EPSCOR Merging the Data Needs of the State Agencies with those of the Scientific Community

A Proposal for a Collaborative Resource (Re-)Analysis

Don Thomas
&
The EPSCOR Team

(To State the Obvious)

- The quality of Hawai'i's ground-water resources is among the best in the world
- We all recognize these resources as critical assets for our communities
- For most communities, the available resource is adequate to meet current needs.... BUT

The resource is under varying degrees and urgencies of threat from multiple stressors:

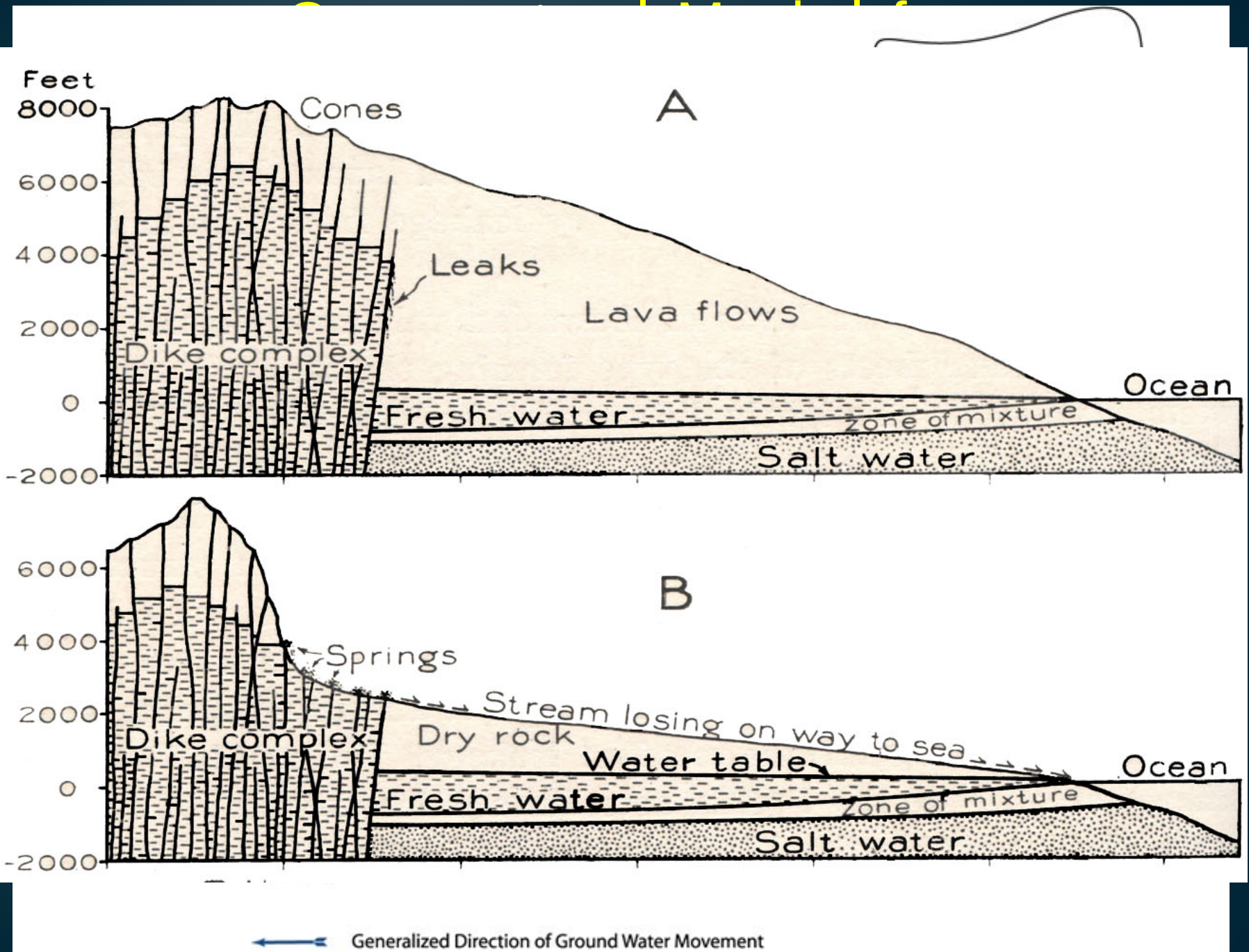
- Over production in some locations
- Contamination
  - Red Hill (headlines)
  - Pesticide use – (headlines)
  - Wastewater spills – (headlines)
  - OSDS – (no headlines????)
- Climate Change
  - Manmade - or Not – headlines (see Anasazi & overproduction...)

- These threats are managed by
  - CWRM – overproduction, protection of the resource
  - DOH – Point and Non-Point source contamination
  - DWS - quality delivered to the user

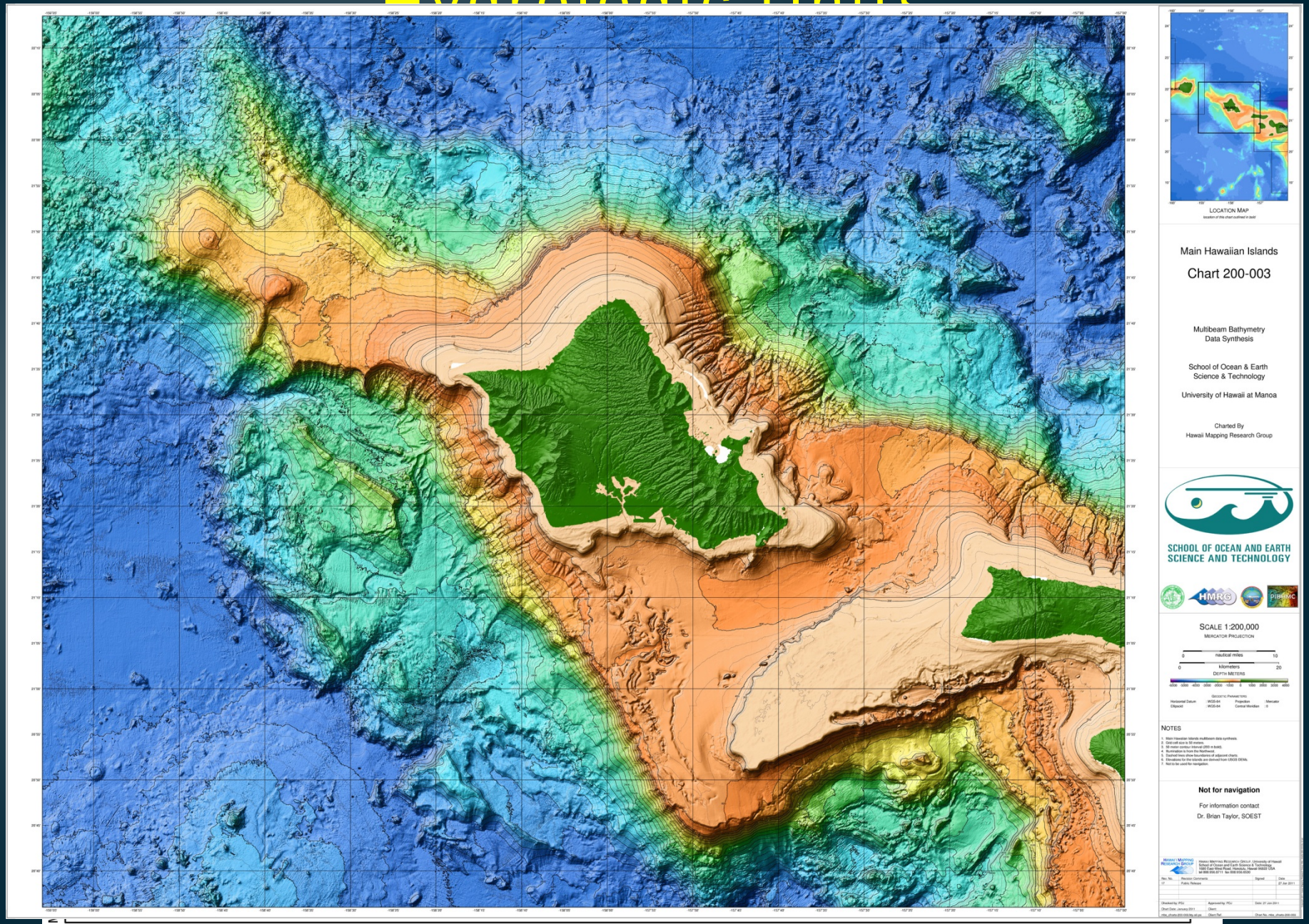
All over committed and under-resourced to fully manage the complete spectrum of threats that the resource is subject to…

There is a further threat that compounds all the others:

We don’t yet fully understand how water flows, or how it is stored, inside Hawai’i’s volcanoes


Feet
8000
6000
4000
2000
0
-2000
Cones
A
Leaks
Lava flows
Dike complex
Ocean
Fresh water
Zone of mixture
Salt water
6000
4000
2000
0
-2000
B
Springs
Stream losing on way to sea
Dry rock
Water table
Dike complex
Ocean
Fresh water
Zone of mixture
Salt water
Generalized Direction of Ground Water Movement

Hydrologic Units



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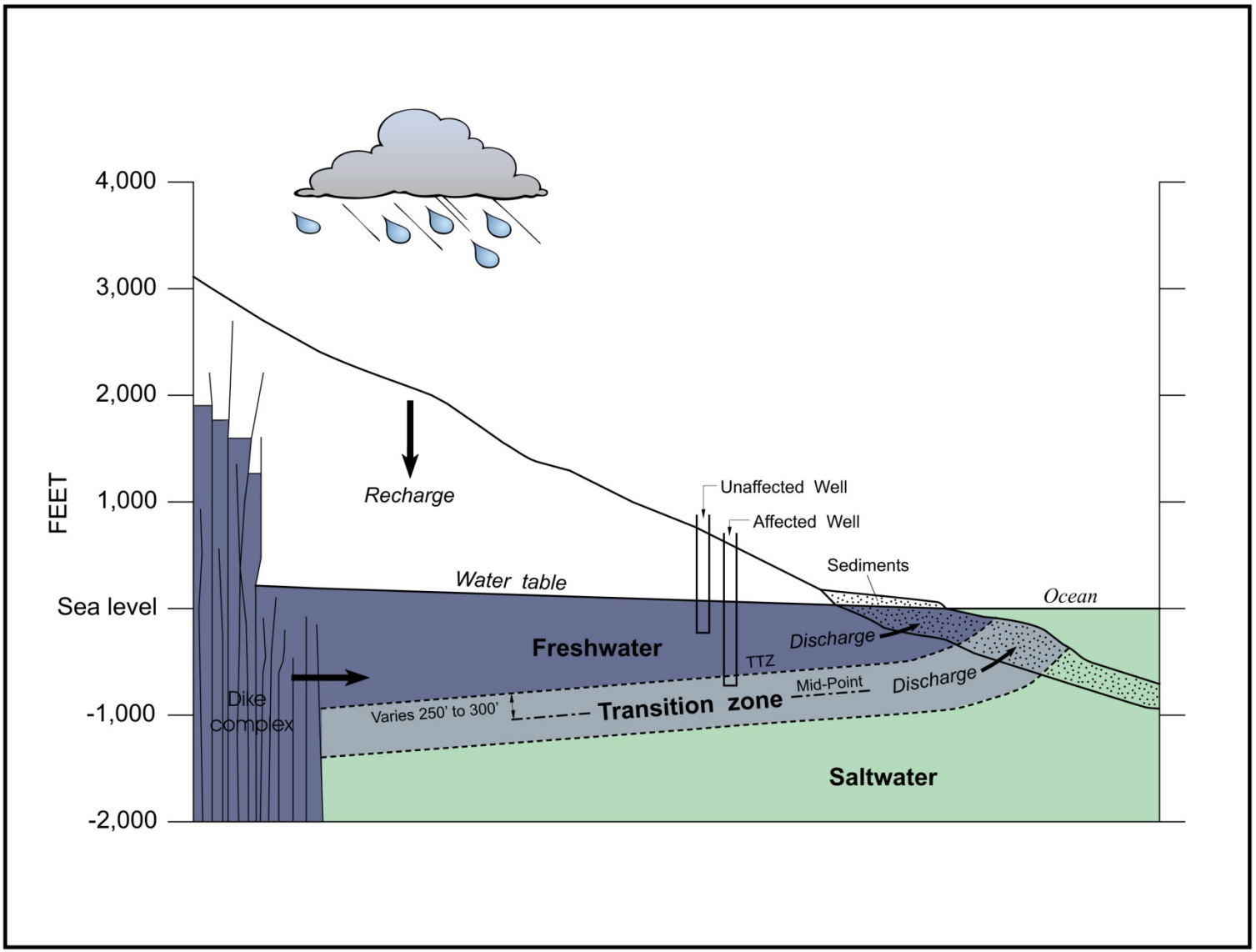
Map Projection: Universal Transverse Mercator



Map ID: 1010

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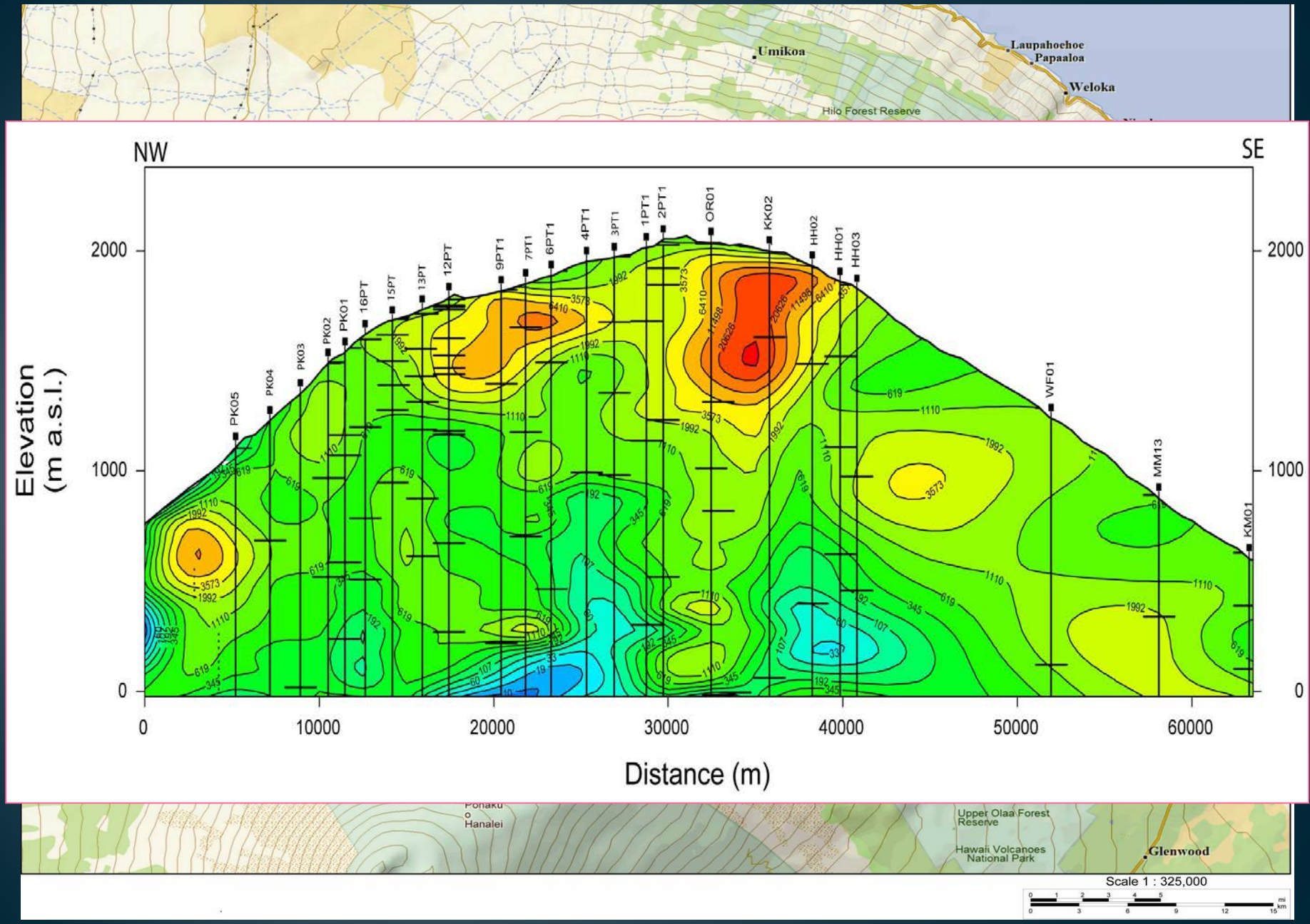
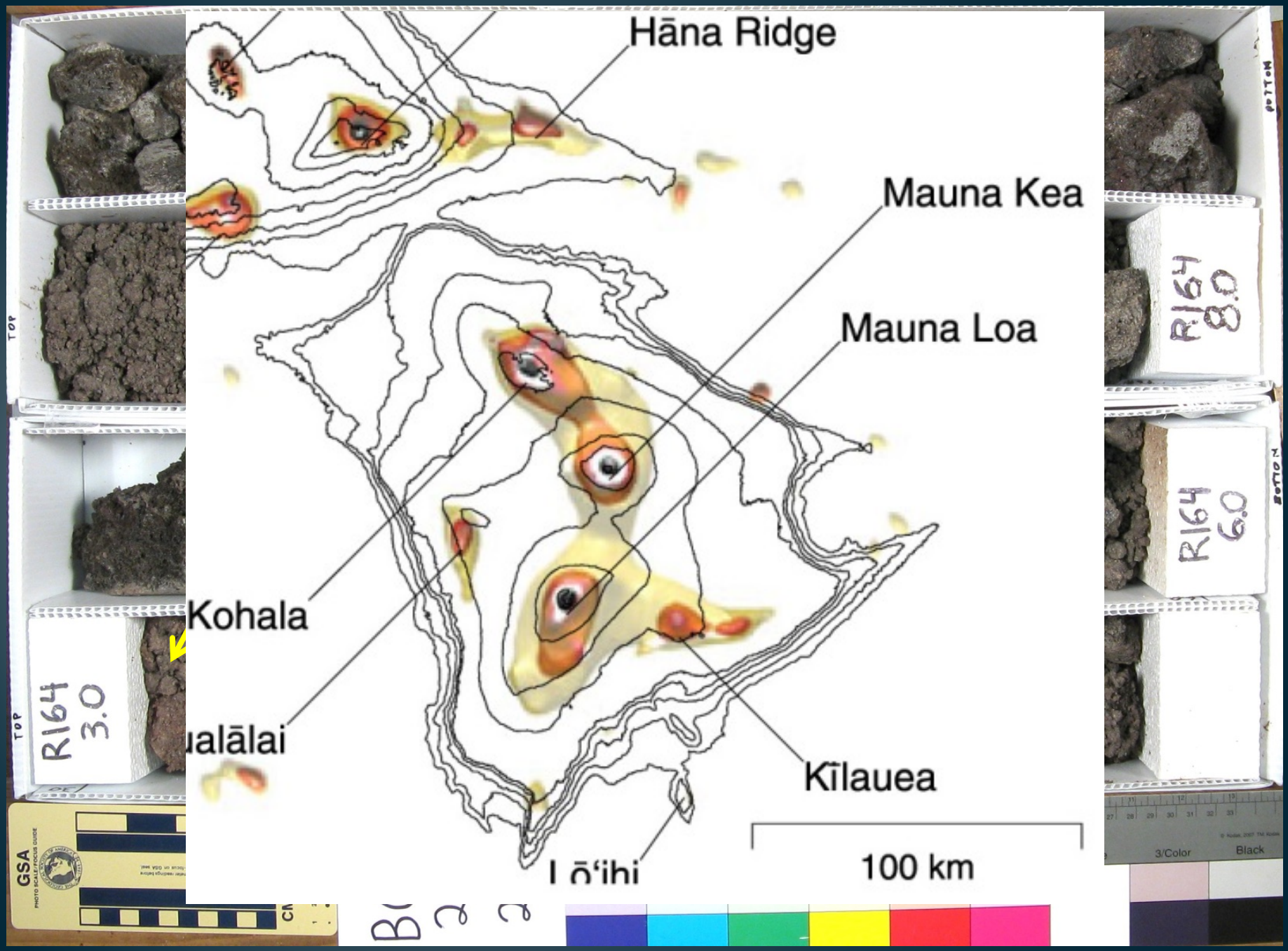
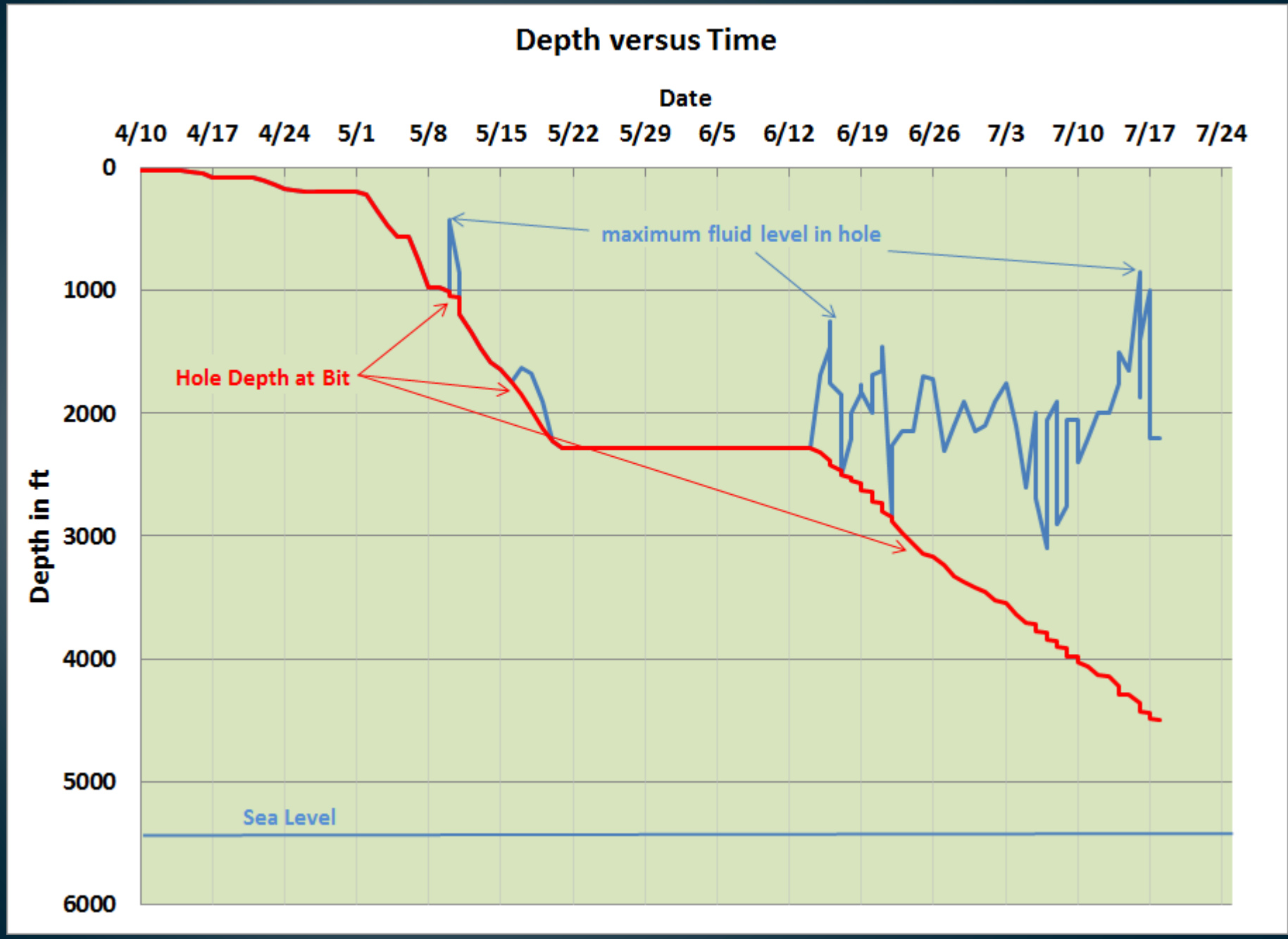
ercator

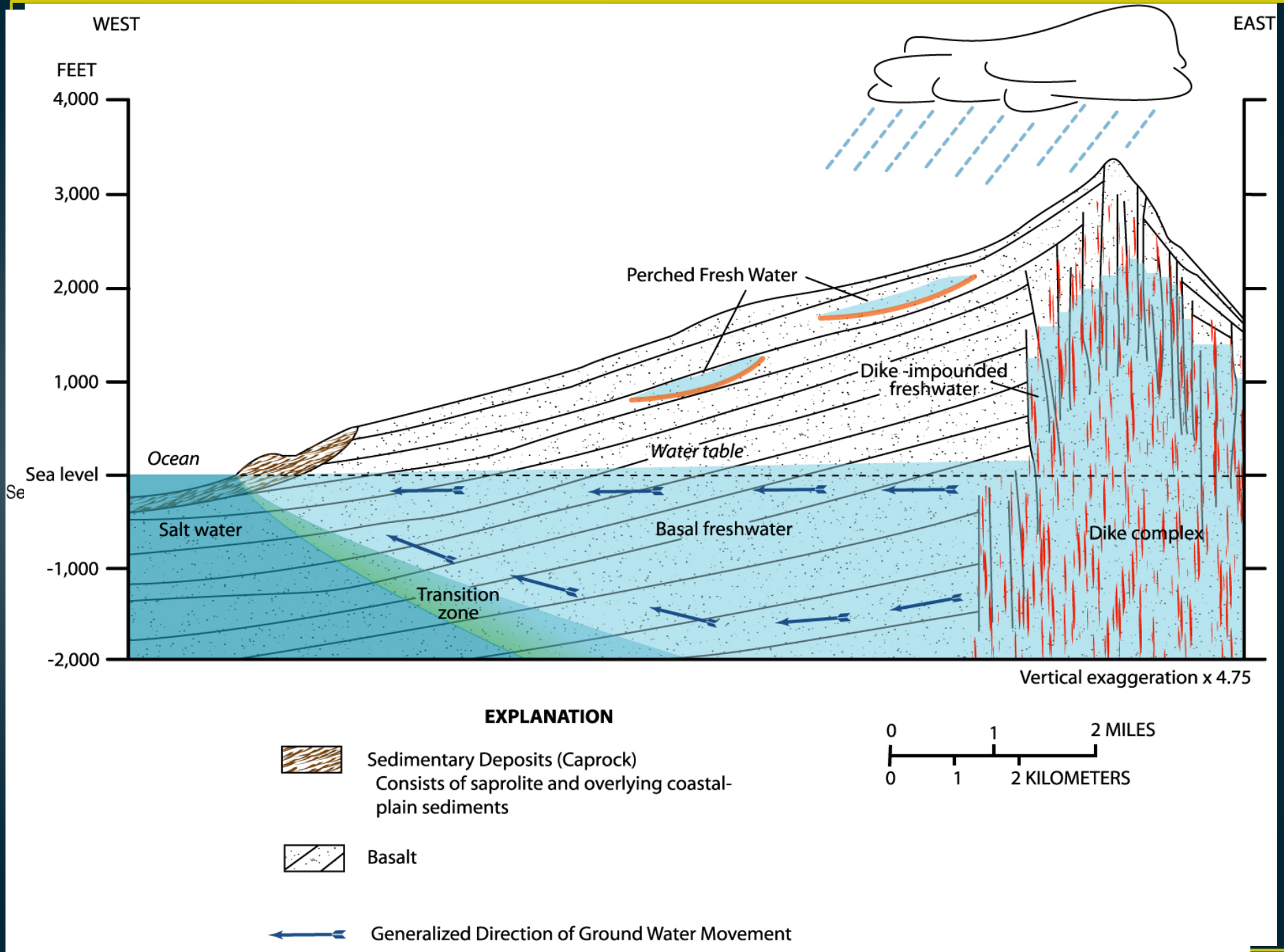
Later drilling, in the Keauhou aquifer, on Hualalai, found a system similar to that found in Hilo

- The Kamakana Well encountered a thin basal lens, underlain by salt water saturated rock down to ~1000’ below sea level and then a second freshwater saturated interval below that
- We believe that the Keopu Deep Monitor Well farther south in Kona may have encountered a similar aquifer


Umikoa
Laupahoehoe
Papaaloa
Weloka
Hilo Forest Reserve
NW
SE
Elevation (m a.s.l.)
Distance (m)
0
10000
20000
30000
40000
50000
60000
0
1000
2000
PK05
PK04
PK03
PK02
PK01
16PT
15PT
13PT
12PT
9PT1
7PT1
6PT1
4PT1
3PT1
1PT1
2PT1
OR01
KK02
HH02
HH01
HH03
WF01
MM13
KM01
Ponaku
o
Hanalei
Upper Olaa Forest
Reserve
Hawaii Volcanoes
National Park
Glenwood
Scale 1 : 325,000


Hāna Ridge
Mauna Kea
Mauna Loa
Kohala
ualālai
Kīlauea
Lō'ihi
100 km
R164 3.0
R164 8.0
R164 6.0
TOP
BOTTOM
GSA


Depth versus Time
Date
4/10
4/17
4/24
5/1
5/8
5/15
5/22
5/29
6/5
6/12
6/19
6/26
7/3
7/10
7/17
7/24
Depth in ft
0
1000
2000
3000
4000
5000
6000
maximum fluid level in hole
Hole Depth at Bit
Sea Level

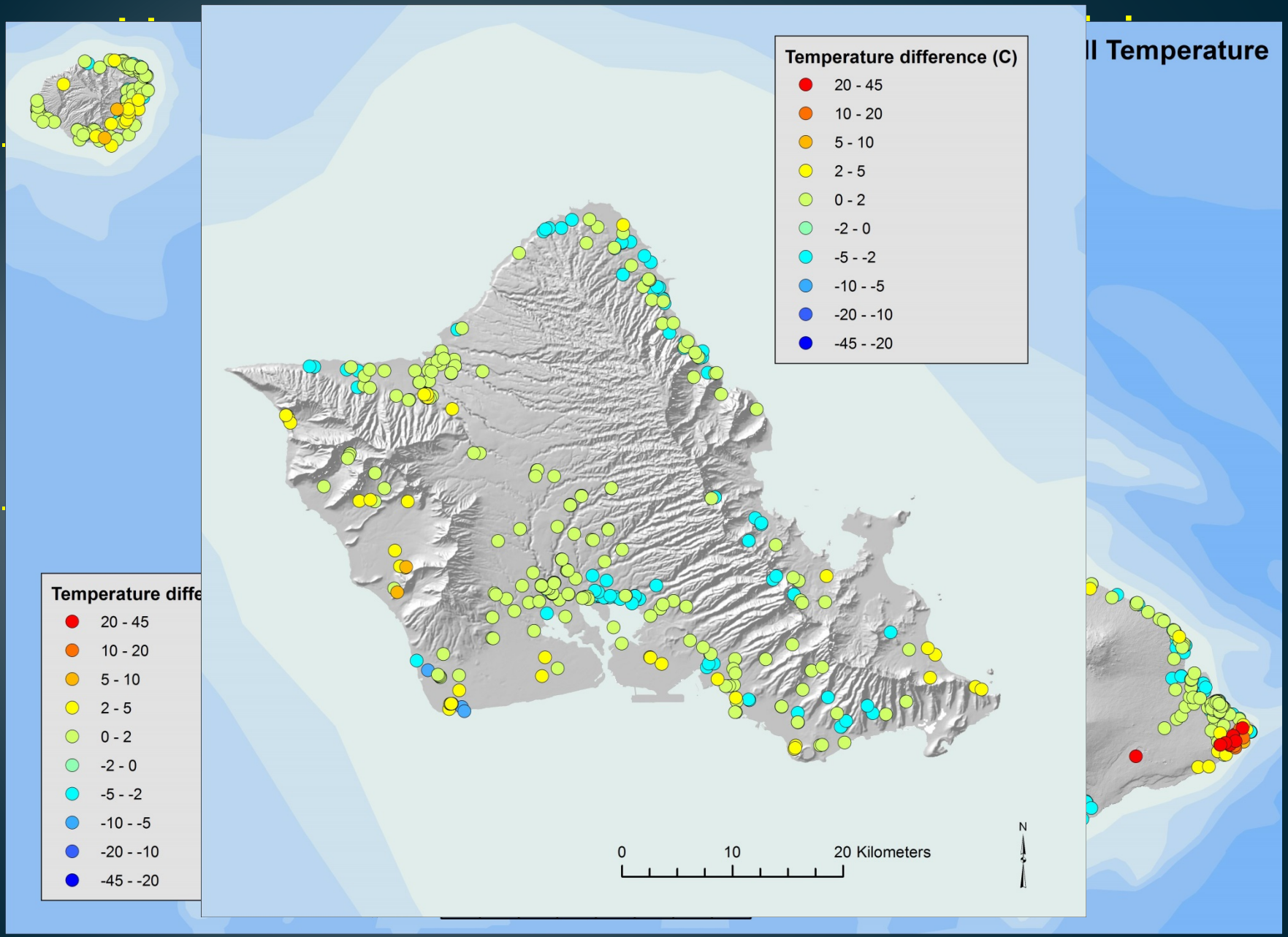

WEST
EAST
FEET
4,000
3,000
2,000
1,000
Sea level
-1,000
-2,000
Perched Fresh Water
Dike -impounded freshwater
Water table
Ocean
Salt water
Basal freshwater
Dike complex
Transition zone
Vertical exaggeration x 4.75
EXPLANATION
Sedimentary Deposits (Caprock)
Consists of saprolite and overlying coastal-plain sediments
Basalt
Generalized Direction of Ground Water Movement
0
1
2 MILES
0
1
2 KILOMETERS

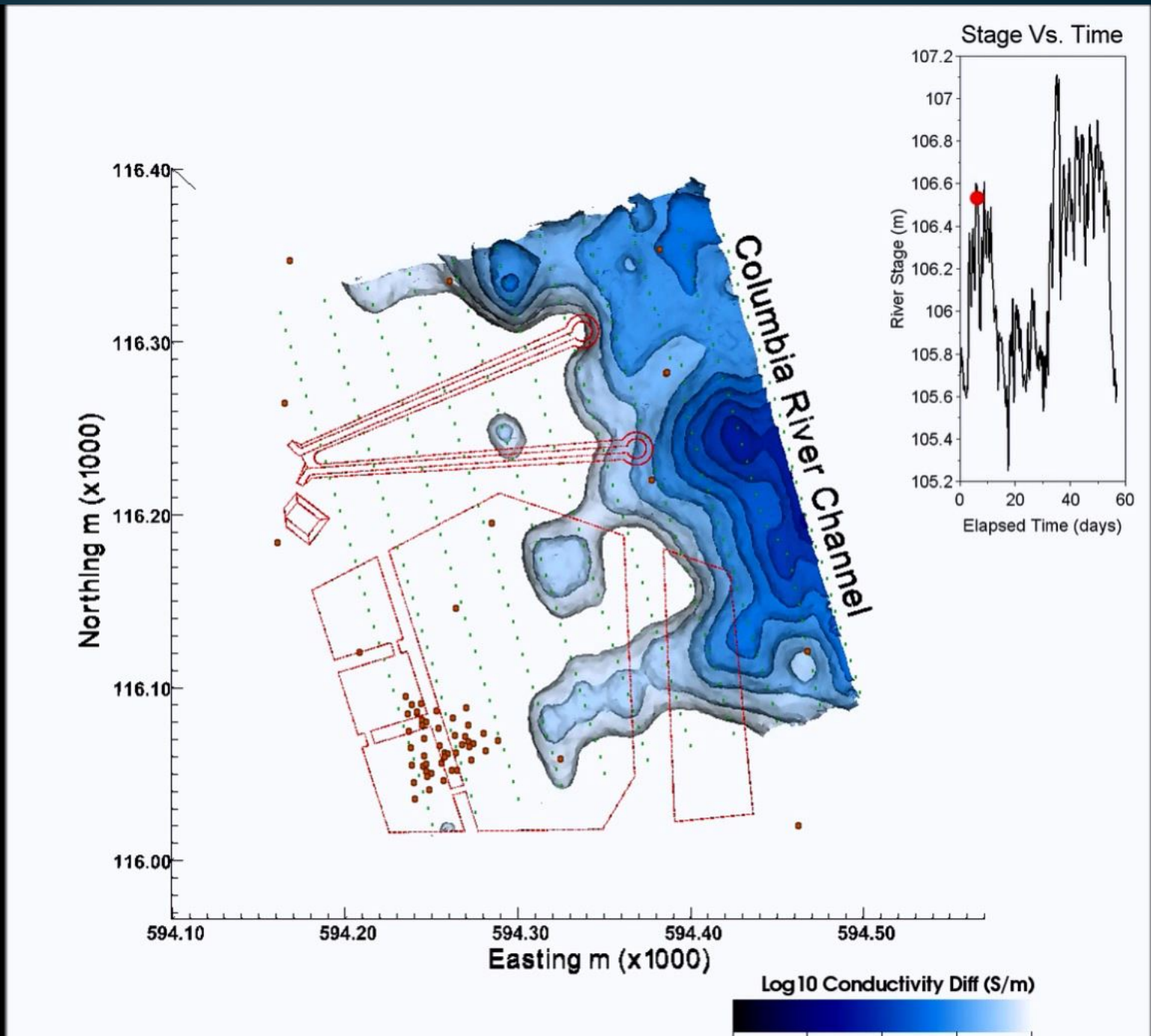
Proposal

- A collaborative effort among the UH and CWRM, DOH, and county DWS to:

- Better define the distribution and extent of groundwater aquifers (in 3-Dimensions) on each of the islands

- Develop better models for groundwater flow that can more reliably project the rates and direction of flow of the groundwater (and potential contaminants)


Temperature difference (C)
20 - 45
10 - 20
5 - 10
2 - 5
0 - 2
-2 - 0
-5 - -2
-10 - -5
-20 - -10
-45 - -20
0
10
20 Kilometers
N
Temperature diffe
20 - 45
10 - 20
5 - 10
2 - 5
0 - 2
-2 - 0
-5 - -2
-10 - -5
-20 - -10
-45 - -20
ll Temperature


Stage Vs. Time
River Stage (m)
Elapsed Time (days)
107.2
107
106.8
106.6
106.4
106.2
106
105.8
105.6
105.4
105.2
0
20
40
60
Columbia River Channel
Northing m (x1000)
116.40
116.30
116.20
116.10
116.00
594.10
594.20
594.30
594.40
594.50
Easting m (x1000)
Log10 Conductivity Diff (S/m)

How Do We Propose To Do This

- Develop innovative downhole monitoring instruments that can provide better, more timely, and more robust water level and chemistry data for selected monitoring and production wells
- Develop better estimates of coastal discharge of groundwater that can help us constrain the overall disposition of the recharge into the islands
- Use these legacy and new data sets to test and refine existing conceptual and numerical models for groundwater storage and flow inside the islands

How Do We Propose To Do Thi$$$

- We currently have a proposal submitted to National Science Foundation that would allow us to cover the costs of conducting a targeted effort to accomplish our goals in the Keauhou/Kiholo and Pearl Harbor/Honolulu aquifers
- Provide funding for interns, field work, development of the visualization software, development of the monitoring tools, model development etc.
- Now working on development of a proposal to DOD for site specific work in the Pearl Harbor area

Cooperation from our Collaborators

- Provide access to the legacy data and clear guidance on (C.I.) access restrictions
- Provide guidance on the types of monitoring that would be most beneficial to operating needs and access to a subset of wells that can be monitored
- Provide guidance on what mapping or sorting capabilities would be most useful to potential users (e.g. highest chlorides; greatest change in chloride, hits on criteria pollutants, greatest deviation from prior set point, etc.
- Provide us with feedback on areas of interest for conducting active or passive geophysical surveys and tests

What is the Desired End State

- A better understanding of the groundwater flow and storage inside the islands
- A suite of useful, user-friendly tools for agency staff to monitor the condition, and highlight significant changes, in groundwater quality and availability
- A set of tools that can allow the agencies to better convey the condition of our groundwater resources (and the threats thereto) to the public and decision-makers
- More robust modeling capabilities that can reliably reflect storage and transport processes and can support agency needs (e.g. SWAP, contaminant plume definition)

What is the Desired End State

- Guidance on how to best access the needed water resources – sustainably – while minimizing costs and adverse impacts on natural hydrologic processes

Old Joke – With A (sharp) Point

I've got good news and bad news:

The good news: In 20 years we'll all be drinking recycled wastewater

The bad news: There's not going to be enough to go around


Pau