

TRANSCRIPTS OF SEPTEMBER 10, 2008

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**Presenter #1
Charles Cole, Citizen: Water
Harvesting**

MR. COLE: Thank you for allowing public input. What I'd like to do over the next 15 minutes or less is have us focus on the question of the potential for harvesting rain water and using that as part of our water needs.

MEMBER JOHN CARLSON: Could you tell us who you are and where you come -

MR. COLE: Yeah, name is Charles Cole. I'm an academic biologist, research scientist. I have a Ph.D in ecology and evolutionary biology from the U of A, 1969. From there, I went to the American Museum of Natural History in New York, worked there 34 years and I'm still, while retired, active on their scientific staff. Do a lot of work at the Southwestern Research Station in the Chiracahuas and in South America, and it was in South America that my wife and I ran into the concept of rain water harvesting.

CHAIRMAN JIM BARRY: Charles, let me interrupt. Is this fact sheet yours?

MR. COLE: Yes.

CHAIRMAN JIM BARRY: Okay.

MR. COLE: That goes with today's talk.

CHAIRMAN JIM BARRY: Is the Rain Water Harvesting Fact Sheet in front of everybody? Go ahead, Charles.

MR. COLE: All righty. So, when we -

CHAIRMAN JIM BARRY: We've already used up a minute and a half of your time, but I'm just getting - start now. The clock starts now.

MR. COLE: When we started to build our retirement home - it's up here in the Tucson Mountains, on the east slope of Tower Peak overlooking the City of Tucson, a couple of miles or so off of the end of Grant Road, and it's notorious for two things in respect to the water issues. We're off the water grid

and people have had the experience, too many of them unfortunately, of trying to drill for a well, and either getting no water, or getting water that lasted for only a year or two until they sucked it all out of the pocket they hit, and then running out of water.

So, with this information in mind, we decided we better just go independently and be on our own. We did put in a well, we didn't want to rely on it. So, we also decided to harvest the rain. Where do we keep the rain water? We keep it in a cistern that's nearly 26,000-gallon capacity. It's 10-feet deep and 20-feet across. How do we get the water into the cistern? We just capture the rain that falls on the roof. You see gutters all around the roof, and down spouts take the water into pipes in the ground and start piping it over toward the cistern. But you see here a fiberglass box which has filters in it; that's the foot rule on top for a scale. These boxes are mail-ordered from a company in Ohio, as mentioned in that article by Peter Pfeiffer in the *Fine Home Building* magazine which was our model for building this.

So, I'll pull the lid off of the filter box, and you see the first thing the water encounters in here is a eight-inch hardware cloth, and that - if it hasn't rained for three months or so, that takes out large things like beetles and twigs and leaves that may have blown up onto the roof. Now, I'll take the lid off of this filter here and you see there's a fabric filter that catches an awful lot of the sediment and then the water goes through the filter into this pipe and on its way on toward the cistern already pre-cleaned. Now, I'll take apart the rest of the filter box there and you'll see that it has a false bottom; that false bottom allows the first 35 gallons or so of the rain water that comes off the roof to just be dropped right out of the box and into a drain pipe and on off into an arroyo nearby so that the gunkiest water after the rain doesn't go into the cistern.

All right. So, we got the water into the cistern. How do we know how much water is in there? And you see this little stand pipe on the side here. You know how to check the oil in your car or truck, you have a dip stick? I just pop the lid off of this pipe here and I have an 11-foot-long dip stick, and I can measure the depth of water in the cistern up to, with accuracy, within a quarter of an inch. If you want to get real fancy and put in a digital readout of some kind, you could do that, too.

Okay. How do we get the water from the cistern into the house? Well, this is a pump house here and I'll lift this roof onto one side and we'll see that we have here a pump and we

have two filters, so water is drawn automatically on demand. We don't have to think about it, don't have to participate in it in any way, it's just like having a pressure tank on your well, if you have a well; it's done automatically that way. When the pressure's low, it turns on the pump, brings the water through these two 20-micron filters.

Now, for those of you who don't normally think in microns, put your thumb and index finger together, and then start to slowly pull 'em apart until you can see light coming through there, and that's just about a millimeter, and there a thousand microns in a millimeter, so that shows you what kind of filtration we have at this point when we take it down to any particles that are larger than 20 microns, and the water goes on into the house.

And this is the pressure tank. And behind the pressure tank - you can forget this tub, that's the brine tank that goes with it, your water softener for the well. Well water's terrible stuff. We use it as little as possible just to keep the well from becoming dysfunctional. So, this has nothing to do with our treatment system. The pressure tank is what brings the water in on demand and establishes the pressure throughout the house, so we have here a large activated charcoal filter tank that the water goes through when the water is called on into the house.

Then up behind that we have two more filters, a carbon block and a sediment block. These go down to ten microns and five microns, and an ultraviolet lightbulb that the water passes over, which blasts any biologicals that may have made it in the water up to that point, and then from here the water goes into the house, and that's the water we use for showering and flushing the toilets and everything at the kitchen sink, washing, dishwasher, clothes washer, et cetera.

But, for the water that we drink, we have a small reverse osmosis unit under the kitchen sink and, by the time the water comes through that, there's just about nothing in it that you want to worry about; it's really clean. I swear we have the best water in town, and I'll put it up against anybody's if somebody wants to do some testing. So, that's the water we drink and we cook with.

Now, in winding down here, what I'd like to do is discuss a couple of possibly bad ideas, and I say "possibly bad" because I don't - I'm not sure they've been investigated sufficiently yet to know whether they're good or bad, but I want to point out too that in building this system, we're entirely independent now. For three years we haven't had to use the well because of the rate at which the water goes in, and our rate of

use from the cistern, and we have a seven-month supply of water in the cistern right now; it's been overflowing since January on and off, and we hope the winter rains will start in three months. I also hope that the next speaker will not tell us that the rainfall is going to stop in Tucson over the next few years. But, I want to point out, too, that in doing this we did this without putting any demands on the Tucson Water's infrastructure, on the groundwater of Tucson, or on the Tucson taxpayers, and anybody can do that. New developments for whether resorts, malls, housing, single houses, multiple houses, what have you, all the developers need to do is start making calculations with their engineers and consult with hydrologists for the part of town where they are, find out what the rainfall is like where they are, put in a fudge factor for bad years of rainfall, good years of rainfall, calculate your square footage area of which you can collect water when it rains, the size of the cistern, et cetera, and then you're in business. This is what they do all over Australia. Google rain water harvesting in Australia someday, you'll be surprised at what you get. Collection surfaces can be roofs, multiple buildings, garages, carports, solar panels.

So, let's get crazy here for a minute. This is where the bad - possibly bad ideas come in. On a broader scale, wouldn't it be interesting if, perhaps, the engineers with Tucson Water and the engineers with electric utilities would get their heads together with people who know something about the aquifer - of course, Tucson Water knows that and rainfall and the possibilities for harvesting in different parts of town and think about combining projects, sort of along the line that Bob Cook was talking about the other day.

For example, we've trashed out a lot of desert in Avra Valley already, and we have all those settling tanks for the CAP water, and someday when we're getting energy independent from foreign oil, we're going to be thinking about huge acreages, square miles of solar panels somewhere. What are we going to do? Are we going to destroy that much more desert for them? Or can we put solar panels on stilts out there in Avra Valley over the water collection basins and can we hook up gutters to them and we - can we collect clean rain water that comes off the solar panels so that we set up anywhere we choose to set them up and then we can take that clean rain water, pipe it either into the aquifer or off into the City Distribution Center? We could cover the CAP canal area with solar panels and capture rain water and we could do it with all the large parking lots in town. People pay twice as much to pay to park in the covered parking section of the Tucson International Airport than they

pay for the uncovered parking. Imagine what electricity could be generated if we covered parking lots with solar panels and we put gutters on 'em and collected rainfall off of those gutters.

A lot of people ask the question: "If you collect the rainfall and utilize it and then send it on its way, aren't you having a negative impact on recharge of the aquifer?" The answer seems to be "No." There's a national average of 61% of the rainfall that rather immediately returns to the atmosphere by evapotranspiration; doesn't have any chance to get down into the aquifer anywhere, anyway; that's a national average. And the average in Tucson where it's warm and dry is even higher than that. But, by capturing that water and getting it into a water-tight container and putting it to use, you get 100% of it, you don't lose more than 60%. And look at the amount of water, the volume that comes off the Santa Catalina Mountains with the rainfall over there. Engineers must be able to come up with a way to capture that rainfall in a fairly harmless fashion and either get it into the aquifer or get it into reservoirs and get it ready for distribution to Tucson.

This may require changing some laws, but our water laws are getting old now and they were formed at a time when we didn't know as much about the aquifers and the challenge in the Tucson Basin as we know today. And we have legislators and what our laws should be doing is working for us not for the past, but for today and tomorrow. So, if there are some legal constraints to some of these thoughts, I don't think those should prevent us from going ahead and trying to come up with the best ideas for solving water problems and adding to our present distribution network capabilities if we can change laws if necessary to help us for tomorrow.

Among the very many good ideas we've heard in the course of these meetings, there's been one that I don't think is as good as the others, and that is an idea that on the one hand says we should develop a tremendous effort and extensive infrastructure development to get ourselves reliant upon foreign water while, at the same time, we're working so hard to get ourselves independent and off of the addiction to foreign oil.

In closing, I'd like to thank the members of the Committee for your long, hard efforts on this project. I can't think of anything that is more important for the future of Tucson. Thank you very much.

(Applause.)

CHAIRMAN JIM BARRY: We've got five minutes left. We'll take questions. Bonnie?

MEMBER BONNIE POULOS: Thank you very much, Mr. Cole. I don't know if you have heard about the Rain Water Harvesting

Ordinance that is in the works for the City of Tucson that may be going for vote in October that would require commercial developments to harvest a certain percentage of rain water for use in their outdoor landscaping. Do you think that's a step in the right direction, or do you think that we need to be doing other things in terms of setting some models for encouraging or mandating water harvesting?

MR. COLE: Well, it is definitely a step in the right direction but, as you say, it doesn't go far enough. Why think of water usage only for outside use when, in fact, it doesn't take much to clean it up and use it for human consumption; in fact, that water's pretty darn clean to begin with. So, I wouldn't draw the line in outdoor usage by any means, and they certainly don't in Australia and elsewhere.

By the way, the City of Santa Monica, California, just built a new library and they built it atop a 200,000-gallon cistern, so this sort of thing is getting underway. I don't know if they're drinking that water or not, but they certainly should be.

CHAIRMAN JIM BARRY: John?

MEMBER JOHN CARLSON: Yeah, many questions. You didn't talk anything about the dollar investment, both the capital and the maintenance and operation of your system, and a couple of those filters, I don't know how the hell you get them to change and that sort of thing. But, the other thing is do you use anything for your landscaping and how about the big deluges, they just roar past your house, you don't try to capture them or anything? Talking about runoff. Go ahead.

MR. COLE: We don't capture the runoff, but that could be worked with also, so that's a potential for other projects. We thought what we caught off the roof would probably be adequate for our needs.

MEMBER JOHN CARLSON: Yeah, I see that.

MR. COLE: And it's working out that way. Our builder estimates that we had to add \$35,000 to the cost of our construction loan and mortgage to pay for this. And, when you look at the locality where we are, that turns out to be a good deal. A recent estimate to pipe water up into Camino del Cerro nearby was that they were going to assess every homeowner \$50,000 to \$60,000, and they voted it down. Other people in our neighborhood whose well has given out on them pay \$7,000 a year to haul water, which means our system has paid for itself already. So, it's more expensive than an in-town water system would be, but for off-site and out-of-grid, it's economical. Maybe \$70 a month to change all the filters; they're easy to get at and easy to change. One of the expenses is the ultraviolet

lightbulb which gets changed every year, and there are a lot of filters involved. It's really difficult for me to get a precise figure on the filters because our well water goes through those filters, too, and it's awful stuff, so it requires them to be changed far more frequently than they would be if we went 100% on the - on the cistern.

MEMBER JOHN CARLSON: How's your electric bill?

MR. COLE: Electric?

MEMBER JOHN CARLSON: Yeah, how's your bill?

MR. COLE: There's just the one pump like you have on a well pump, there's nothing more involved in the electric. Oh, well, the UV light. I don't know how to dissect that out of the electric bill.

MEMBER JOHN CARLSON: Okay. But, it's minor MR. COLE: It's minor.

MEMBER JOHN CARLSON: Yeah.

MR. COLE: Yeah, yeah. No, this can be done in an economical fashion.

CHAIRMAN JIM BARRY: Okay. One more from the Committee and one from the audience. I see that gentlemen. Vince, go ahead.

VINCE VASQUEZ: I guess the question of Tucson Water. What's the average residential water bill?

CHRIS AVERY: About \$17 a month.

CHAIRMAN JIM BARRY: Okay.

VINCE VASQUEZ: How much?

CHRIS AVERY: Seventeen.

VINCE VASQUEZ: Thanks.

CHAIRMAN JIM BARRY: Okay. One from the audience. Yes, sir. Come up here and give us your name, please. You got one minute to ask a question.

JIM BRAITHWAITE: My name's Jim Braithwaite. You've done a wonderful job of taking out the particulates, which is a great first cut on pathogens and UV is very effective. Adding ozone would dramatically increase the disinfection power because the UV stimulates the ozone. Have you considered that in your planning or in your literature review?

MR. COLE: We have not.

JIM BRAITHWAITE: Okay. Thank you.

MR. COLE: I'll look into it now.

CHAIRMAN JIM BARRY: All right, Mr. Cole. Thank you. Very good presentation. Thank you very much. (Applause.)