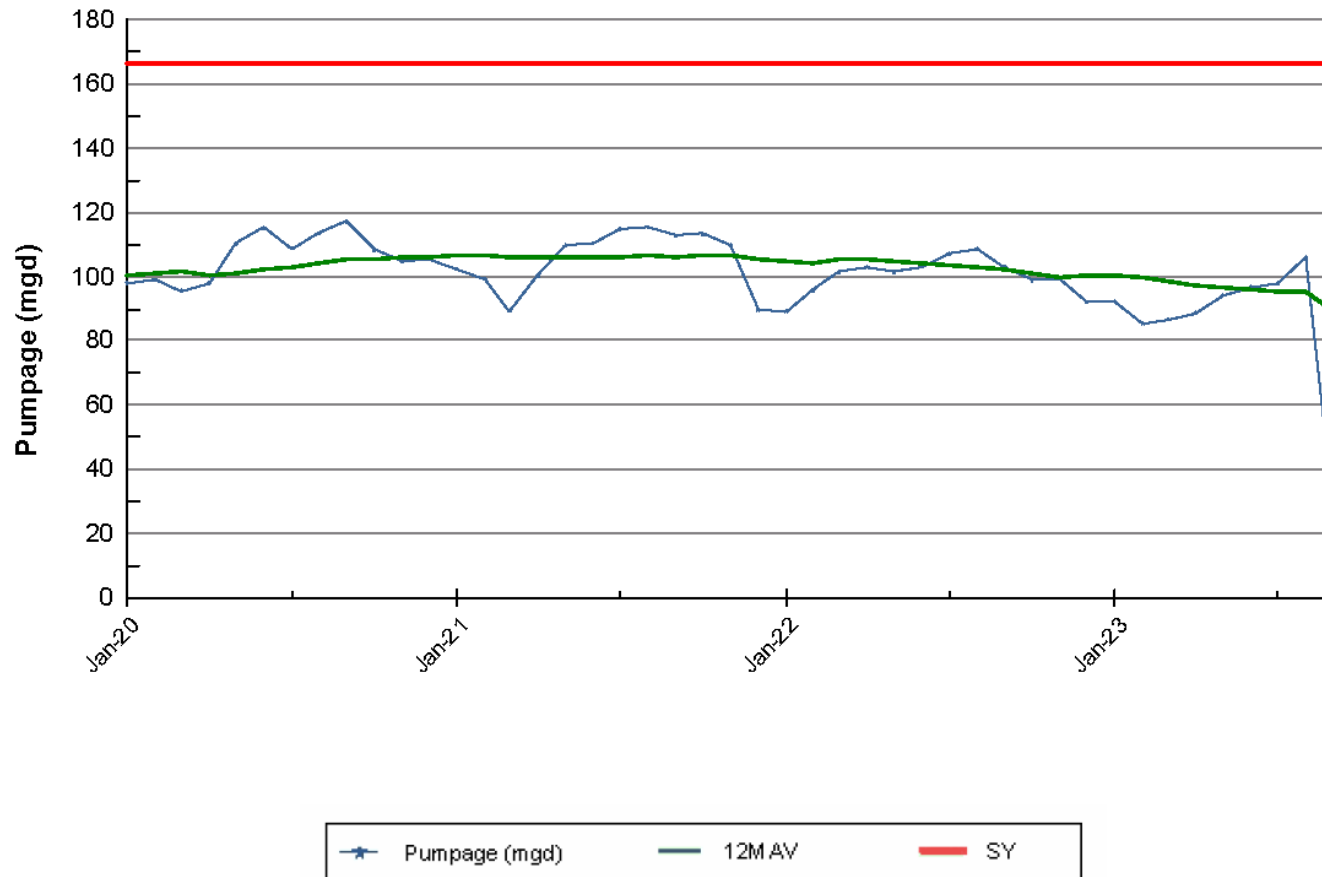


# Pearl Harbor ASEA Pumping as of 9-30-2023



Commission on Water  
Resource Management  
Information Management System

## Monthly Pumpage Chart 12 Month Moving Average

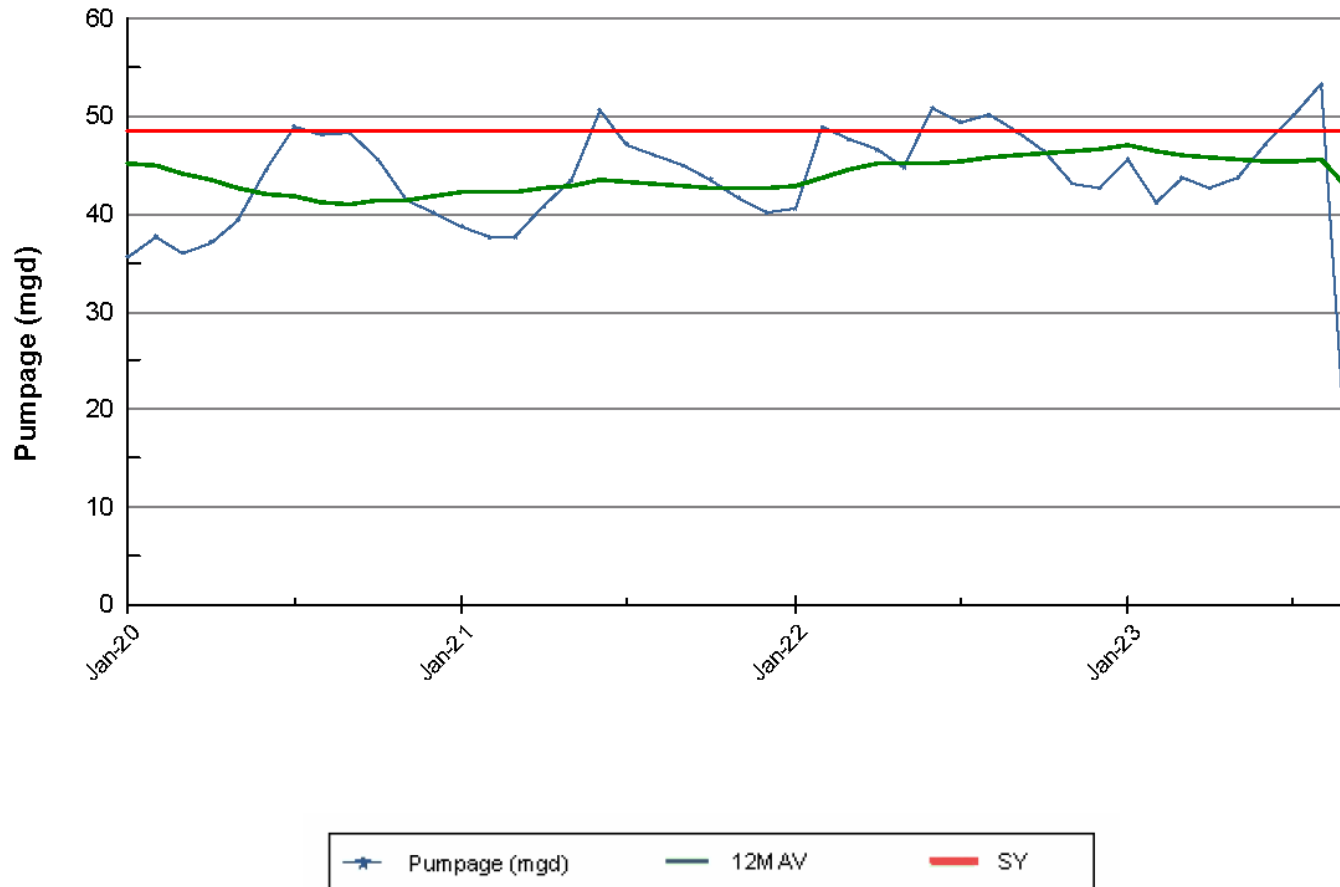


# Honolulu ASEA Pumping as of 9-30-2023

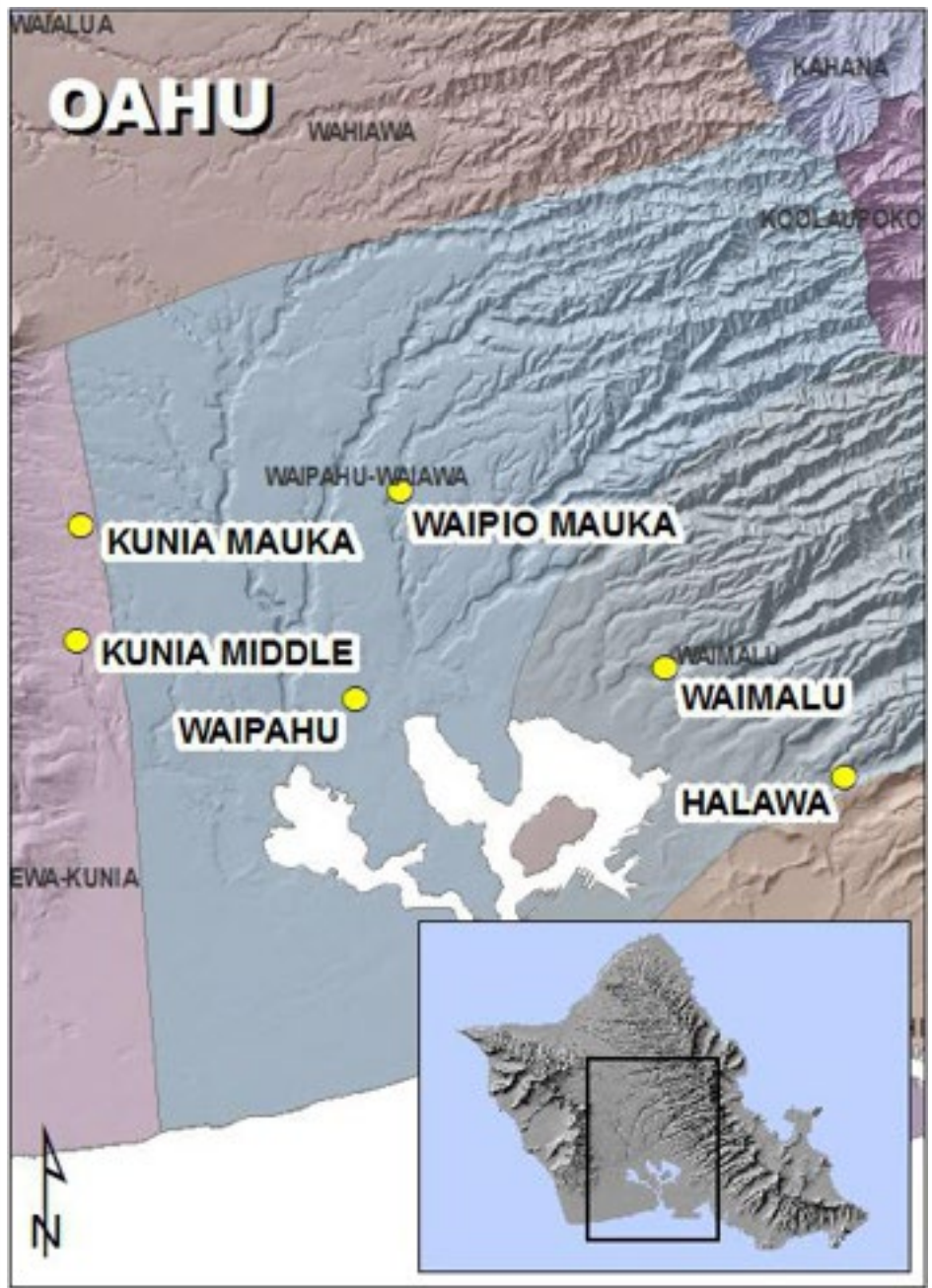


**Commission on Water  
Resource Management**  
Information Management System

**Monthly Pumpage Chart  
12 Month Moving Average**

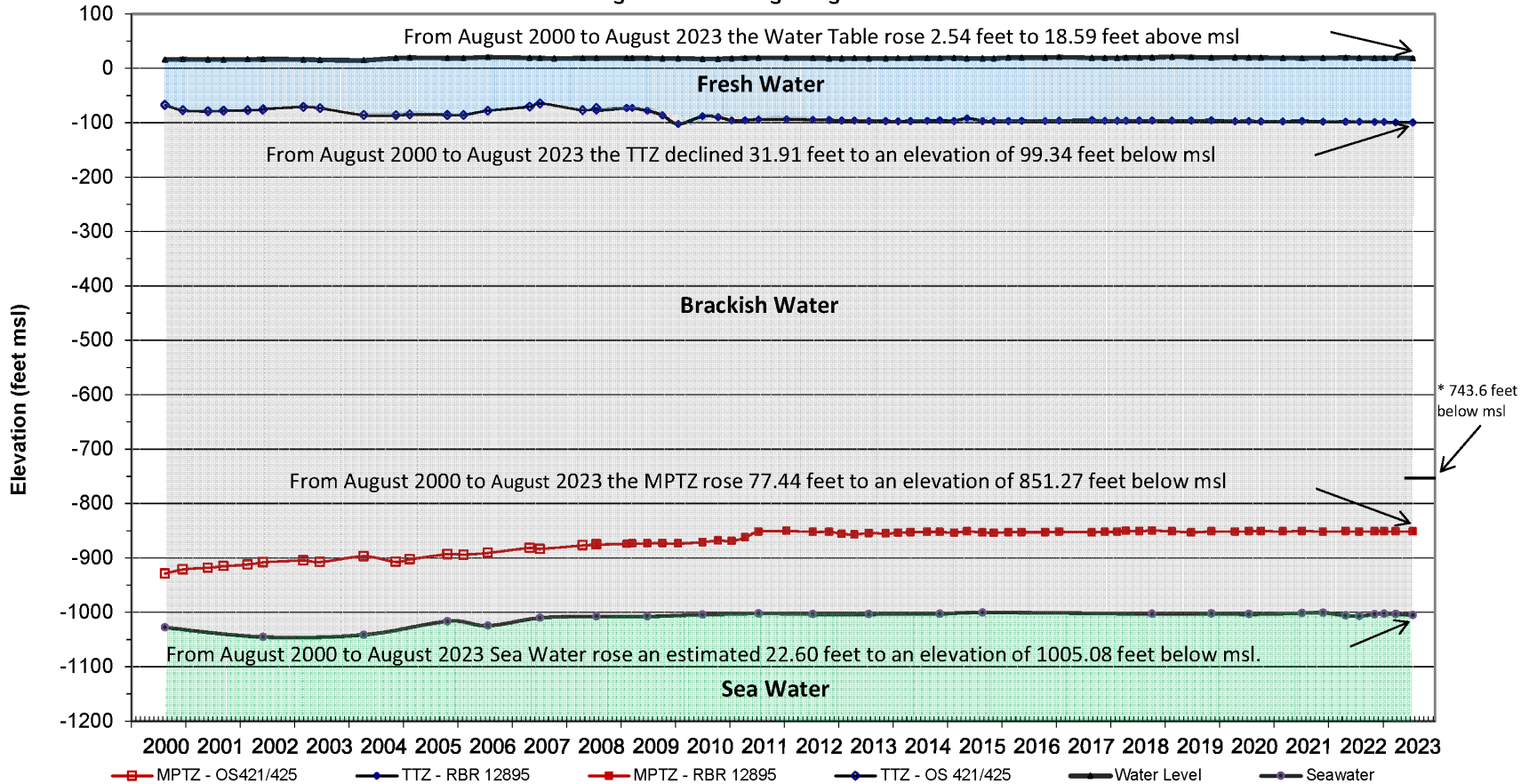






## Halawa Deep Monitor Well, Oahu (3-2253-003)

### Fluctuations in the Water Table, Top of Transition Zone (TTZ), and Midpoint of Transition Zone (MPTZ) From August 2000 through August 2023

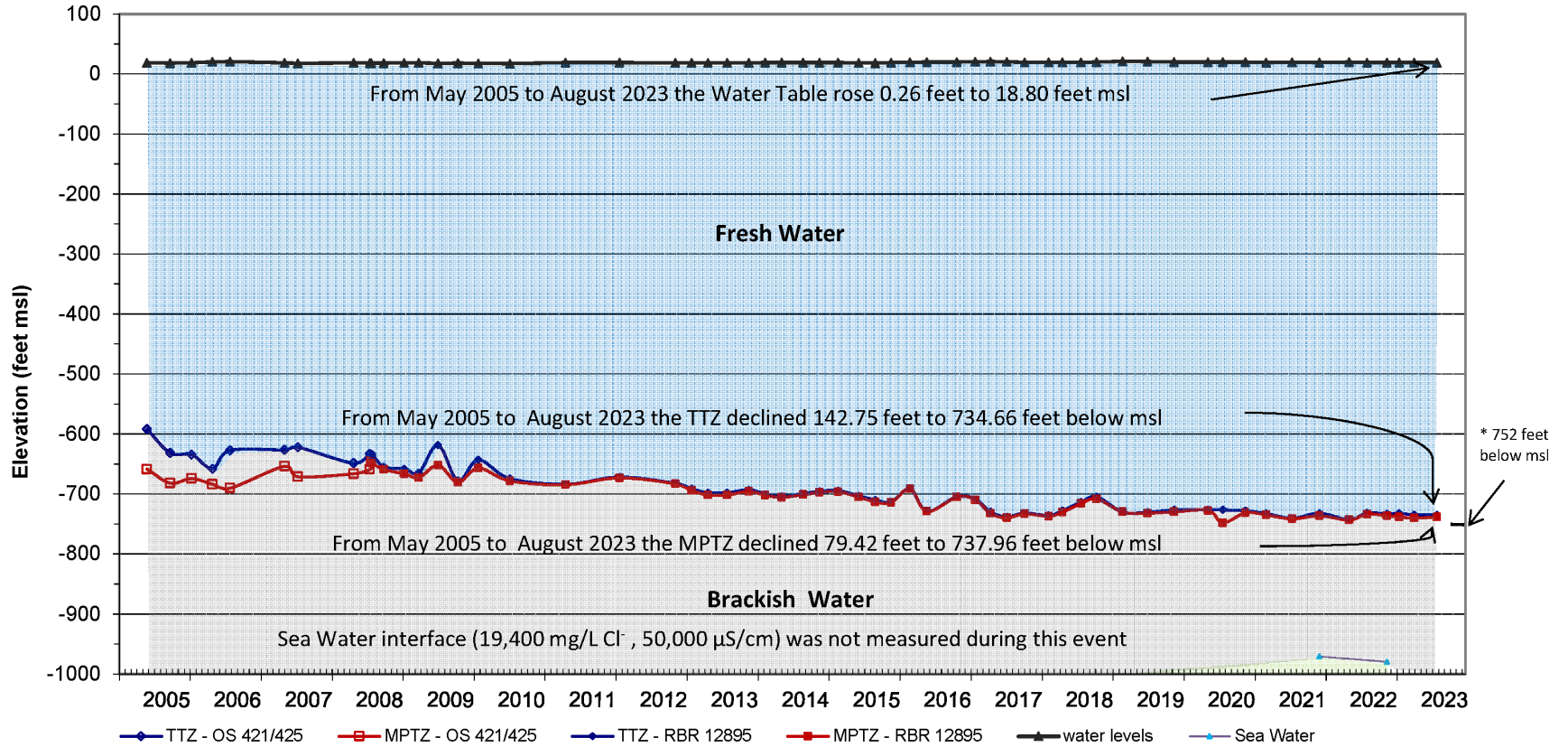


Notes: (1) TTZ = 1,000  $\mu\text{S}/\text{cm}$  ( $\sim 220 \text{ mg/L Cl}^-$ ); MPTZ = 25,000  $\mu\text{S}/\text{cm}$  ( $\sim 8,500 \text{ mg/L Cl}^-$ ) (2) Fresh Water  $< 220 \text{ mg/L Cl}^-$ , Brackish Water  $220 \text{ mg/L Cl}^-$  to  $18,999 \text{ mg/L Cl}^-$ , Sea Water  $\geq 19,000 \text{ mg/L Cl}^-$ ; (3) OS 421/425 = Ocean Sensors CTD (absolute conductivity); (4) RBR 12895 = RBR Global CTD (Specific Conductivity); (5) msl = mean sea level.

\* Since the year 2000, the MPTZ has risen 77.44 feet, rising toward a calculated Ghyben-Herzberg equilibrium elevation of approximately 743.6 feet below msl (relative to the Water Table, measured at 18.59 feet above msl). Note the relatively thick mixing zone, resulting from upward borehole flow of an influx of brackish water.

## Waimalu Deep Monitor Well, Oahu (3-2456-005)

**Fluctuations in the Water Table, Top of Transition Zone (TTZ), and Midpoint of Transition Zone (MPTZ) from May 2005 through August 2023**

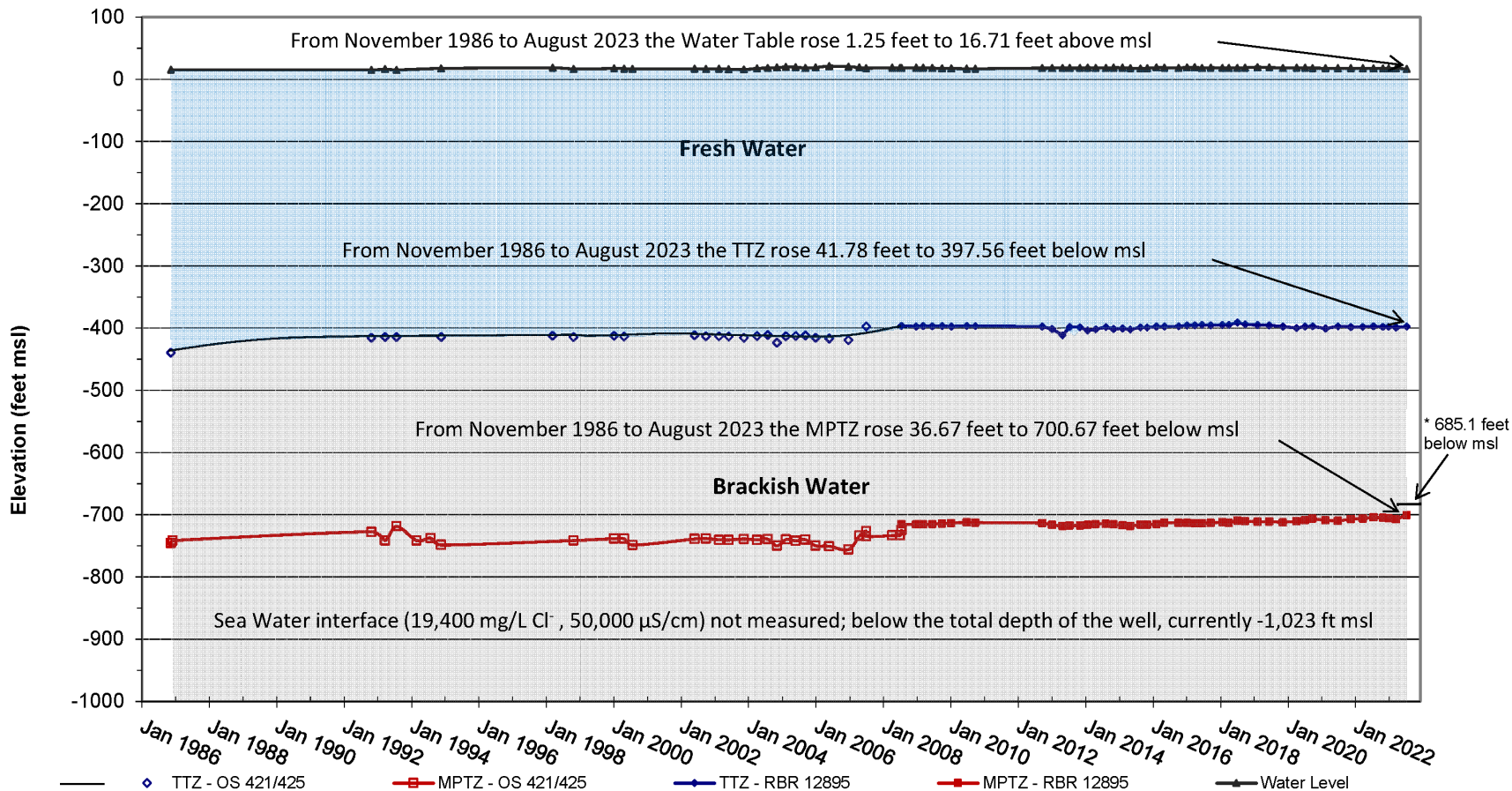


Notes: (1) TTZ = 1,000 μS/cm (~ 220 mg/L Cl<sup>-</sup>); MPTZ = 25,000 μS/cm (~ 8,500 mg/L Cl<sup>-</sup>) (2) Fresh Water < 220 mg/L Cl<sup>-</sup>, Brackish Water 220 mg/L Cl<sup>-</sup> to 19,399 mg/L Cl<sup>-</sup>, Sea Water >= 19,400 mg/L Cl<sup>-</sup>; (3) OS 421/425 = Ocean Sensors CTD (absolute conductivity); (4) RBR 12895 = RBR Global CTD (Specific Conductivity); (5) msl = mean sea level.

\* Since the year 2005, the MPTZ has declined 79.42 feet toward a calculated Ghyben-Herzberg equilibrium elevation of approximately 752 feet below msl, relative to the Water Table measured at 18.80 feet above msl.

# Waipahu Deep Monitor Well, Oahu (3-2300-018)

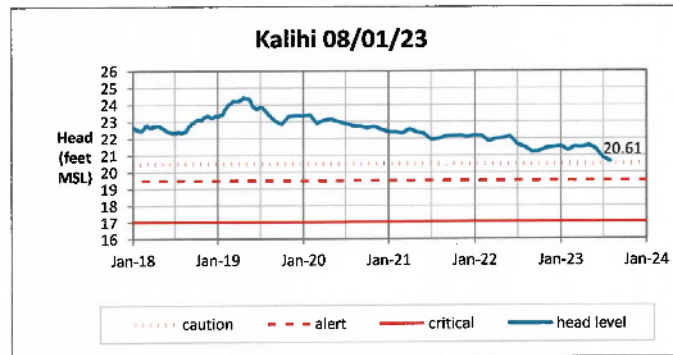
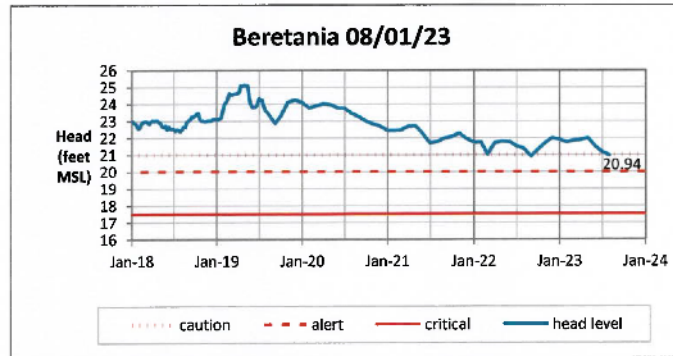
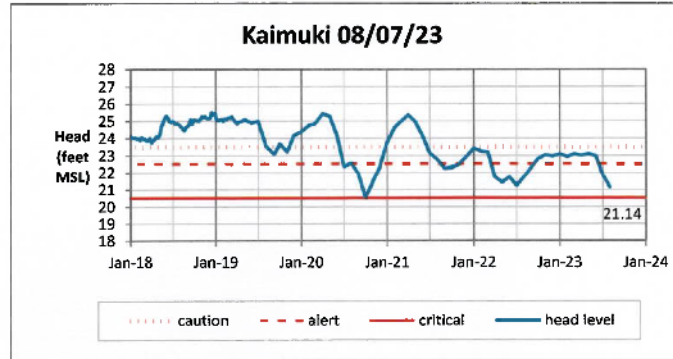
## Fluctuations of the Water Level, Top of Transition Zone (TTZ), and Midpoint of Transition Zone (MPTZ) From November 1986 through August 2023



**Notes:** (1) TTZ = 1,000 μS/cm (~ 220 mg/L Cl<sup>-</sup>); MPTZ = 25,000 μS/cm (~ 8,500 mg/L Cl<sup>-</sup>) (2) Fresh Water < 220 mg/L Cl<sup>-</sup>, Brackish Water 220 mg/L Cl<sup>-</sup> to 19,399 mg/L Cl<sup>-</sup>, Sea Water >= 19,400 mg/L Cl<sup>-</sup>; (3) OS 421/425 = Ocean Sensors CTD (absolute conductivity); (4) RBR 12895 = RBR Global CTD (Specific Conductivity); (5) msl = mean sea level.  
\* The MPTZ at 700.67 feet below msl, is below the calculated Gyben-Herzberg elevation of 685.1 feet below msl, relative to the Water Table measured at 16.71 feet msl.

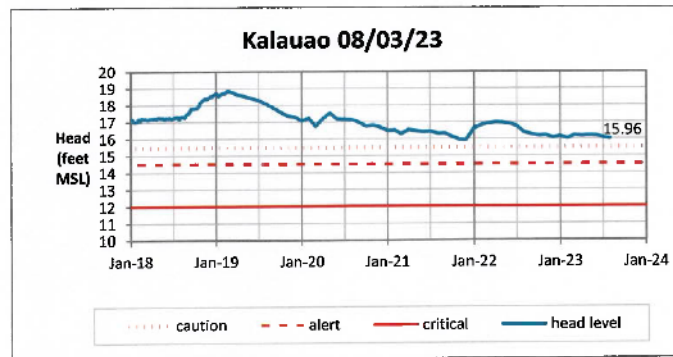
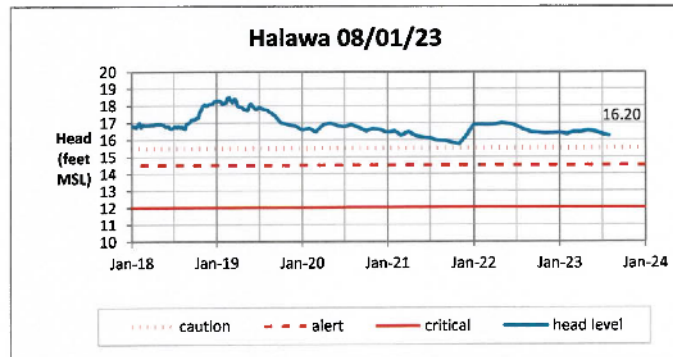
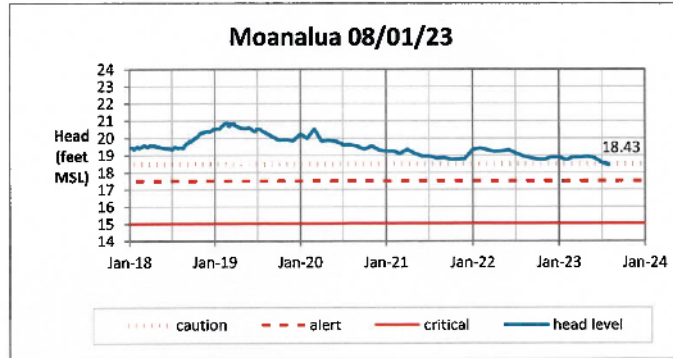
# Honolulu BWS Index Wells

## Head Report



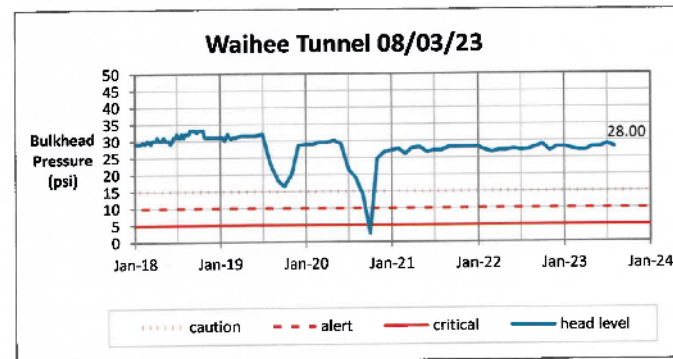
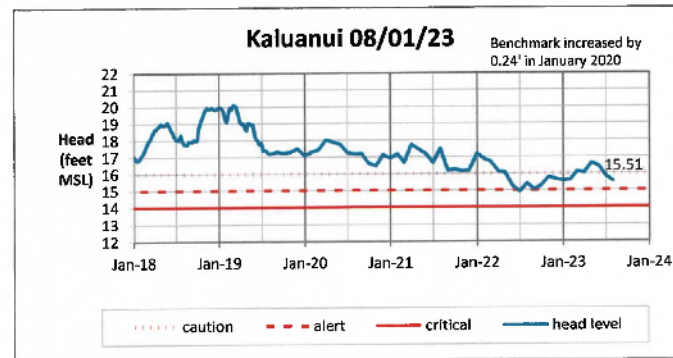
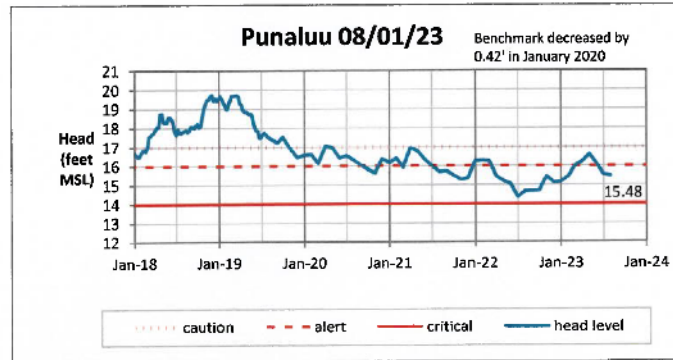
# Honolulu BWS Index Wells

## Head Report



# Honolulu BWS Index Wells

## Head Report



# Honolulu BWS Rainfall and Monthly Production

