



Rainwater Harvesting and Catchment Water Quality

Our family's experience with catchment systems and water quality testing.

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Collection and storage of rainwater for household use and drinking is a surprisingly common necessity in Hawai'i, especially in rural areas such as the Hāmākua Coast. Nearly 60,000 people are using and drinking rainwater in Hawai'i, and most of those households are on the Big Island.

My family and most of my neighbors in mauka Pa'auilo and Kalopa have no access to county water supply lines. When we collect, store, and supply rainwater to our homes, we are solely responsible for the quality of our water and for keeping our families safe from water-borne disease pathogens and toxins.

The dilemma for households like ours on rainwater catchment systems is often, *"How safe is safe enough?"* What are the standards for drinking water quality, and how does a family supplying its own water requirements know whether their water is safe?

Recently, in connection with a county-wide catchment water quality study, "Big Island Drink Smart" (BIDS), our water was tested against the same standards that govern water quality provided to households by the county water agency and that are applied in other places in the US and the world. While our experiences, our catchment system configuration, and our potential health risks may be different from yours, if you depend on rainwater catchment, I hope that you may find our experience and results interesting and useful.

I will summarize our experiences and our testing results for this article. If you are interested in the details of our test results and other explorations into the science of water quality in studies from other countries who depend heavily on rainwater catchment, see our new PMKCA.org website page on Rainwater Catchment under "Interests".

Personal Background

Our family's drinking water supply history may be unusual compared to most people in the US. Before graduating from college, we only drank water from public water systems. But for most of the next 53 years, until just recently, we have been drinking untreated rainwater.

My first exposure to drinking rainwater came during a two-year period when my wife Karen and I were in the Peace Corps in the Marshall Islands. Our house had a thatch roof and was not suitable for collecting rainwater, but we had access to a 2,000-gallon concrete tank nearby. All our household water was carried from the tank to our house in plastic 5-gallon buckets.

My second exposure to drinking rainwater happened when Karen and I built a home on 15 acres of logged-over land on the Olympic Peninsula in Washington state. A small perennial stream ran by the house, and we tapped into the stream above our house and piped the water to a concrete storage tank that then supplied our household and drinking water. We thought the water would be “clean enough” since the watershed for the stream was an uninhabited forested hillside.

So, when we moved to Hawai'i in 1986, onto property without access to county mains, we had no qualms about using rainwater off our roof in our household, including for drinking. At our high elevation, we expected our water to be “clean enough.”

Water Quality Concerns and the “Big Island Drink Smart” Study

While we drank untreated rainwater for years, we have never been careless about its quality. Here in Hawai'i, we made sure that no rodents could ever get on the roof of our house (which collects our rainwater). We kept away trees that could shed leaves or bird feces onto the roof. We ensured that all collected water was stored in tanks with solid metal roofs, excluding any entry by rodents and birds. We raised two kids using untreated water without any problems.

After reading about the increased prevalence of rat-lungworm disease (RLD) and noticing the appearance in our neighborhood of the semi-slugs, the most dangerous vector of the worm larvae, we decided to filter our household water supply. We added 5-micron carbon block filters to our catchment tanks; these filters have been shown to block passage of the larvae.

Around this time, we heard about the Big Island Drink Smart study. One important aspect of the study was an in-depth analysis of the water quality of 20 home catchment systems from various areas on the island. We applied and were accepted to become one of the 20 homes tested.

Water samples were collected from both our catchment tank and from the faucet at our kitchen sink. Each sample was analyzed for chemical, metal, and bacterial contamination. The water would also be checked for rat lungworm larvae. A detailed description of all the components of our catchment system was also taken.

We recently received partial results of the testing, a year since our water samples were collected. Unfortunately, we still don't have the results of the tests for chemical contaminants which would show presence or absence of toxic chemicals.

The test results, while missing the toxic chemicals component, showed that the water we are using and drinking from our catchment system meets or exceeds most of the standards applied to water supplied by other managed sources.

Measurements of the presence of toxic metals (lead, for example) were all within normal ranges. Water-borne pathogens such as E. coli bacteria were close to World Health Organization guidelines when tested. Other forms of bacteria were detected in small quantities, but most forms of bacteria (like those within our own bodies) don't cause disease.

The test for rat lungworm was “equivocal”, meaning that not enough DNA material was available in the sample to produce either a positive or negative result. Since the water sample was taken before the carbon block filters were installed, I am not worried about rat lungworm in our catchment system.

	Drinking water standards				Your test results	
	MCL	MCLG	AL	SMCL	tank	sink/faucet
Copper (mg/L)	-	1.3	1.3	1	0.054	0.225
Zinc (mg/L)	-	-	-	5	0.033	0.172
Silver (mg/L)	-	-	-	0.1	ND	ND
Arsenic (mg/L)	0.01	-	-	-	0.01	0.01
Chromium (ug/L)	100	100	-	-	ND	ND
Lead (mg/L)	-	0	0.015	-	ND	ND
Aluminum (mg/L)	None	-	-	0.05-0.2	0.056	0.074
Mercury (mg/L)	0.002	0.002	-	-	0.004	0.003
Nickel (ug/L)	average range in US drinking water is 2 - 4.3 ug/L				ND	ND
Cadmium (mg/L)	0.005	-	-	-	ND	ND
Manganese(mg/L)	-	-	-	0.05	ND	0.001
Iron (mg/L)	-	-	-	0.3	0.035	0.024
Nitrate (mg/L)	10	10	-	-	0.19	
pH	typical range for drinking water 6.5 - 8.5				5.15	
Turbidity (NTU)	1*	-	-	-	0.83 – 0.88	
E. coli (MPN/100 mL)	5%**	0	-	-	0.9 – 1.0	
Total coliform	5%**	0	-	-	73.3 – 93.3	

ND	Not Detected
MCL	Maximum Contaminant Level: The highest level of a contaminant that is allowed in drinking water.
MCLG	Maximum Contaminant Level Goal: The level of the contaminant in drinking water below which there is no known or expected risk to health.
AL	Action Level: The concentration of a contaminant which if exceeded, triggers treatment or other requirements which a water system must follow.
SMCL	Secondary Maximum Contaminant Level: level is for unregulated compounds, which may not be desirable for aesthetic reasons, but are not considered to pose a health risk.
*TT	Treatment Technique. A required process intended to reduce <u>level</u> of contaminant in water. TT =% of samples < 0.3 NTU in at least 95% of measurements taken each month.
**	No more than 5.0% samples total coliform-positive (TC-positive) in a month. (For water systems that collect fewer than 40 routine samples per month, no more than one sample can be total coliform-positive per month.) Every sample that has total coliform must be analyzed for either fecal coliforms or E. coli if two consecutive TC-positive samples, and one is also positive for E.coli fecal coliforms, system has an acute MCL violation.

On Hawai'i island, in communities where county-supplied water isn't available, rainwater catchment systems can provide quality water to our households, but only if they are properly maintained and meet the local water quality standards. They also must meet the needs of all members of a household and be reevaluated over time.

In our household, we are confident about the quality of the water provided by our rainwater catchment system. We have taken care to keep the water going into the system as clean as possible and to protect the stored water from intrusions from other sources. We take prudent steps to filter out potentially dangerous pathogens. We are happy to continue drinking our catchment rainwater.