What Do We Know About Lahaina Area Sector Aquifers? (LASEA)

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Outline

1. Background
2. LASEA Groundwater Geography
3. Historical and Recent Groundwater Extraction
4. Recent Saltwater Contamination of Potable Water
5. What About Sustainable Yields?
6. What Are the Implications?
7. Summary

All data are from State of Hawaii Commission on Water Resource Management

Background Chronology

1. 2024-03-??: Letter from Stufflebean to Cheng: No Water for Pulelehua
2. 2024-04-19: Letter from Lee to Stufflebean (?) Requesting Explanation of Water Resources in West Maui (by reference)
3. 2024-04-25: Response from Stufflebean (signed by Bissen) to Lee *Municipal Water Use and Demand in West Maui*
4. 2024-06-01: BWS Draft Letter to CWRM Supporting MDWS and Need for Monitoring of Aquifers Before More Permanent Developments
5. 2024-06-??: Testimony from Lee Challenged Position Based on *... lack of information* about aquifers
6. 2024-06-17: Testimony from Paltin Objected to Sacrificing In-stream Flow For Housing
7. 2024-06-27: Letter from Lee to Sterling Accusing BWS (Helly) of Violating Sunshine Law
8. 2024-07-15: Testimony from Lee Re-iterating Objections

Letter to BWS from Councilmember Lee ...

Rather than the Board and DWS telling CWRM to not allow permits for new uses, the County and the State should be doing everything in our collective power to find a way to provide water for Pulelehua and any other new affordable housing in West Maui. Your draft letter even concedes that the Lahaina Aquifer Sector is poorly understood and that current values are "guess-timates" based on Oahu data. Your draft letter states, and presumably this pertains to DWS, too, "We have no idea what is going on in the other five aquifers [besides the Honokowai aquifer]."

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Again, thank you for t
for your thoughtful consideration. Please do not hesitate to contact my office if you have any questions or if we can be of assistance in this or any other matter.

Sincerely,

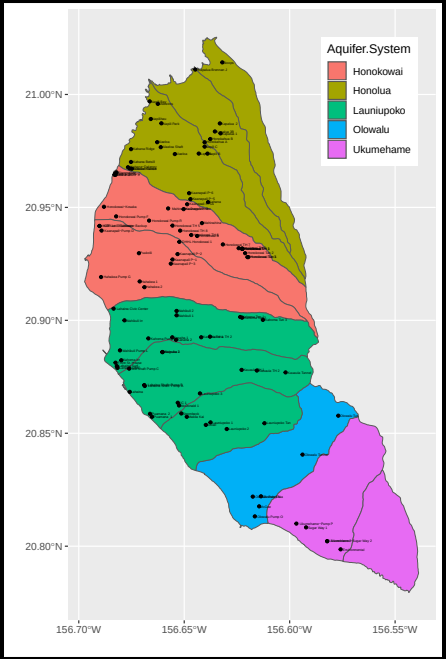
ALICE L. LEE
Council Chair

in West Maui. Your draft letter even concedes that the Lahaina Aquifer Sector is poorly understood and that current values are "guess-timates" based on Oahu data. Your draft letter states, and presumably this pertains to DWS, too, "We have no idea what is going on in the other five aquifers [besides the Honokowai aquifer]."

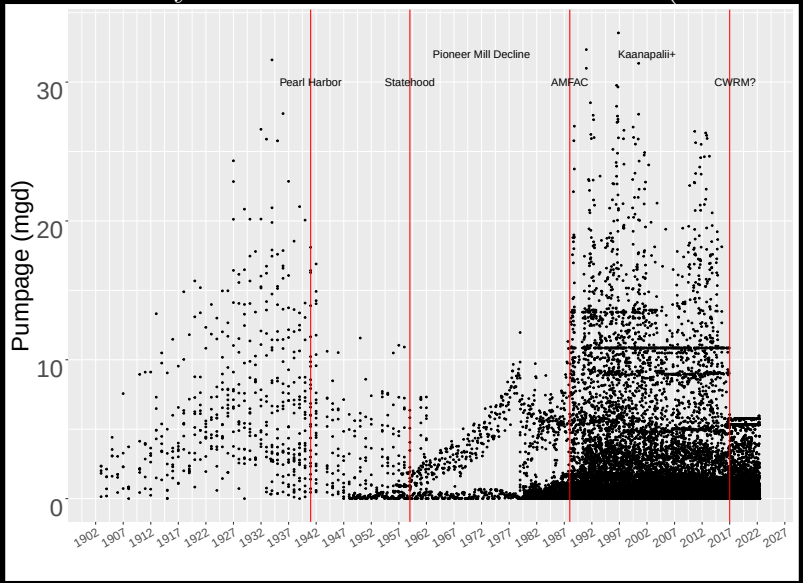
With such a severe lack of information, how does it follow that water has been available and provided to date but is now suddenly unavailable? How can it be said with certainty that 75,000 gallons per day cannot be made available for Pulelehua?

So, Let's Consider What We Know ...

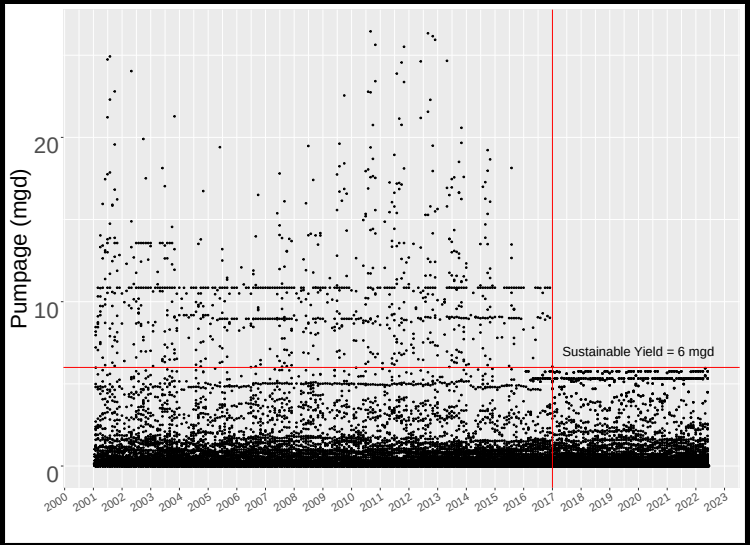
LASEA: Aquifer Geography



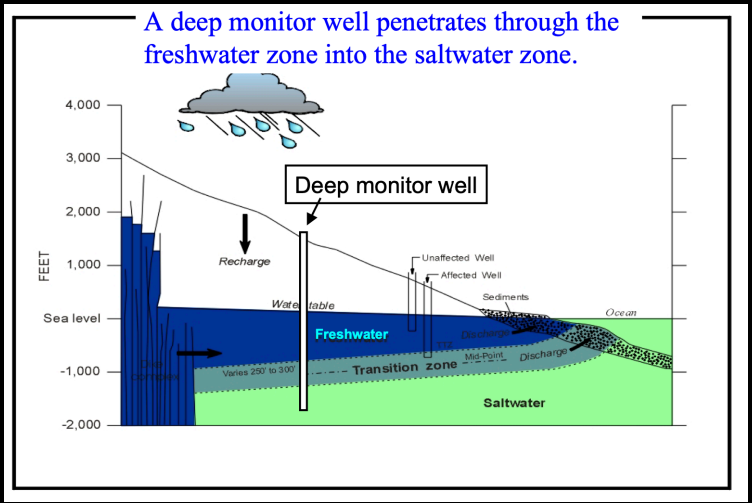
History of Groundwater Extraction (1902-2024)



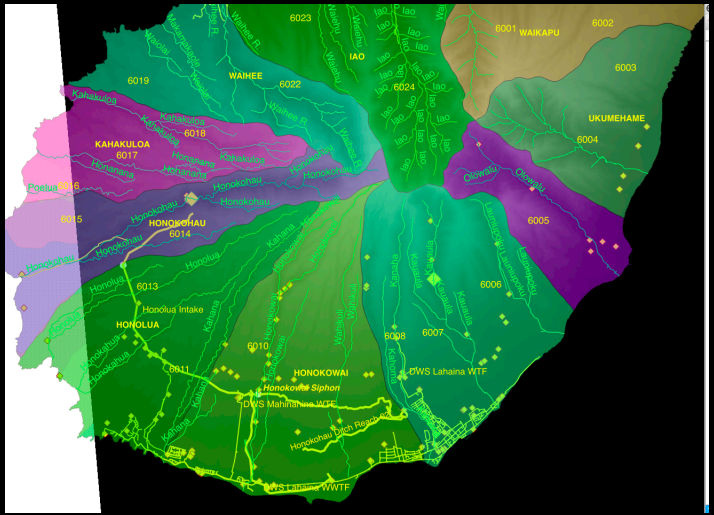
Recent History of Groundwater Extraction (2001-2024)



Background: What is an aquifer, what are various types of groundwater wells? (from CWRM)

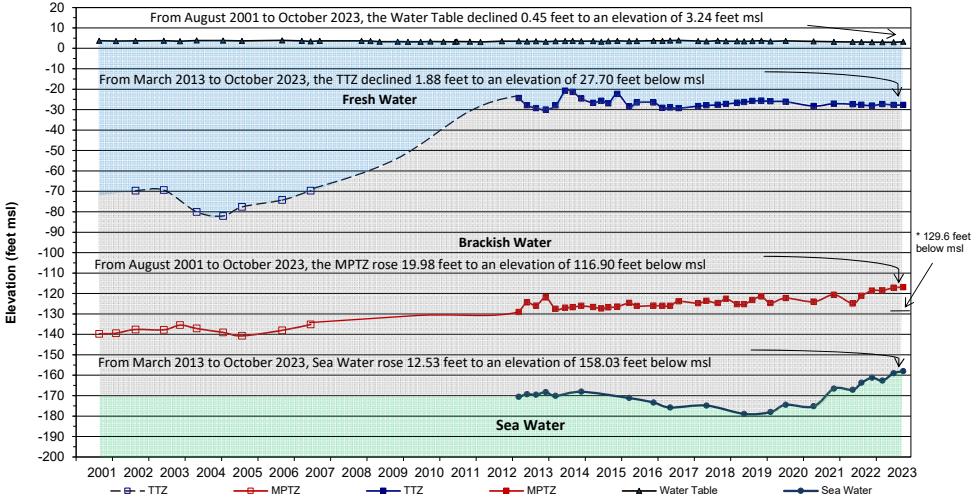


Mahinahina Deep Monitor Well



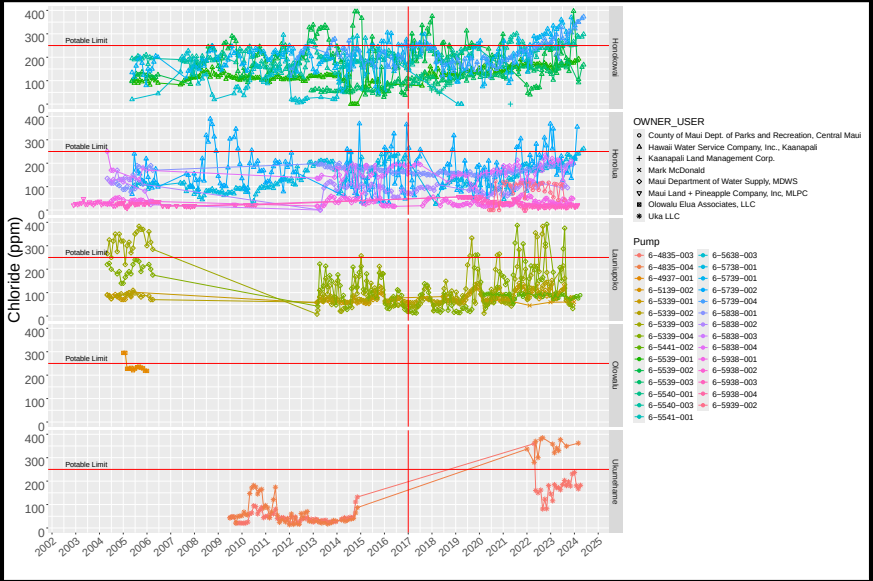
Mahinahina Deep Monitor Well, Maui (6-5739-003)

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



Notes: : (1) TTZ = 1,000 µS/cm (~ 220 mg/L Cl^-); MPTZ = 25,000 µS/cm (~ 8,500 mg/L Cl^-) (2) Fresh Water < 220 mg/L Cl^-, Brackish Water 220 mg/L CL^- to 19,399 mg/L Cl^-, Sea Water >= 19,400 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. 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 comaprative purposes.

* Since the year 2001, the MPTZ rose 20 feet, to an elevation of 116.9 feet below msl, where it is above a calculated Ghyben-Herzberg equilibrium elevation of 129.6 feet below msl, relative to the Water Table, measured at 3.24 feet above msl.



Water Quality

Saltwater Contamination of the Potable Water Supply

What About the Sustainable Yields? The Only Management Tool

SY(mgd): Sustainable yield is derived for the steady state relationship among head, infiltration and net draft, which is equivalent to sustainable yield. The infiltration value is given in the I(mgd) column. The calculated sustainable yield assumes that all groundwater is pumped from basal aquifers seaward of the high level zone except where high level water approaches the coast. The relationship is:

$$D/I = 1 - \{h(e)/h(0)\}^2$$

in which D is allowable draft (sustainable yield), I is infiltration, h(0) is initial head and h(e) is the equilibrium head.

Assigning a value for 1, the controlling variable in the equation is h(e). This head is selected to preserve the quality of water produced at the steady state. Where the initial head was low, the ratio h(e)/h(0) must be high and the ratio D/I small. The head ratio used to obtain sustainable yield is based on experience with known aquifers, such as those of Honolulu and southern Oahu. The sustainable yields are calculated from the following:

h(0) Range(ft)	h(e)/h(0)	D/I
4 – 10	.75	.44
11 - 15	.70	.51
16 – 20	.65	.58
21 – 25	.60	.64
>26 and HL	.55	.75

h(0): Initial head before the start of groundwater development. The head refers to a specific location, and h(e) is specified for that location. Many initial heads are estimated because of absence of information.

The estimates of sustainable yield are not meant to be an exact number which could be used in final planning documents. The estimates are constrained not only by the scanty data base but also by the fact that they do not consider the feasibility of developing the groundwater. The estimates should not be equated to developable groundwater. In many regions, taking advantage of a high estimate would not be economically feasible.

Not design limits

From 1990 State of Hawaii Water Resources Protection Plan
George A. L. Yuen and Associates, Inc. (pp. V-3, B-3)

Water Management Area - Ground Water Withdrawals

Aquifer System	SY	2020 12-MAV	2021 12-MAV	Develop. tunnel discharge	APU*	total existing + APU	% SY	other perm. well capacity	total incl. other perm. well capacity	% SY
Ukumehame	2	0.042	0.065	0	1.08	1.145	57%	0	1.145	57%
Olowalu	2	0.082	0.069	0.1	0.003	0.167	8%	0.065	0.167	8%
Launiupoko	**7**	**1.637**	**1.303**	**3.91**	**1.036**	**6.249**	**89%**	**1.433**	**7.682**	**110%**
Honokōwai	**6**	**3.48**	**4.008**	**2.5**	**2.533**	**9.041**	**151%**	**0**	**9.041**	**151%**
Honolua	8	2.131	2.534	0	1.969	4.503	56%	0	4.503	56%
Honokōhau	9	0	0	3.75	0.001	3.751	42%	0	3.751	42%

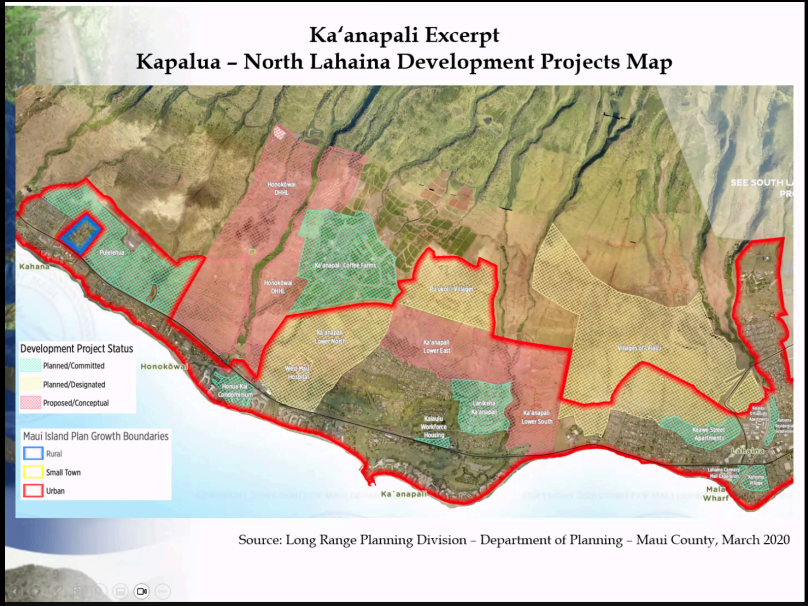
Aquifer system	12-MAV August 2022-23
Ukumehame	0.082
Olowalu	0.392
Launiupoko	2.252
Honokōwai	4.274
Honolua	2.244
Honokōhauwai	0

- **DHHL** has an approved groundwater **reservation** of 770.000 gpd from the Honokōwai Aquifer that is included in the authorized planned use (APU) of 2.533 MGD.

Nonetheless …

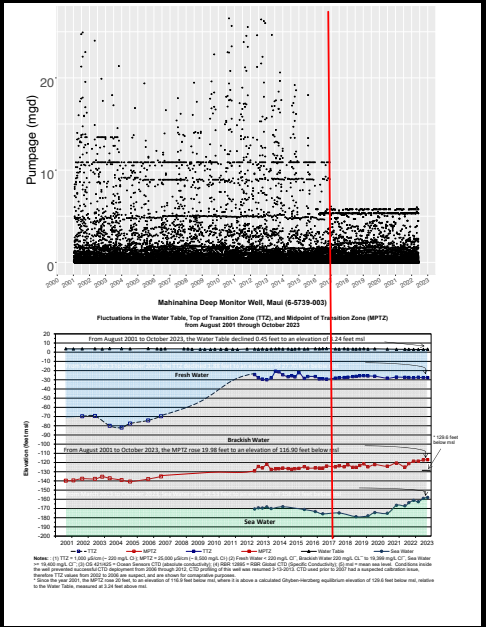
A Canary in the Coal Mine

From CWRM Meeting 2024-06-18



When do you say when?

Figure from CWRM Meeting 2024-06-18



What Are the Implications of Doing Nothing?

- We know the aquifer with the *only* Deep Monitor Well is showing disturbing trends and possibly unexpected behaviors.
- We have no other information about the other aquifers except the chloride and water levels for some of the production wells and the record is spotty.
- Big Island apparently has more advanced problem. Is that our future?

Letter to BWS from Councilmember Lee ...

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ALICE L. LEE
Council Chair

Nothing Sudden About It: This is Not News for Maui

- Over the last few years, water level in Iao aquifer has declined below that predicted by RAM (Oki and Meyer, 2001) *Clark C. K. Liu, Project Report PR-2006-06, April 2006, Water Resources Research Center, University of Hawaii*
  1. transition zone between the freshwater and saltwater has risen
  2. salinity of water pumped from wells in the aquifer has increased.
  3. forced draft from the aquifer has been cut back to a level below the established sustainable yield
  4. to prevent further decline of water levels and saltwater intrusion
- For more than 24 years, nothing has been done to prevent this from occurring elsewhere
- Now, it is happening in LASEA
- Water Management Area designation by CWRM, June 14, 2022

Summary: Where's the Leadership?

- Is it reasonable to further risk the water supply for LASEA through forever-commitments to additional new construction?
  - Groundwater pumping should not continue to increase and already should decrease because of deteriorating water quality
  - No identifiable new surface water or groundwater resources from precipitation; and predicted decreases
- Where do you get more water?
  - Infrastructure repair for surface water conveyance?
  - Can other groundwater resources be safely tapped?
  - Ocean water and brackish water desalination? (Oahu)

Summary: Where's the Leadership? (cont.)

- Short-term, the only control is through permits issued by State of Hawaii
  - CWRM stepped-in to prevent a train wreck
  - Reactive, stop-gap measure, based on SY (sustainable yield)
  - Probably too high given the water quality problems (Iao Valley had related problem)
- Long-term, prospective, integrated management is needed
  - Water authority for the Westside is obvious approach
  - Consolidate what is known about all infrastructure and operations
  - Optimize water resource management through a robust monitoring program
  - Provide local control and improved planning based on data
  - Provide a forum for adjudicating conflicts and public transparency
- In the meantime, don't make things worse