

# STREAMing with Aloha

*Science, Technology, Resilience, Engineering,  
Art & Culture, and Math with Aloha*

*A collaboration with Mālama Hulē'ia, the Kauai  
Community Science Center, Kamehameha School,  
and Lihue Boys & Girls Club*



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# Introduction to Alakoko Fishpond and Mālama Hulē'ia March 25th, 2021



For our initial meeting, we joined the Boys and Girls Club students and Mālama Hulē'ia at Alakoko Fishpond. We met with Peleke Flores who is the Community Outreach Coordinator for Mālama Hulē'ia. Peleke showed us around the fishpond, explained the history of Alakoko, and the important work that they are doing.

# Exploring Alakoko Fishpond

## April 1, 2021

For our second meeting at Alakoko Fishpond, we wanted to expand on “kilo”, which means to watch, observe, examine, or forecast, and to also tie it into April’s Citizen Science Month. First, the students set-up an Ant Picnic Citizen Science experiment. Through this experiment students will learn about the major food groups and explore the diet preferences of ants. The students set out prescribed ant food baits then let it sit for an hour. After the hour, students collected the bait and counted how much ants were at each bait. The data that the students collected will contribute to a large database with data from students all around the world who are doing the same experiment.

For our second activity, we decided to explore Alakoko Fishpond more by doing a scavenger hunt. Not only did we learn more about Alakoko Fishpond, we also implemented the act of “kilo”, “hui” and “laulima”. The students broke up into three groups to work together and find several of the items listed on the scavenger hunt (see page 5).

KCSC 3D printed octopuses and fish keychains for the students to take home. They also chose a book to take home and an Ant Picnic activity to do with their families.



## EXPLORATION @ ALAKOKO FISHPOND

Let's use what we learned about KILO, HUI and LAULIMA to explore our surroundings at the Alakoko Fishpond and work together to find as many of these things as you can during the exploration.

**KILO** - means to watch, observe, examine or forecast. It can be referred to the action of watching or to a person that is an expert in these skills.

**HUI** - a team or group of people.

**LAULIMA** - cooperation or a group of people working together, literally meaning many hands.

## PLANTS

- 10 mangrove seedlings that you pulled up
- A flower or flower petals from any plant
- 'Ae'ae, native ground cover plant
- Ahu'awa, native grass plant that is around the edge of the fishpond
- A nui (coconut)
- A kukui nut
- A leaf or plant that has been chewed on by an insect or animal
- 2 different types of leaves

## ANIMALS

- A fish you see in the river, take a photo or describe
- A fish you see in the fishpond, take a photo or describe
- An insect, take a photo or describe
- A spider or spider web, take a photo or describe
- Animal poop
- Animal tracks
- A bird feather
- A butterfly

## OTHERS

- Something that is beautiful
- Something that you don't know what it is
- A piece of 'ōpala (trash)
- Something you would like to learn more about
- Something you have seen in your yard
- An interesting stick
- Describe your favorite view at Alakoko Fishpond
- Something you think is a treasure



Pictured above are students setting up the Ant Picnic activity and counting how much ants they collected. Also pictured are photos of KCSC team and students on the scavenger hunt.

# "a-MAZE-ing" Fishponds

## April 8, 15 & 29, 2021

For the rest of the program, we were located at the Boys & Girls Clubhouse - Lihue. While at the Clubhouse, we started on a project that would last three weeks. We decided to make mazes based off of Hawaiian fishponds! This project reinforced the idea of "laulima", working together. It also introduced a new concept, the "Design Thinking Process". Our interns, Kathleen and Braelyn, helped explain this process by showing the students their own projects. Kathleen, a junior from Waimea High School, brought a robot that her and the WHS Robotics team built for competitions. Braelyn, a senior from Waimea High School, showed a 3D printed pediatric treadmill that she designed and printed herself.

The students broke up into two groups then started on their fishpond mazes. First they decided on what type of Hawaiian fishpond they wanted to base their maze off of. Then they worked on what type of characteristics they wanted for their maze. For example, will the maze include kalo, an auwai, and/or a mākāhā? After they decided on all of the characteristics, they drew out what they wanted their maze to look like on a big piece of paper. Using all of their ideas and their brainstorming sketches, they made a prototype.

After the prototype, we made the bigger, final product that they could drive a Sphero through! A sphero is a programmable robotic ball designed to inspire creativity and curiosity through coding and play.

We did take a week off from the mazes to learn about escape rooms and 3D printing. Kalia, a KCSC and Kauai Makerspace 3D Printing Instructor, researched and designed a fishpond-themed escape room for the students. The students teamed up in pairs to help the little goby fish find his way back to his fishpond home. We also brought a 3D printer for the students to look it.

# DESIGN THINKING PROCESS

## 1. Fishpond Type

- Loko Kuapā - fishpond made of a rock wall & sluice gate on shoreline
- Loko Pu'uone - fishpond separated from the ocean by a sand berm
- Loko Wai - freshwater fishpond
- Loko l'a Kalo - fishpond with taro

## 2. Characteristics

- 'Auwai: ditch or channel
  - Mākāhā: sluice gate
  - Wai kai: brackish water
  - l'a: fish
  - Kalo: taro
- (see "Hawaiian Glossary")

## Criteria

- Pick a fishpond type
- Did you brainstorm & draw your maze?
- Incorporate two characteristics
- Maze should be designed with Sphero robot in mind

## 4. Prototype

Gather your materials  
and start building!

## 3. Brainstorm

On a big piece of paper (which will be provided) draw your fishpond maze.

BE CREATIVE  
&  
HAVE FUN!



Pictured above are the students designing and building their prototypes.



**10** Pictured above: students put the final touches on their fishpond mazes!

# KCSC Escape Room

## April 22, 2021

We did take a week off from the mazes to learn about escape rooms and 3D printing. Kalia, a KCSC and Kauai Makerspace 3D Printing Instructor, researched and designed a fishpond-themed escape room for the students. The students teamed up in pairs to help the little goby fish find his way back to his fishpond home. They had to answer riddles, solve anagrams and even had to learn a some Hawaiian words to help the o'opu. After all the students made it back to the fishpond, Kalia showed us how she made the escape room using Google Forms.

Since Kalia is also a 3D Printing Instructor, we brought a 3D printer for the students to see live and in-action. Kalia showed the students how to set it up, explained the different websites and programs associated with 3D printing, and explained how the 3D printer melts the plastic filament down to form a new 3D shape. The students all had awesome questions and were so intrigued by the whole process. Kalia even 3D printed each student a giveaway that took at least 2 hours each!

(Pages 12 through 18 are the information sheets that the students used to solve the escape room.)





Pictured above: Kalia teaches the students about how she made the virtual escape room and how the 3D printer works. Also pictured is Braelyn helping students with the escape room.



**KCSC Escape Room**  
**- Fish Far From Home -**

*By: Kalia Jopling*

# 'O'opu Species

Five species of native 'O'opu occur in streams in the Hawaiian Islands. Four species are in the family Gobiidae (gobies) and one species ('O'opu Akupa) is a member of the family Eleotridae (sleepers).

		
<b>'O'opu Nopili (E)</b> <b>(Sicyopterus stimpsoni)</b>	<b>'O'opu Alamo'o (E)</b> <b>(Lentipes concolor)</b>	<b>'O'opu Naniha (E)</b> <b>(Stenagobius hawaiiensis)</b>
		
<b>'O'opu Akupa (E)</b> <b>(Electris sandwicensis)</b>	<b>'O'opu Nakea (I)</b> <b>(Awaous guamensis)</b>	

1. 'O'opu Nopili - Stimpson's Goby (*Sicyopterus stimpsoni*)
2. 'O'opu Alamo'o or 'O'opu hi'u kolei (*Lentipes concolor*)
3. 'O'opu 'O'opu Naniha - Naniha Goby (*Stenagobius hawaiiensis*)
4. 'O'opu Akupa - Sleeper fish (*Electris sandwicensis*)
5. 'O'opu Nakea (*Awaous guamensis*)

# 'O'opu Eating Habits

- One species of the Hawaiian goby, 'o'opu nakea, are omnivores that eat benthic algae, aquatic insects and insect larvae, worms, and crustaceans - including 'ōpae (shrimp). They may feed on suspended food particles in the water column as well.

# 'O'opu Predators

- Some predators that eat include fishes and birds, such as the 'auku'u (black-crowned night herons).
- When it comes through the estuary, many species of native fish will eat 'o'opu nakea such as aholehole, ulua (*Caranx* spp.) moi (*Polydactylus sexfilis*) and kaku (*Sphyræna barracuda*).
- Habitat degradation results from water diversion, stream channelization, dams, pollution, and the introduction of exotic species and parasites.
- Water diversions, stream channelization, and dams result in habitat degradation through altered stream flows that lead to the destruction of key water characteristics such as freshets, riffles and runs, higher water temperatures, and lower dissolved oxygen levels.
- Exotic species, such as tilapia, are another important threat to the 'o'opu nakea. Once tilapia are introduced in a habitat, they have been found to establish themselves quickly and outcompete native fish.
- Historical introduction of game fish and more recent unwanted exotic fish from the aquarium trade is a problem as well.
- These exotic fishes prey on native fishes, outcompete native fishes for food and spread parasites and diseases.
- Fishing could become a more severe threat in combination with the above threats because 'o'opu nakea are abundant in Kauai rivers and are fished during their spawning migration.

## 'O'opu Facts

- Adult 'o'opu nakea are relatively good climbers and swimmers, they will often burrow under rocks leaving only their eyes showing.
- 'O'opu nakea are the largest of the native Hawaiian stream fish and may achieve a size of over 14 inches (35 cm). Some are so big you can, reportedly, put your whole fist in their mouth.
- 'O'opu nopili, one of the species of Hawaiian gobies, got its name from its ability to cling onto the rocks. Hawaiians used it as a gift for weaning and housewarming so that the good luck may "cling".
- 'O'opu can travel up to heights as high as 1,200 feet above sea level.

## 'O'opu Origins

- Today, they can be found in streams on the island of Hawai'i, Kaua'i, Moloka'i, Maui and O'ahu.
- 'O'opu nakea are usually found in the middle to lower reaches of streams, with a larger range in larger streams.
- 'O'opu will hatch and begin their life in a Hawaiian mountain stream. After a heavy rain, they are washed down to the ocean. There they will grow bigger and stronger, in hopes of returning to their birth place.

# 'O'opu Uses

- 'O'opu is considered a delicacy and an important recreational fishery for them still exists on Kauai in Hanalei and Waimea rivers.

# 'O'opu Anatomy

- An adult 'o'opu has a mouth that is located on the bottom of its head, with a row of teeth that line up beneath the upper lip for scraping algae off the rock.
- It also uses its mouth to climb up the rock surface and move upstream. To maintain position in a fast moving stream, 'o'opu use suction discs that are formed by their pelvic fins (the paired fins that are located on the bottom of the body) to cling onto rocks.



# **Alakoko Information**

- Alakoko is just up from Nawiliwili boat harbor on the southeast side of Kaua'i.
- This ancient, 39-acre freshwater pond was constructed by building a 4-foot wide, 5-foot tall, and 900-foot long wall of carefully placed lava rocks along the banks of the Hule'ia River.
- The fishpond is believed to be between 580 and 1,000 years old.

## **Alakoko System**

- A wooden gate in the wall allows fish from the river to enter the pond. They will eventually grow bigger while in the pond and become trapped, providing an important food source for those who are taking care of the fishpond.

## **Alakoko Threats**

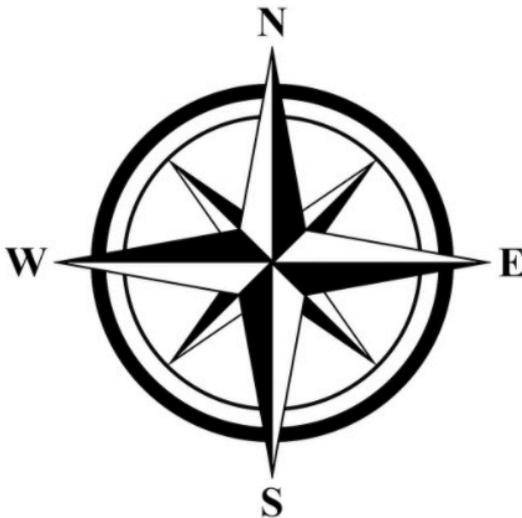
- Alakoko has not been in use as a fish pond since the death of Kaua'i's King Kaumuali'i in 1824. Sadly, it has been deteriorating. The rock wall is threatened by Mangrove Trees which now cover majority of the pond and filling the pond with silt. It is estimated that it will be completely silted up in as little as 30 years.

# Alakoko Myths

- Hawaiian legend says that the fishpond was built in on enight by magical little people called Menehune. A chief asked the menehune to build the pond and they did this by passing stones, from man to man, from a source that was 25 miles away.
- When they finished working for the day, they all washed their bloodied hands in the river causing the water to turn red. The Hawaiian word, Alakoko, means “bloody ripples” or “rainbow-hued ripples” and the fishpond became known as Alakoko.

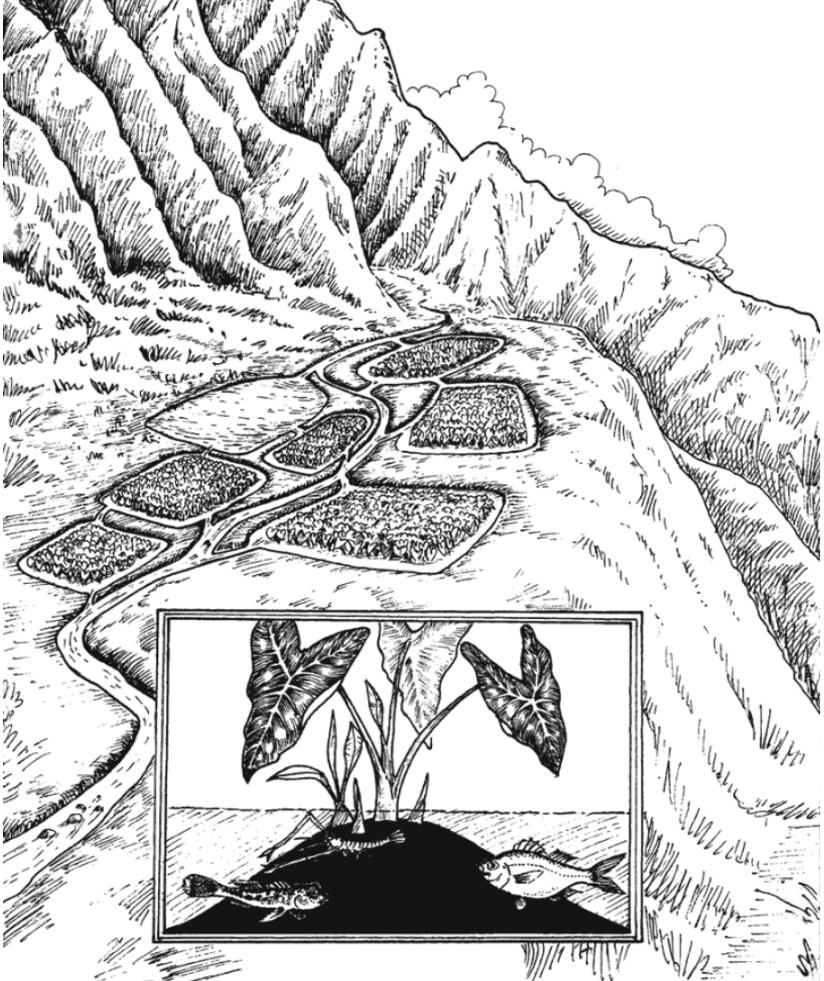
## Helpful Tips

- North, East, South, West - also remembered as Never Eat Soggy Waffles.
- East is known as the right direction on the compass rose
- West is known as the left direction on the compass rose



# Holoholo Through an Ahupua'a

One morning Kalena and her cousin Akoni decided to **holoholo** and explore an **ahupua'a** from the mountain to the sea. They began in the **ma uka** region where they first came across a **loko i'a kalo**, a pond where both fish and **kalo** are raised. Akoni looked into the loko and noticed something and asked, "Kalena, why is there **āholehole** swimming in the loko i'a kalo? I thought they lived in the ocean". Kalena laughed and explained that, "Hawaiians were very **akamai**. They knew that āholehole, **awa** and **'ama'ama** could survive in freshwater. These fish help keep the loko clean by eating all the algae". They watched the fish swim around the kalo then continued on their journey.



**TYPE IV**

Stream

Lo'i

Lo'i

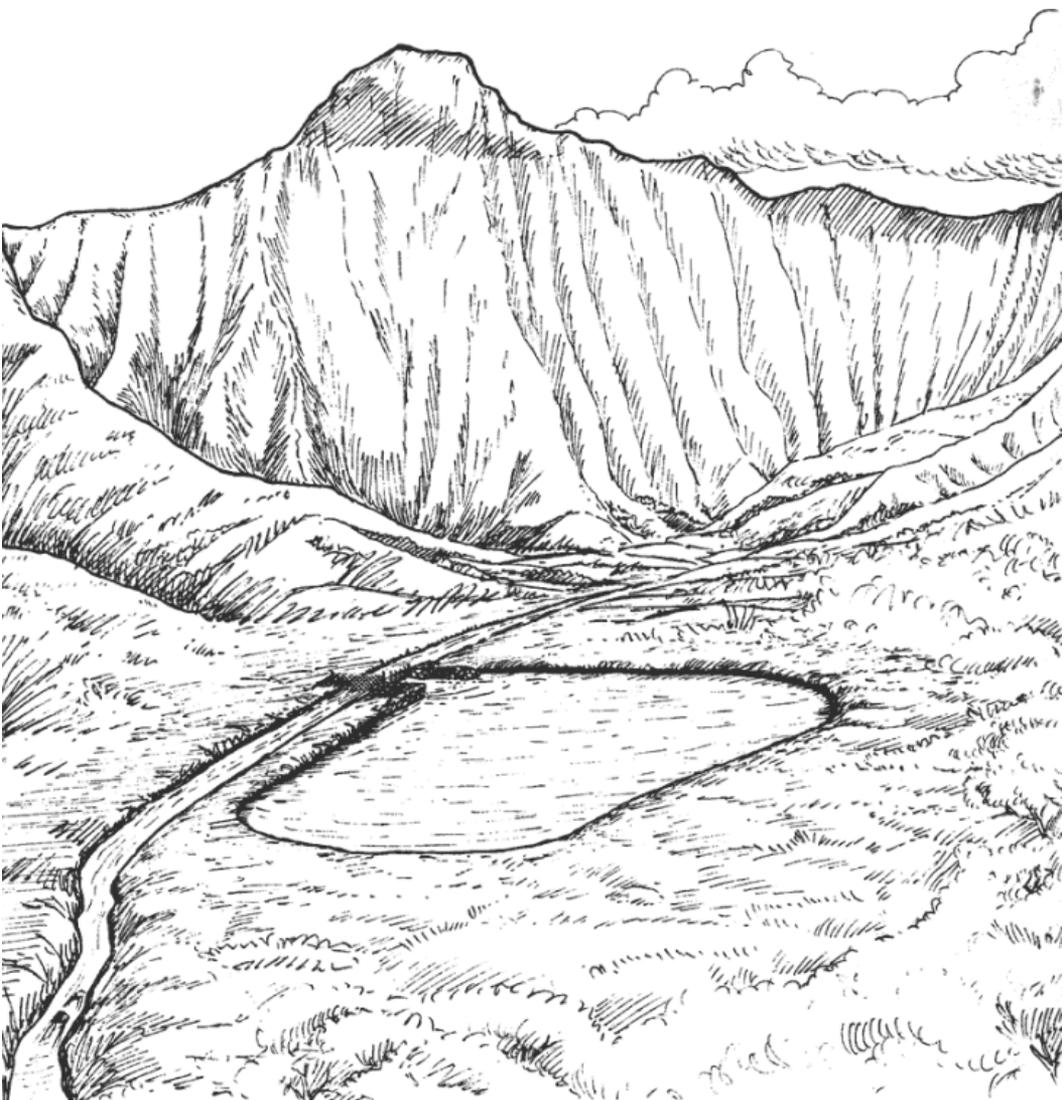
Lo'i

LOKO  
I'A KALO

Lo'i

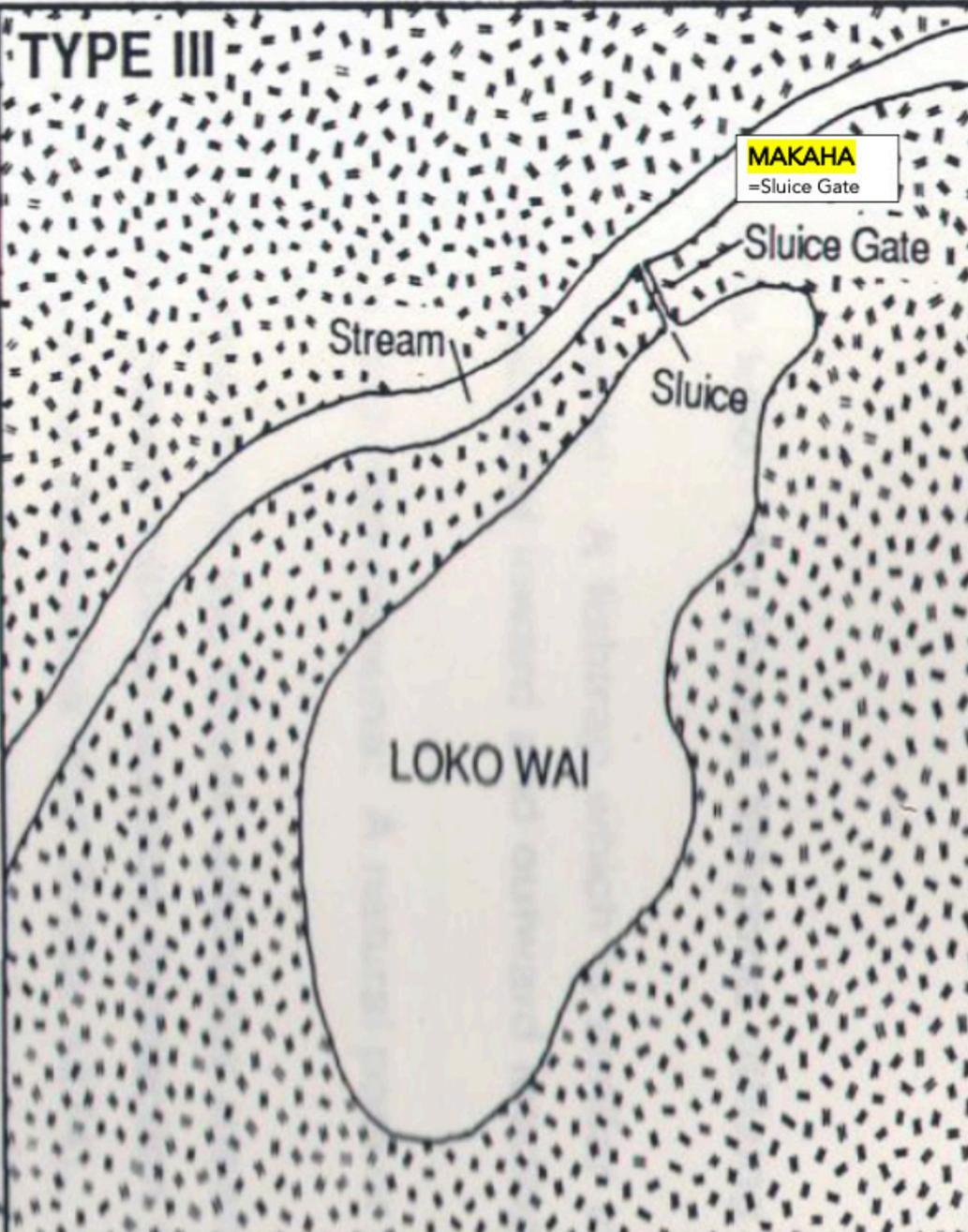
Ditch

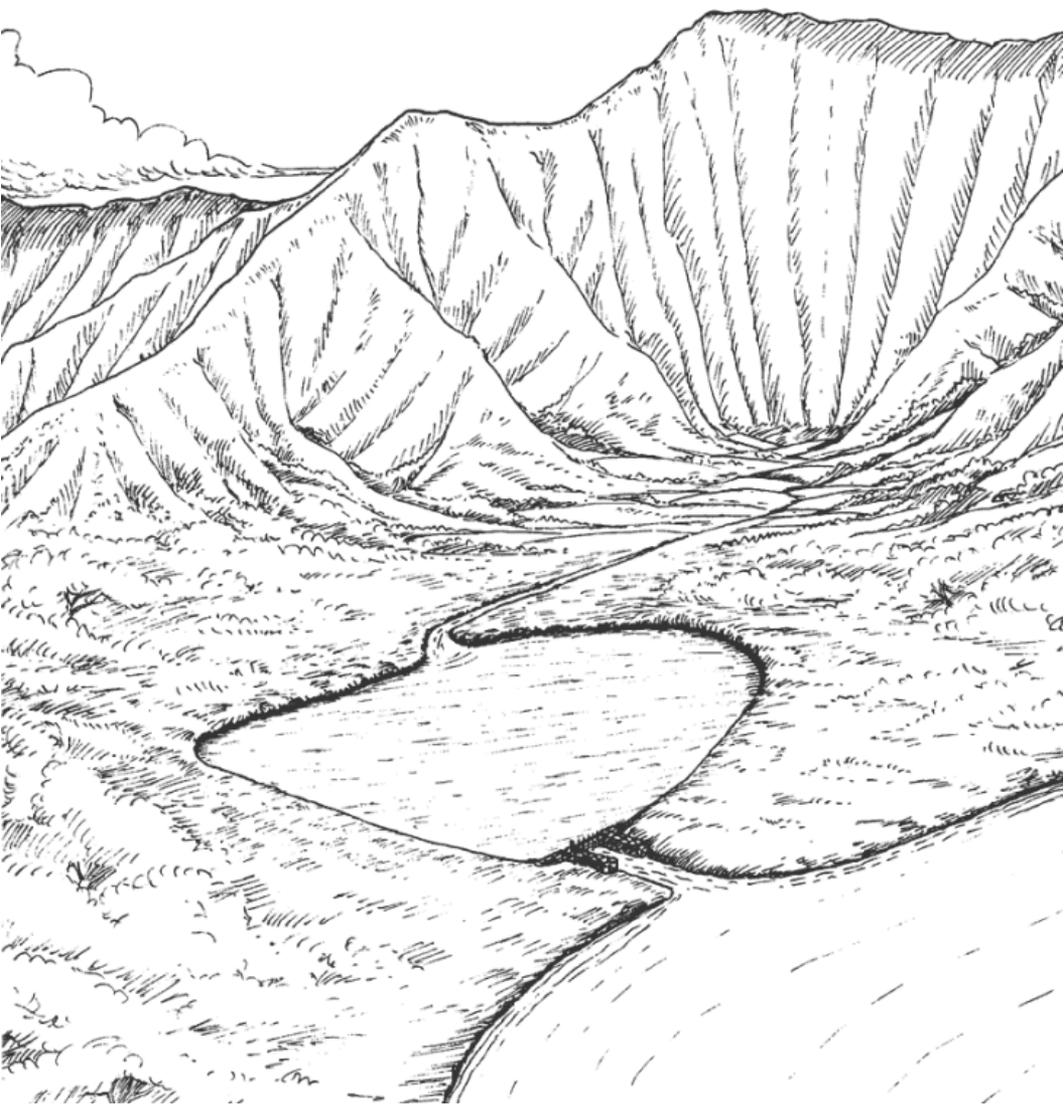
As the morning went on, the sun was rising higher and Kalena and Akoni were getting hot. They continued down the ahupua'a, Akoni saw a river nearby. They followed it until they saw an **'auwai** which channeled water into a large **loko wai**. The cousins played in the cool freshwater pond. The water was so clear that Akoni could see the small **'o'opu** and **'opae** swimming about. After cooling off, the cousins decided to **hele** on and check out the **ma kai** area of the ahupua'a.



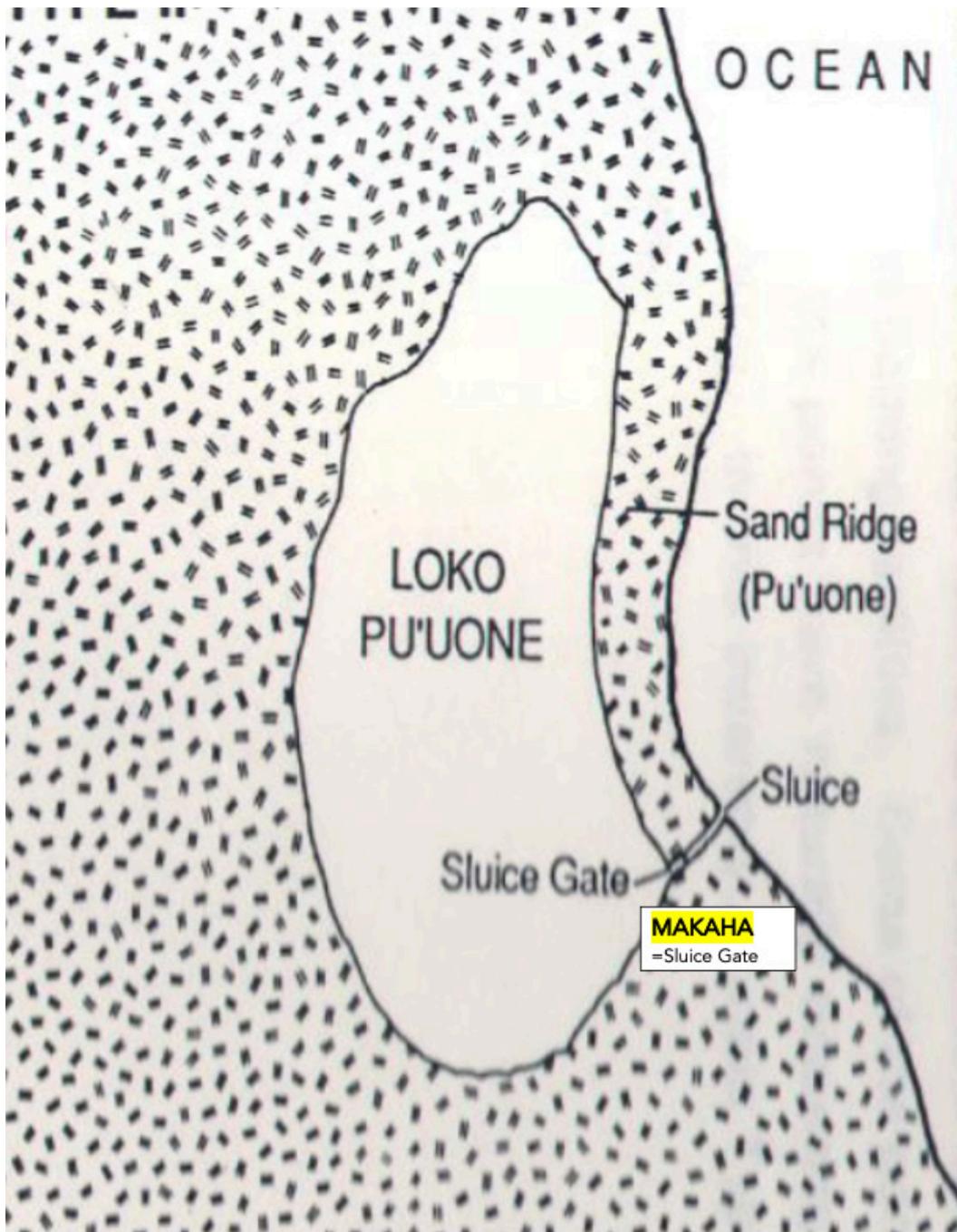
TYPE III

**MAKAHA**  
=Sluice Gate

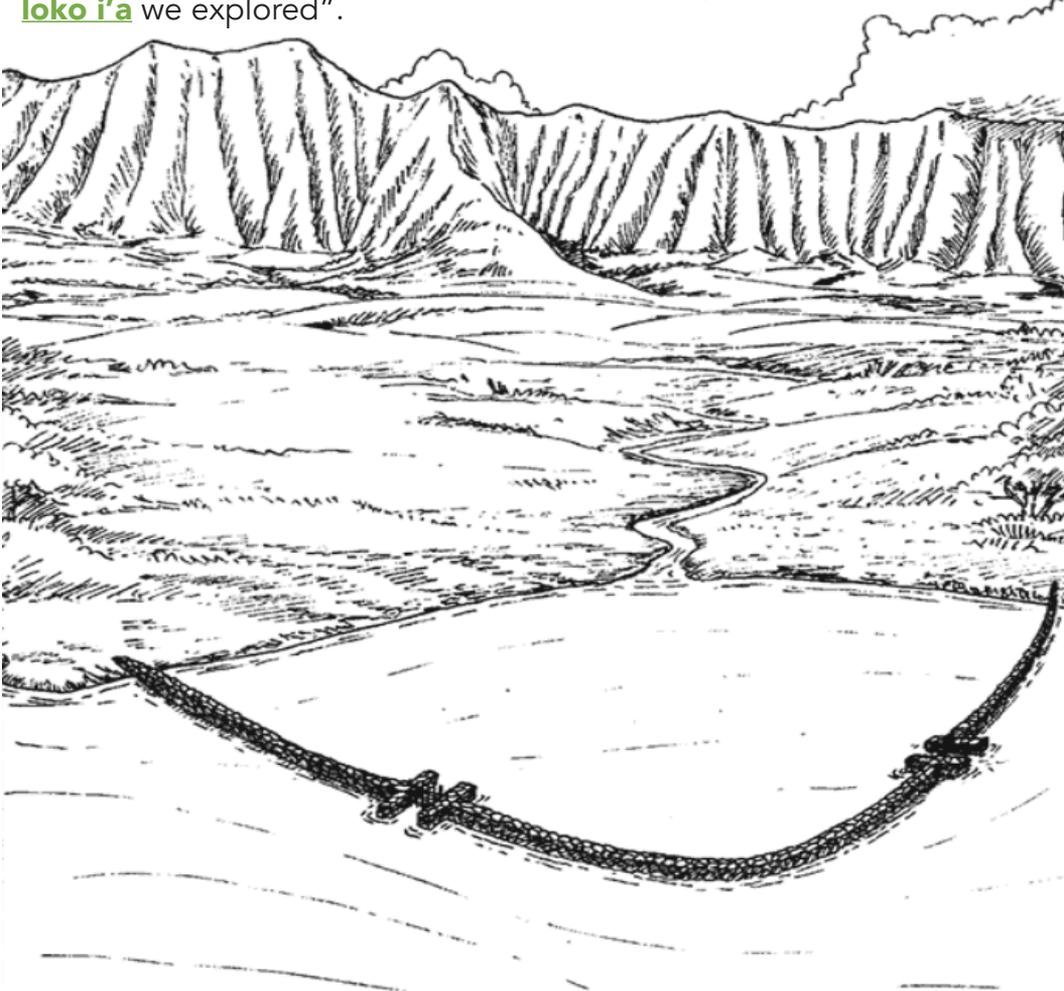




Before they knew it, they were near the ocean where they came across a **loko pu'uone**. Akoni was feeling a little thirsty and took a sip of the water. "**Auē** Kalena! This water is salty!" Kalena laughed at her curious cousin and explained, "Akoni, this loko pu'uone is near the **moana** and the salt water mixes in with the fresh water making **wai kai** or brackish water". Akoni looked with amazement and saw a bunch of different **i'a** swimming about. "Kalena, staring at all the i'a is making me hungry. Can we eat soon?" Kalena replied, "**'ae** Akoni, let's hele on to the **kai** and see what we can find there".

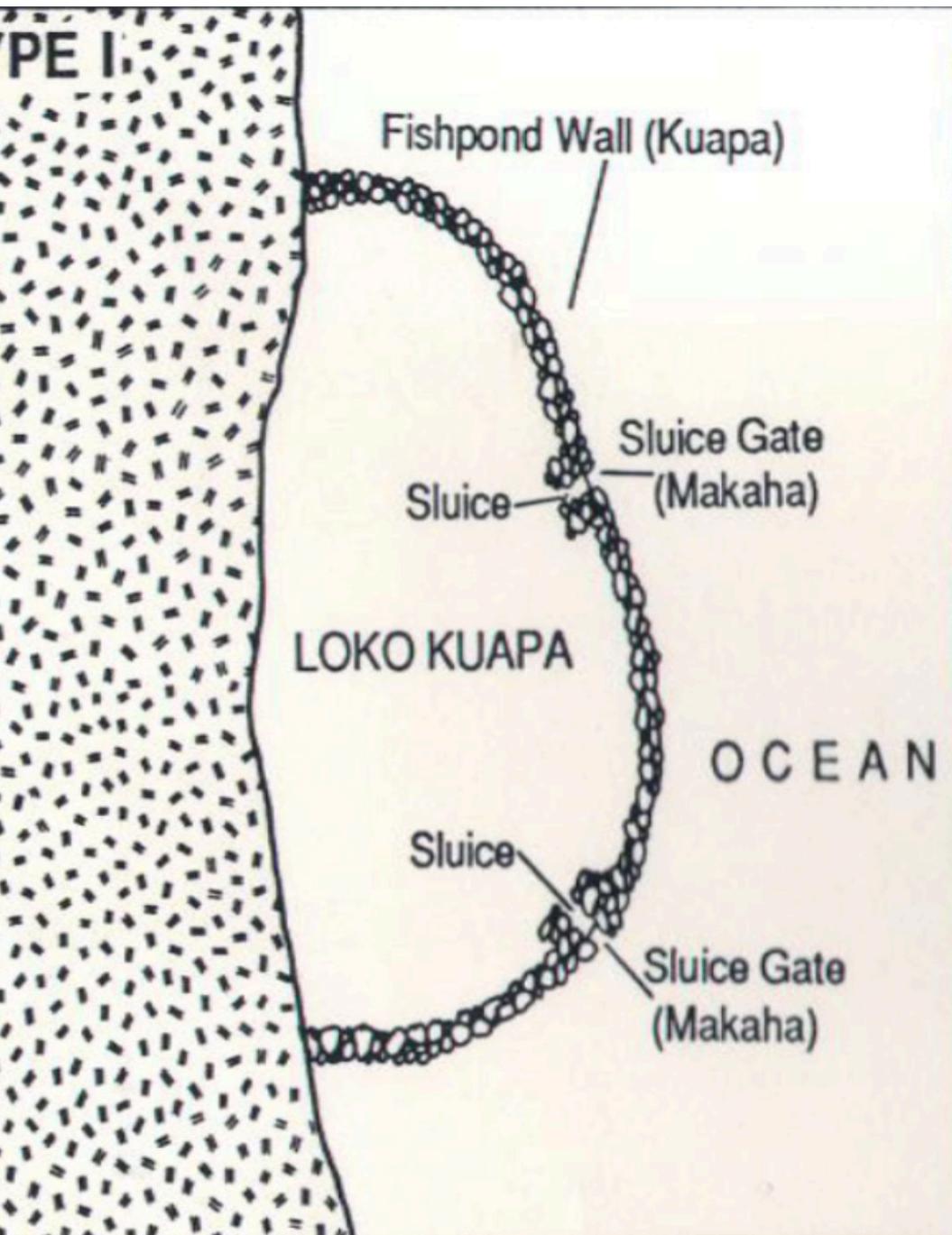


Akoni couldn't wait to eat. He could hear his **'ōpū** growling. When they arrived at the ma kai area of the ahupua'a, they found some **limu** along the shore. As Kalena picked some things for their meal, Akoni noticed a large rock wall in the ocean, "Kalena, what is that?" Kalena replied, "that is a **loko kuapā**, another type of loko that has a wall made of many **pōhaku** and **mākāhā** which keeps the fish in the pond. It also has more variety of fish than all the other **loko i'a** we explored".



Akoni couldn't wait any longer, he went to the ocean to start fishing with his **'upena** and caught three 'ama'ama. The cousins were happy to eat the limu and 'ama'ama, a delicacy of the **ali'i** and after their long journey, they felt like ali'i of the ahupua'a that they just explored.

TYPE I



# Hawaiian Glossary

- 'Auwai: ditch or channel
- Mākāhā: sluice gate
- Wai kai: brackish water

- 'Ae: yes
- Ahupua'a: traditional land division from the mountain to the sea
- Akamai: smart
- Auē: oh dear!
- Ali'i: chief
- Hele: to go
- Holoholo: to go for a walk
- 'Ōpū: stomach
- 'Upena: net

- Loko: pond
- Loko i'a: fishpond
- Loko i'a kalo: fishpond with taro
- Loko kuapā: fishpond made of a rock wall and sluice gate on the shoreline
- Loko pu'uone: fishpond separated from the ocean by a sand berm
- Loko wai: freshwater fishpond

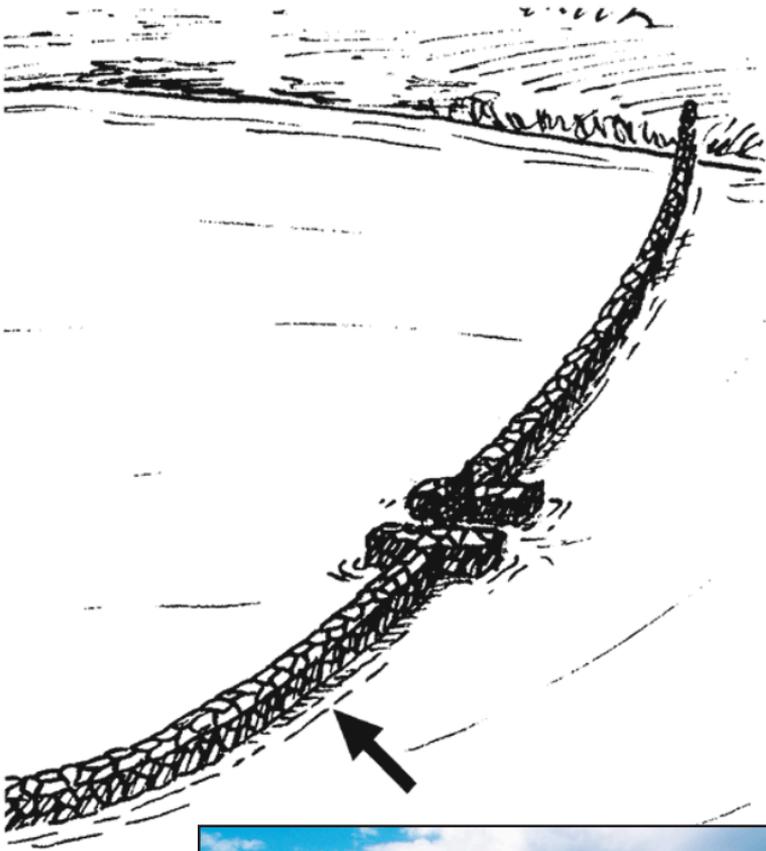
- I'a: fish
- Āholehole: Hawaiian flagtail fish
- 'Ama'ama: mullet
- Kalo: taro
- Awa: milkfish
- 'O'opu: goby fish
- 'Ōpae: shrimp
- Limu: seaweed

- Kai: sea
- Ma uka: uplands, mountain area
- Ma kai: lowlands, seaward area
- Moana: ocean
- Pohaku: rock

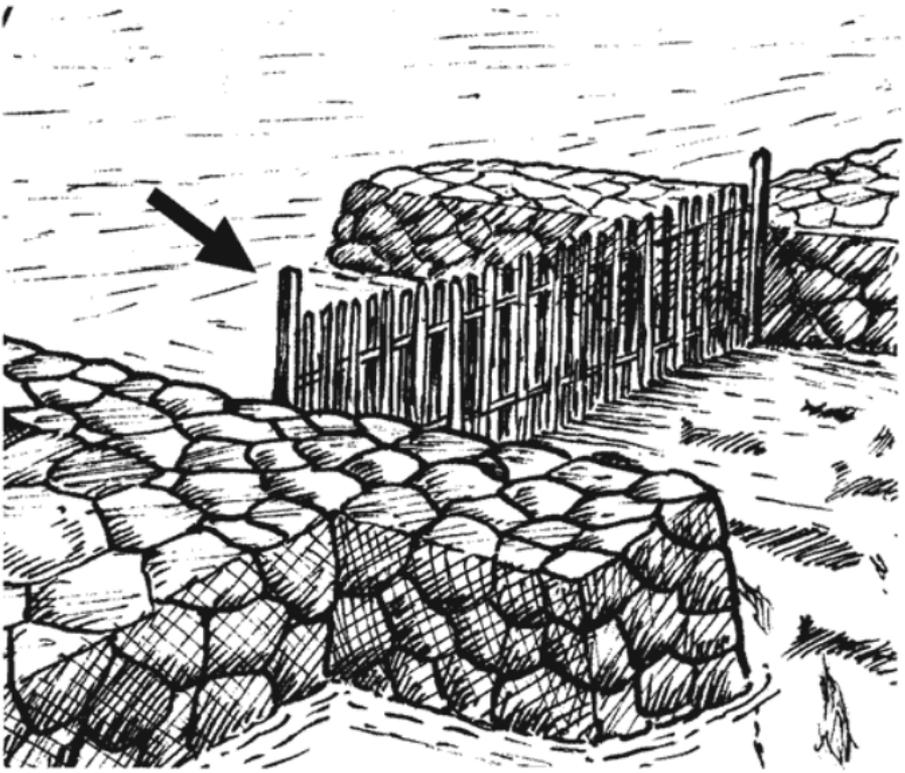
# 'Auwai



# Kuapā



# Mākāhā



# Kuapa of Alakoko, What's Under The Wall?

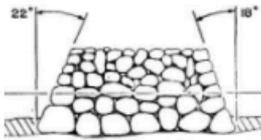
By Jan TenBruggencate



The Alakoko fishpond wall has been described in detail many times over the years, often by people who apparently never actually inspected the wall itself.

It is a unique structure among Hawaiian fishponds, an inland pond wall structure that—for much of its length—combines an earthen berm with basalt boulders armoring on its outer river-side face, but not on the inner pond-side face. Kaua'i archaeologist William "Pila" Kikuchi in 1973 said it was the first brackish-water fishpond built in the Hawaiian Islands. He said it was alternately called Alakoko, Alekoko and Pēpēawa. . It is the largest fishpond on the island of Kaua'i, according to a 2012 report prepared by Angela I. Fa'anunu, Margaret Magat, and Hallett H. Hammatt, of Cultural Surveys Hawaii.

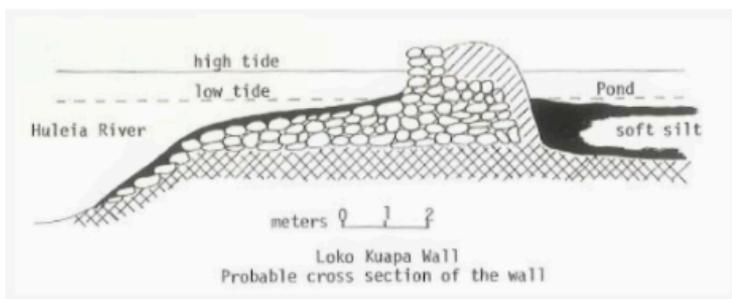
In its combined mud and rock construction it is different from most known Hawaiian coastal pond walls. Those tend to be entirely made of large basalt boulders, or more commonly, basalt on both inner and outer walls, with an interior of porous `ili`ili, or small stones and pieces of coral. Below, from Kikuchi, 1973, is a cross-section view of a standard wall construction often used on the other islands, this one the Ali`i Fishpond on Molokai

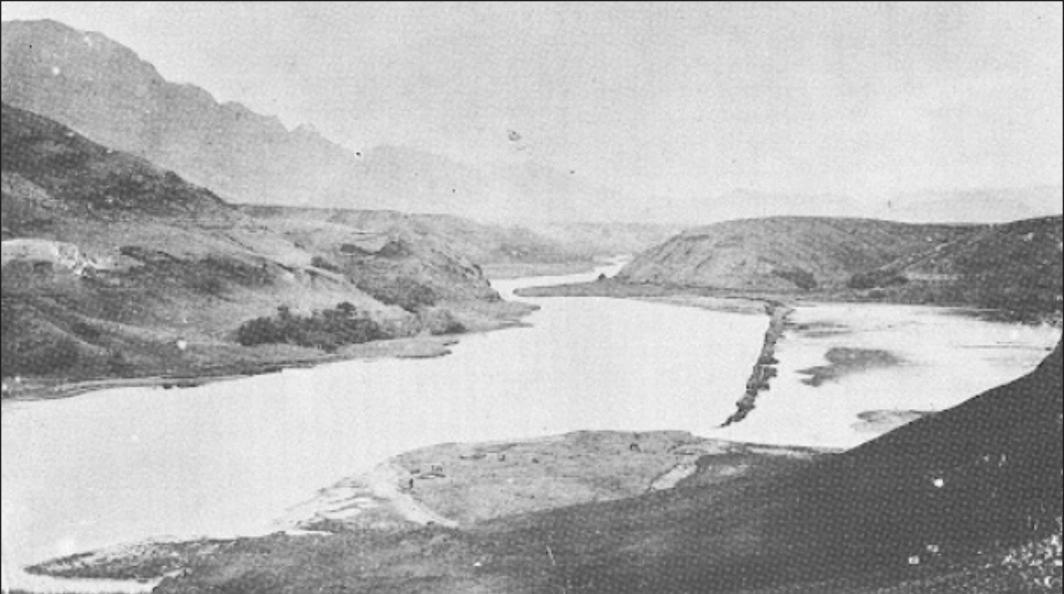


But the Alakoko wall uses a technique related to one that is common on Kaua`i, where many Hawaiian old wall structures, whether for religious structures like heiau or for border walls, are constructed of earthen berms faced on the sides and top with basalt boulders. Some say that's because there are fewer rocks and more soil on Kaua`i, which is geologically much older than the other islands.

The east-west-running Alakoko pond wall disappears into the swamps and hillside at the west and touches the surrounding ponds and lowlands to the east

Archaeologist Francis K.W. Ching in his 1973 "The Archaeology of Puna, Kaua`i," reports that the entire wall is underlain or bordered by an older basalt wall on the river floor, which is between 13 and 20 feet wide. Here is his rendering of his assumed cross-section.





Above photo: An 1890 photo attributed to Theodore P. Severin shows the wall in disrepair with its eastern end broken open.



Above photo: A photo dated at 1900 shows the breach repaired. The provenance of this photo is not known.

By 1912, the photo below shows that significant additional work had been done, adding new ponds at the eastern end of the wall. This photo by Ray Jerome Baker is courtesy of Bishop Museum.



