SOAH DOCKET NO. 952-13-5210

LOST PINES GROUNDWATER CONSERVATION DISTRICT

APPLICATION OF END OP, L.P. FOR WELL REGISTRATION, OPERATING PERMITS, AND TRANSFER PERMITS	)	STATE OFFICE OF ADMINISTRATIVE HEARINGS

HEARING ON REMAND

Friday, November 7, 2014

BE IT REMEMBERED THAT at 9:00 a.m., on Friday, the 7th day of November, 2014, the above-entitled matter came on for hearing at the Bastrop County Courthouse Annex, 804 Pecan Street, Bastrop, Texas; before MICHAEL O'MALLEY, Administrative Law Judge, and the following proceedings were reported by Lou Ray, Certified Shorthand Reporter.

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* There is a duplication of the use of the number 5 between the Hearing on the Merits and the Hearing on Remand

P R O C E E D I N G S

FRIDAY, NOVEMBER 7, 2014

(9:00 a.m.)

(Exhibit Applicant End Op Nos. 51 through 108 marked)

(Exhibit GM Nos. 5 through 9 marked)

JUDGE O'MALLEY: Good morning. Today is Friday, November 7, 2014. We're in Bastrop, Texas. We're here today for the remand hearing in Docket No. 952-13-5210, Application of End Op, LP, for Well Registration, Operating Permits and Transfer Permits.

My name is Michael O'Malley. I'll be the Administrative Law Judge presiding, and I'll take appearances of the parties. Let me begin to my left here, and we'll just go down the tables.

MR. GERSHON: Yes, Mike Gershon with the law firm of Lloyd-Gosselink on behalf of Aqua Water Supply Corporation.

JUDGE O'MALLEY: Thank you.

MR. LEIN: David Lein and Robin Melvin from Graves Dougherty Hearon & Moody on behalf of the Lost Pines General Manager.

JUDGE O'MALLEY: Thank you.

MS. REESE: Stacey Reese with Stacey V. Reese Law, PLLC, and my Co-Counsel Russell Johnson of

McGinnis Lochridge --

JUDGE O'MALLEY: Thank you.

MS. REESE: -- on behalf of the applicant.

JUDGE O'MALLEY: Let's go off the record.

(Discussion off the record)

JUDGE O'MALLEY: Okay. Off the record the parties indicated that they waived opening statements. Is that correct?

MR. LEIN: That's correct.

JUDGE O'MALLEY: And we're ready to move to evidence. So we will begin with End Op and your direct case.

MS. REESE: Your Honor, End Op calls Mr. Paul Thornhill.

(Witness Thornhill sworn)

JUDGE O'MALLEY: Please be seated.

WITNESS THORNHILL: Test one, two, three.

(Laughter)

JUDGE O'MALLEY: Go ahead, Ms. Reese.

PRESENTATION ON BEHALF OF THE APPLICANT

PAUL THORNHILL,

having been first duly sworn, testified as follows:

DIRECT EXAMINATION

BY MS. REESE:

Q Mr. Thornhill, please state your full name for

the record.

A Paul D. Thornhill.

Q Do you have any relation -- are you related to Mr. Mike Thornhill of Thornhill Consulting, Inc.?

A Not at all. A mere coincidence.

Q Is a true and correct copy of your CV in Exhibit 51?

A I do not have the exhibit.

MS. REESE: One second, please. Let the record reflect that I've handed Mr. Thornhill End Op's exhibit binder with Exhibits 51 through 108 and also a copy of the GM exhibit binder.

Q (BY MS. REESE) Is this a true and correct copy of your CV, Mr. Thornhill, contained within Exhibit 51?

A Yes.

Q Tell us about your degrees and licenses?

A I received a bachelor of science in civil engineering from University of Texas at Austin in 1971, I received an MBA from the University of Texas at Austin in 1991, and I'm a registered professional engineer in the State of Texas.

Q When did you obtain your engineering license?

A About 1977.

Q If you look on Page 4 of Exhibit 51 where your CV is, does that list your employment history?

A Yes.

Q And so you've had quite a bit of experience working as an engineer throughout your career. Why don't you tell us about your experience at the Texas Water Rights Commission back in the '70s. What was the nature of your work there?

A When I first got out of school, I went to the Water Rights Commission, which is the predecessor to the current TCEQ. My main function was to perform water availability analyses for surface water supply permit applications and also to perform dam safety analyses.

Q What is Espey? After you left the Texas Water Rights Commission, you went to Espey. What is that?

A Espey, Huston & Associates was a mid-size engineering firm that eventually had nationwide offices. I worked there as an engineer then as a vice-president. When I left, basic consulting for public and private clients.

Q What was the nature of the work that you did while you were there?

A Me personally, I continued to work on various water resource projects for public and private clients. I was also a part of the management team managing the firm.

Q Did you conduct any reservoir feasibility

studies during your time there?

A Yes, I did.

Q Did that includes a project for the Guadalupe-Blanco River Authority and the Upper Guadalupe River Authority?

A Yes, those were two of our clients.

Q And they are located in what part of Texas?

A The Guadalupe River Basin, the next basin west of here. Both of them are in that basin.

Q In connection with conducting your engineering services and studies over the years, did you regularly publish reports that were relied upon by your clients and used in proceedings similar to today's?

A Yes.

Q Tell us about your experience at LCRA. After you left Espey, you went to CH2M and then -- which, by the way, what was your work like at CH2M? Similar to the work at Espey?

A Yes, CH2M Hill was a much larger national and now international consulting firm. I was there for about nine years as I recall, again performing basic water types of projects myself, as well as participating in the management of the firm. I was a vice-president there, too.

Q And then you moved on to LCRA, the Lower

Colorado River Authority. Could you tell us what LCRA is or does?

A LCRA is an entity created by the state Legislature back in the '30s. They essentially manage all the Highland Lakes, including the dam that creates Lake Austin, which they don't own but they operate for the City of Austin. They also generate electricity, perform various transmission services for electric transmission, manage parks, do water quality sorts of things.

Q And it looks like you moved up the ranks at LCRA. Tell us briefly the positions that you held there and the nature of your work there.

A I was -- when I first came in, I was chief engineer of what was called WaterCo at the time, which was the entire water side of LCRA. I was promoted to the manager of WaterCo, about two years later is my recollection, which was essentially the responsibility for all the staff and all the facilities of all the Highland Lakes, all the hydroelectric generation, all the irrigation districts, all the water and wastewater utilities. I'm sure I left something out, but it was basically the entire water side of LCRA.

Q And who was your boss when you were at LCRA?

A I reported directly to Mr. Beal, Joe Beal, who

is sitting here.

Q When you were working at LCRA, did you -- did the nature of your work include experience -- any experience in rates or establishing rates?

A Yes.

Q What about risk management?

A Yes. The final couple of years I was the chief risk officer for all of LCRA, including the electrical generation and transmission.

Q And what does that mean, "risk officer"?

A Essentially, the way I interpreted it and the function I performed, was to look at all the activities of the organization, cause there to be an evaluation of the risks that those activities faced, and then to develop or implement plans to ameliorate those risks as best we could, everything from rate risk to chance of a power plant catching on fire.

Q During your time at LCRA, did you negotiate water supply contracts and particularly a contract with SAWS?

A Yes.

Q And tell us what SAWS is.

A SAWS is the -- San Antonio Water System is the acronym. They essentially provide all of the water and wastewater services or -- I assume it's all. It might

be just predominant share of water and wastewater services -- to San Antonio in the Bexar County area.

Q Did you participate in the negotiation of any groundwater rights during your time at LCRA?

A Yes, we purchased a couple of very significant groundwater rights.

Q Did you -- were you involved in negotiating the details --

A Excuse me. Excuse me. You said "groundwater." I'm sorry. I was thinking of surface water. I did participate in the purchase of a groundwater option to drill 20 wells on the property of Pierce Ranch. That was -- as far as I know, that was the only groundwater purchase that I was directly involved in.

Q Thank you for clarifying for the record.

Did you -- were you involved in negotiating any deals with the City of Austin for a long-term water supply?

A Yes, I was.

Q So you retired from LCRA back in 2008. Correct?

A Yes, August of 2008.

Q And what have you been doing since you -- since you retired?

A Well, besides working in my garden, I have

created an engineering company called Paul Thornhill Engineering, and I use that as the vehicle to perform various consulting assignments. When people approach me and ask me to be involved in projects, I evaluate them and decide whether I will. So I've been working part time basically since 2008.

Q Have you ever given expert testimony?

A Yes, I have.

Q And in what types of proceedings and what was the nature of your testimony?

A When I was at the Water Rights Commission is the first time I ever gave testimony. I probably testified in -- I don't know -- 25 or 30. I guess they were similar to what we're doing today, but they were directly in front of the Commission in those days. They were -- when someone asked for a permit, there would be a hearing in front of the three Commissioners. I testified on behalf of the staff, the Executive Director.

When I left there and began consulting, I was -- as a result of the studies I was doing, I was asked to sometimes defend those studies in an administrative proceeding or a court. So I testified in federal court a couple of times. I think it's state district court in Kerrville. I'm not sure of the title

of that court, and I would guess probably -- I don't know -- a half dozen times.

Q Have you testified before the Texas Legislature?

A Yes, in the form of either the Senate or House Natural Resources Committee. I can't remember which. Maybe both. I testified regarding aquifer storage and recovery as a technology that Texas should consider.

Q And have you been an expert -- admitted as an expert in a court of law on surface water?

A Yes.

Q Have you been admitted as an expert in a court of law on groundwater?

A Yes.

Q Given your education, your prior employment, particularly at LCRA, and the Texas Water Rights Commission and your recent resulting work, do you consider yourself to be an expert in the Texas water resources industry?

A Yes, I do.

Q Do you consider yourself to be an expert in long- and short-term water supply planning, evaluations and permitting?

A Yes.

Q Do you consider yourself to be an expert in

water feasibility studies, water supplies and project management?

A Yes.

Q What about water supply contract negotiations?

A Also.

Q Do you consider yourself to be an expert in the cost of various regional water supplies?

A Yes.

Q Is the expertise in this industry the reason you were retained as an outside consultant in connection with the End Op project?

A I believe so.

Q And tell us when you were engaged on the End Op project.

A It's my recollection that last fall, about a year ago, maybe 13 or 14 months ago, I was approached by some folks with an entity called Cap Rock to perform due diligence as they considered participating in some form in the End Op project. That was it.

Q Was it your understanding that the Cap Rock group was interested in becoming an investor in the End Op project?

A Not until much later, and I've never been asked to be an investor. They asked me would I be interested in being a participant once they had make the decision

to go ahead and invest in the project.

Q I asked you a slightly different question, Mr. Thornhill. I was -- I was asking you what was the purpose of Cap Rock engaging you? Was it to evaluate the feasibility of the project because they were considering becoming an investor in End Op?

A I'm sorry. Yes, they -- that was my understanding. I was working specifically for -- it was called Cap Rock. I understand that to be a group of investors. I don't know much about the details of what they are.

Q Okay. So you said that you conducted some due diligence. Did that work involve identifying potential buyers of the End Op water?

A Yes.

Q Did that work involve analyses of how much it would cost End Op to provide delivered water making certain assumptions?

A I'm sorry, could you repeat the question?

Q Sure. Did that work involve evaluating the cost for End Op to deliver water?

A Yes.

Q Did your work involve the analysis of the availability of the groundwater in the Simsboro?

A Yes.

Q And why did you study that?

A In order to understand was there sufficient water to supply the 46,000 acre-feet that's subject to this hearing.

Q And what did you conclude when you evaluated the availability of the groundwater in the Simsboro?

A That there is a lot of water under Lee and Bastrop counties within this district and much more than what we were requesting or the sum of all the other requests that have been received.

Q How were you compensated during this due diligence period when Cap Rock engaged you?

A In the due diligence period, I had an arrangement where I was paid $250 plus expenses for my activities.

Q And ultimately did Cap Rock decide to invest in the End Op project?

A Yes.

Q And what was your role in the project once they became an investor?

A They asked me to continue to consult with them, to continue to be a part of the project, and also began asking me would I be interested in participating in the project.

Q Okay. How have you been compensated and by

whom since you completed your due diligence?

A Beginning in about March of this year, the checks that I received in payment have been from an entity called End Op, so I'm assuming I'm being paid by End Op.

Q And you had testified earlier that March was around the period of time in which you completed your due diligence?

A Yes. I mean, I think that's the time that the actual purchase by Cap Rock into the End Op project occurred, and after that we moved forward as End Op, not Cap Rock.

Q And what was the purpose of you continuing on after you completed the due diligence?

A In essence the -- I would summarize it as a continuing need to perform evaluations, to answer questions, to basically point it towards being able to market this water if permits were achieved.

Q And are you continuing to be compensated at $250 an hour by End Op?

A Yes.

Q Have you received any other compensation in connection with your outside consulting role?

A No.

Q Have you been offered any other compensation in

connection with your outside consulting role?

A Yes.

Q And what is that?

A About June, May or June is my recollection, the partners of -- or what I call the partners, the group of individuals that I'm working with, asked if I would be interested in a participatory share of 2 percent of some part of the project. I'm not sure exactly what the details would be. We've talked about it back and forth. But as we sit here today, that has not been consummated. I've not agreed to it. And, frankly, I'm not sure what the offer is.

Q All right. Are you taking on any other role other than as an outside consultant for End Op?

A Yes.

Q And what is that role?

A They've asked me to fill the position of chief executive officer for a -- doing business as business extension of End Op, which is called Recharge, and I've agreed to that. So in addition to my engineering firm today, I am the CEO of an organization called Recharge.

Q And approximately when did you become the CEO of Recharge?

A About a month ago.

Q And how are you being compensated in your role

as CEO?

A No different. There is no special compensation. I continue to bill the hourly rate that I previously had, and we're -- I assume that we'll continue to talk about the 2 percent participation, and that's all as far as I know.

Q Okay. Is the offer to have an interest in the project, other than as an outside consultant on an hourly basis or in your role as CEO of Recharge, contingent upon your testimony here today?

A No.

Q So in other words, End Op didn't say they would revoke this offer of interest if you didn't testify in a certain manner today?

A Correct; they did not.

Q Is this expertise that you've testified to, is this the expertise that you rely on to provide your testimony here today?

A Yes.

Q And the subject matters and the specifics of your testimony, are they outlined in Exhibit 51, specifically Paragraphs 2 and 3 under the designation of experts of Exhibit 51?

A Yes.

Q Okay. So these are the -- the topics that you

intend to give opinions on today. Correct?

A Yes.

MS. REESE: Your Honor, End Op tenders Mr. Thornhill as an expert on the matters identified in Paragraphs 2 and 3 on Exhibit 51.

JUDGE O'MALLEY: Are there any objections to Mr. Thornhill being designated as an expert?

MR. LEIN: No, Your Honor.

JUDGE O'MALLEY: Okay. Mr. Thornhill will be so designated.

Q (BY MS. REESE) Did you prepare a report in connection with your testimony today?

A No, I did not.

Q Why not?

A There simply wasn't time.

Q Did you prepare a written report in connection with the due diligence that you conducted on the End Op project?

A No, I did not.

Q I think it would be helpful for the court, because you didn't provide a written report, for us to do a quick overview of the opinions that you intend to provide today. Is that okay with you?

A Yes.

Q As you understand it, Mr. Thornhill, what are

the issues on remand in this proceeding?

A The -- I forget the exact wording, but it's basically the need for additional water over a 5-year period and a 30-year period.

Q And actually it's --

A I guess the wording is beneficial use is what I'm remembering, the beneficial use for water over the 5-year period and the 30-year period.

Q Does the amount of groundwater put to a beneficial use during the 5- and 30-year period sound familiar to you --

A Yes.

Q -- in terms of what you were asked to evaluate?

A Yes. I read the language, but I just -- I'm sitting here and I just can't remember exactly what it said.

Q No problem.

Tell us what "beneficial use" means to you.

A To me, you know, "beneficial use" is a definition that's contained in the Water Code that says if a use falls within the categories that the Water Code describes, municipal, irrigation, industrial, mining and some others, that if the use falls within those categories, it is deemed to be beneficial use.

Q Is it your opinion that End Op intends to put the water to a beneficial use?

A Yes.

Q And what use is that?

A Municipal.

Q A public water supply in other words?

A Public water supplies are usually municipal. They might have some power or something, but usually that's municipal, yes.

Q What is your understanding, based upon the remand questions, of exactly what it is that you were directed to do? Is it to determine whether or not the water will be put to a beneficial use, or is it to determine a specific amount that will be put towards -- to a beneficial use during a specific time period?

A What I was asked to do is do both, essentially look at the remand question, as I understood it, and then also to develop the information about the actual need for water during those time periods.

Q Is the need to demonstrate a particular amount of water in a 5- or 30-year period a requirement under Texas law to obtain a permit as far as you know?

A No.

Q Nonetheless, how did you go about determining an amount in a 5- and 30-year period?

A I went to the data that's publicly available on the Water Development Board website regarding regional planning, and I downloaded a bunch of data and information and basically did some calculations using that data.

Q Did you analyze the population -- projected population growth?

A Yes, I did.

Q Did you analyze projected water demand growth --

A Yes.

Q -- based upon population?

A Yes, I did.

Q Did you review anything else or analyze any other information?

A Regarding the specific demands, that was the source of my data. I also looked at the risks associated with continuing reliance on the existing water supplies. I also looked at costs, would our ability to deliver water be cost effective compared to what my understanding of the potential customers' current costs were and then some other things along those lines.

Q You made a distinction between the term "demand" and what you were asked to do. Could you

explain why you were careful about using the word "demand"? What do you mean by that?

A "Demand" is simply the term of art that I use to describe a customer or a user's water use. It's the full amount of their use, it's the growth in their use. It's all these issues associated with their use. So when I use the word "demand," I'm not trying to distinguish between the remand language. I believe they're essentially the same concept.

Q Did you form an opinion in conducting your analysis on what the appropriate horizon for planning for water is?

A Well, I think I had an opinion before this if that's, yeah, what you're asking. The -- to me, the appropriate quote-unquote horizon is at least 30 or 40 years, better 50 years, which is what the state has adopted, 50 to 55 years, that's what they've adopted in the regional planning. But when I was at LCRA, I recommended to the General Manager and the Board and we unofficially adopted a 100-year planning horizon. We were entering into contacts with customers, such as the City of Austin, that would last a hundred years, and so I thought the only responsible way to plan for that kind of need was to also plan our water supplies for a hundred years. So my opinion, a hundred years is the

appropriate level, but I can understand why shorter terms might be used by others.

Q Shorter terms such as 50 --

A No. In a municipal use, I think 30 years is the absolute minimum for long-term planning, essentially coinciding with the duration of the debt that might be taken out in order to pay for a project.

Q Do you have an opinion on the population growth and the water demand growth in Travis and Williamson Counties?

A Yes.

Q And what is that?

A Based on the information that has been put out over the last 15 years or so by the Water Development Board, I see continuous projections of growth. And every time they update them, they continue to say it's still going to grow beyond the current planning horizon in terms of both population and the conversion of that population into water demands. Both will continue to grow at a fairly rapid rate.

Q Do you have an opinion about how End Op's project could fulfill that project growth in demand?

A Yes.

Q What is your opinion?

A I believe that a project like ours or our

project specifically where we're -- if we obtain the permits, we would have 46,000 acre-feet, would be considered as a very attractive alternative or replacement for current water supplies amongst many potential customers in Travis and Williamson County. And I think fundamentally the water would be provided in such a manner that it would be -- those entities would want to use all of that water from day one if they decided to go into this kind of project.

Q In connection with analyzing the population in demand growth in projected water demand, have you identified any potential customers or users for the End Op project?

A Yes.

Q And who are those?

A After looking at the information that I looked at, I identified four municipal users, City of Austin, Round Rock, Cedar Park and Leander, as well as LCRA as being potential customers.

Q And would LCRA actually use the water themselves?

A If LCRA were the customer, they would not use the water themselves. Their role is to be a wholesaler and intermediary between the water supplies and the customers. So, no, they would not. They have a

de minimis amount of use at various facilities, like watering the grass at the general operation complex. But generally what they do is they sell their water on to the retail user.

The four entities that I mentioned, the four cities, are all retail customers or all -- excuse me -- firm water customers of LCRA, so that the chain would be the water could either flow directly to those customers or flow through LCRA to them. Both are valid.

Q And the potential customers that you mentioned, those four municipalities, what is their current source of water supply? It's being provided by LCRA in part. Could you tell us more specifically about that?

A In Austin's case, essentially 100 percent of Austin's water comes from the Colorado River. Legally part of it comes under water rights that the City owns apart from LCRA, but it's all from the same physical source, the Colorado River and the Highland Lakes.

In the case of Round Rock, Cedar Park and Leander, they all have contracts with LCRA, but they have other sources, for example, with Brazos River Authority, and some of them even have a few wells of their own.

Q In connection with the work that you performed for your testimony today, have you opined on the risks

or uncertainties associated with relying on surface water supplies?

A Yes.

Q And what opinions have you formed?

A My opinion is that we are either right on the cusp of or are currently in a Drought Worse than the Drought of Record. And that based on that, the reliability of the firm yield supply from the Highland Lakes is going to be reduced, and that provides a risk to customers or to LCRA regarding how much water they can assume will continue to be available on a firm yield basis from that supply. The ongoing drought basically has created an issue that I think will call that whole question very, very soon.

Q So what would a user of primarily surface water do when they're faced with such an ongoing drought as, in your opinion, we're experiencing?

A I think they would do what they've done historically and what I've seen them do. First they would go to their supplier, which up until a few years ago was me. They would say, "What are you going to do to solve this problem if the firm yield of your lakes is less than what you thought? What projects would you bring to bear that would supplement your water supply such that I can continue to receive the water from you

that I have contracted for, and how much are those projects going to cost me?"

I would also, if I were that customer, independently go evaluate could I develop additional sources or supplies on my own that would be either complimentary to or more cost effective or both to my continued use of the water from LCRA.

Q And what kinds of alternative or supplemental supplies would be reviewed or considered?

A Well, clearly the subject of today's proceeding, additional groundwater or adding groundwater as a source if you didn't already have it, but also you might look at other off-channel reservoirs commonly before you get to the step of trying to go to a new physical project. You would also look at conservation and reuse and those various strategies.

Q Is groundwater -- is groundwater more resistent to drought than surface water?

A I believe it is.

Q How so?

A The fundamental difference is surface water stored in a reservoir or flowing down a river is subject to evaporation, so you lose quite a bit of that water to evaporation. Water stored underground is essentially zero loss. And so there's some other minor issues, but

fundamentally it's the difference in evaporation between the two sources.

Q Have you opined on the current cost of water for these potential customers that you've identified?

A Yes.

Q Have you opined on the costs for End Op to deliver water to these particular customers?

A Yes.

Q And what did you conclude?

A I believe we can deliver water to Cedar Park, Leander, Round Rock and Austin and LCRA at rates that will be attractive to them when I compare what they are currently spending to develop their current water supplies.

Q Have you opined on the prerequisites necessary before a potential buyer will enter into a long-term water supply agreement?

A Yes.

Q And what do you believe those prerequisites to be?

A The shorthand that I have used, and I'll share it here, is if people came to me at LCRA and asked me would I be interested in purchasing water. I would ask three fundamental questions. I would say, "Do you have the leases? Do you have the permission and legal right

from the ground" -- excuse me -- "from the landowners who actually own that water to come to me and offer me that right? Show me the leases."

The second question I would ask is, "Do you have the permits, or what is the status of your permitting with the groundwater district or districts that would control access to that water?" And third, "Can you tell me the price of your water? How much is it going to cost?" And those three fundamental questions, that's essentially what the dialogue boils down to.

Q In connection with your due diligence, did you evaluate those factors that you consider prerequisites to enter into a long-term water supply agreement?

A Yes.

Q And what did you conclude when you analyzed the groundwater lease rights?

A At the time I first began the due diligence, the agreement between End Op and the landowners was in the form of an option. It's my understanding that there's now been a conversion to the full lease status for 42 of the 46 landowners, and we're still working on the last four. So the leases are in place for 42 of the 46. Options are in place for the other four.

Q And is it your understanding that before we got

to this proceeding today that the district had deemed End Op's applications administratively complete?

A Yes.

Q And in connection with doing so, is that an analysis of whether or not End Op has the right to construct wells in connection with the project?

A You mean right from the district or --

Q Rights themselves from the private landowners?

A Oh, yes. Yes, they have agreements in place that allow them to put wells on these landowners' property.

Q When did you first learn about the End Op project? Was it when you were asked to conduct due diligence on behalf of Cap Rock?

A No. I -- I believe -- and I would say that Mr. Limmer came to see me at LCRA years ago before I left in the early stages of this project and described what he was doing, and would I at LCRA be interested in this water. And I asked him the three questions that I just elaborated on, "Do you have leases? Do you have permits? What's the cost?" He couldn't provide that information to me, and I think that was essentially the first time that I heard of this project.

Q For those who don't know, tell us who Mr. Limmer is.

A Frankie Limmer is -- my understanding is the -- well, he's one of the former partners. I don't know who all the partners are of End Op, but he was to me the spokesperson for End Op at the time I met with him.

Q Do you have an opinion on the most efficient way to contract for water supplies?

A Yes.

Q And what is that opinion?

A Well, I think the most efficient way is to what I call baseload, which is that you would purchase the full amount, some amount that would last a very long period of time. You would not look at it piecemeal. And if you could avoid it, you would, for example in our case, lease the water, purchase the water, all 46,000 acre-feet, for a period of 30 or 40 years. That way you can plan for, and the development costs of delivering and treating that water are the most economical.

Q Is that consistent with the need to obtain long-term financing to complete such a project or construct such a project?

A Yes, that's part of it, and that's usually the primary driver in costs. You at least want to enter into contracts with folks such that your revenue stream matches your debt service stream so that you can assure the bondholders that you will be able to pay them.

That's 30 or 40 years usually, depending on where and how you sell the bonds. Many contracts, though, go much longer than that, like the contact we did with the City of Austin when I was at LCRA, 100 years.

Q What impact, if any, does the five-year permit term have on a project like End Op's and the ability to sell 46,000 acre-feet?

A If I were a customer of this water and what I've been working on trying to provide an answer for is the question that if you're saddled with a five-year permit term, what does that mean in terms of your ability to renew that permit and what are the risks that that brings to me? Fundamentally I want to see, as a customer, long-term permitting in place, 30 years or more. And so I would have a lot of questions. If -- well, I would have a lot of questions about it as a customer.

Q Have you studied the renewal permitting process in connection with End Op's permits at Lost -- pending at Lost Pines?

A I have read the rules. I've never been involved in a permit renewal with them.

Q And what is your understanding of how the renewal works?

A I'm not sure. I think that what would happen

is if the permit was fixing to expire, that there would be a reapplication, and you'd have to go through this whole process again.

Q In contracting -- in contract negotiations, you said you would have questions as a buyer. Do you think that that would deter a buyer from entering into a contract for the full 46,000 acre-feet?

A Yes. If the five-year term carried with it a much smaller amount, based on what I understand the remand question to be, then, yes, as a customer I'm going to say, "Wait a minute. You only got a permit for X. I want to buy Y. How can you deliver Y to me," you know, the larger volume. You asked for 46 and you only got whatever it was. So it's -- it's very important. Again, because as a customer, I'm going to be looking at my long-term costs for my total system, not just the next five years.

Q Are you familiar that End Op has committed to pay for the potential financial impacts on existing users in the Simsboro?

A Yes.

Q And in the projections of costs that you have prepared today, is the mitigation costs embedded within those costs?

A Yes.

Q From a buyer's perspective, is that a good or a bad thing?

A Pretty much it's a good thing.

Q Why so?

A Because it removes one of the issues that would -- I'm sure would come up in discussions, and that is there might be objections, there might be impacts, what have you done to mitigate those impacts. As far as I know, the agreement that we have is the only such arrangement that I'm aware of in a proceeding like this.

Q Have you studied the details of SAWS -- you mentioned earlier, the San Antonio Water System? Have you studied the details of their development activities --

A Yes.

Q -- in connection with forming your opinions?

A Yes, I have.

Q And what have you studied specifically?

A Specifically most recently I looked at the contract that SAWS is -- SAWS and an outfit called Vista Ridge have entered into that was approved by the SAWS board and by the city council within the last couple of weeks. I call it the Vista Ridge contract.

Q And why did you review that?

A That contract -- well, fundamentally because it

was available. I could get to it because they did a fairly unique negotiation process where it was all done in public, and they've posted the results of their negotiations on the website. So I could go there and get the actual contract.

Second, because of the way that contract is structured, it provides a very interesting and I would say almost unique approach to a buyer and a seller agreeing on terms. And so I wanted to understand what that approach was so that I could basically see if it applied to our project or could apply to our project.

Q And what did you conclude?

A I concluded that this is a -- fundamentally a -- to me will set the gold standard going forward because it is a very good contract for both parties. I believe the concepts embedded in that contract have direct applicability to the End Op project ability to deliver water to Austin or Round Rock or whomever. And so I think it's a very useful go-by.

I also know that if I were a potential customer of End Op, one of the first questions I would ask is, "Well, SAWS did this. Explain how your project would relate to the method SAWS and Vista Ridge used," and so I needed to be ready to do that.

Q What is the method that they used for -- what

is "innovative"? You used that term earlier about that particular contract.

A Well, the innovation is that -- two things. One, it was done in public, which is fairly -- I don't know of any other like that. But I think more importantly on the terms of the contract, it was the mitigation of risk to both parties that's embedded in the terms. Fundamentally SAWS has agreed to pay for the physical delivery of water or the ability to have water physically delivered to them in Bexar County. So SAWS has no ownership until the past 30 years of any other pipelines or wells.

Having Abengoa, which is one of the -- the Vista Ridge group which includes a company called Abengoa, have agreed to develop all the entirety of the project in return for a guarantee of payment. So in essence both parties have said if the water is deliverable or is actually taken by SAWS, Abengoa will get paid. And embedded in that is the concept that for certain expenses, which are subject to inflation like energy and O&M, SAWS agrees to pay those as a pass-through cost at their actual cost.

In essence what they've done in this arrangement is remove almost all of the risk to both parties because they're predefining who is going to pay

for what, they're predefining that the energy and O&M can actually increase in cost as energy prices go up in the future. And so that reduced the risk to both parties. They know what their costs are going to be as they go into this, and all that is on their website and in this contract that I pulled.

Q And contrast with -- that with what is the typical water -- long-term water supply agreement.

A Typically -- although there are some variations, typically if I were a water user, I would go find the water myself, buy the water from the source of supply, build the water plants, build the pipelines, build the pump stations, build them and own them myself and embed -- essentially take all the risk for that.

In this case, Abengoa, or the Vista Ridge consortium, has agreed to make the initial investment in return for a contract that says they will be paid. In some entities, like if I bought my water from LCRA like Austin and these others do, LCRA has incurred the cost of creating the supply, and they set a raw water rate, which as a user I go to them and say I want to buy raw water from you, but I'm still responsible for treating it and delivering it to a pipeline to my end users. So that's sort of a combination as opposed to a totally stand-alone project.

Q Obviously you're familiar with LCRA's water supplies given your tenure there. Have you kept abreast since you retired from LCRA?

A I've tried to.

Q And what are your conclusions with regard to LCRA's long-term water surface supply?

A I believe that the supply that I'm familiar with, when I was there, is at risk due to the ongoing drought and the probability that we're already in a Drought Worse than the Drought of Record. I'm also essentially pleased to see that LCRA has moved forward with the concept of constructing an off-channel reservoir downstream in Wharton County. It's very similar to a concept that I worked on for years when I was there.

Also, LCRA has, for the first time, begun to look at investing in groundwater supplies, specifically the Lake Bastrop property that LCRA owns around the Bastrop power plant. They apply it to the Lost Pines district for well permits and have received them. And as far as I know, that's the first major groundwater project they've engaged in.

Q Have you opined on the possible production amounts in the future for End Op water if permits are obtained?

A Could you ask the question again?

Q Sure. Do you have an opinion about the amount of water that End Op could sell if it obtained permits?

A Yes.

Q And what is that opinion?

A I believe we could sell all of it on the first day that the water could be delivered.

Q And, Mr. Thornhill, in forming these opinions that you've summarized for us, did you review, rely upon and/or prepare Exhibits 52 through 106?

A I relied on them, in part, and I prepared them all.

MS. REESE: Thank you. Your Honor, End Op moves to admit Exhibits 52 through 106.

JUDGE O'MALLEY: Okay. Are there any objections?

MR. LEIN: No objection.

MR. GERSHON: No objection.

JUDGE O'MALLEY: Thank you. End Op's Exhibits 52 through 106 are admitted.

(Exhibit Applicant End Op Nos. 52 through 106 admitted)

MS. REESE: And actually, Your Honor, I move to admit 51 as well.

JUDGE O'MALLEY: Okay.

MS. REESE: Thank you.

JUDGE O'MALLEY: Any objections?

MR. GERSHON: No, Your Honor.

MR. LEIN: No, Your Honor.

JUDGE O'MALLEY: End Op Exhibit 51 is admitted.

(Exhibit Applicant End Op No. 51 admitted)

MS. REESE: And for the record, I'd like to note that End Op has withdrawn Exhibit 107.

JUDGE O'MALLEY: Okay. We will note that for the record, that End Op Exhibit 107 has been withdrawn. And that takes care of Aqua's objection. Correct?

MR. GERSHON: It does. Thank you.

JUDGE O'MALLEY: Thank you.

Q (BY MS. REESE) All right. Mr. Thornhill, let's delve into the details of these opinions and what you've reviewed and relied upon and the assumptions you made in forming your opinions.

A Okay.

Q Do you need to take a break, or are you okay?

A No, I'm fine.

Q Okay. You just let me know if you need to take a break.

A Okay.

Q You testified earlier that the appropriate planning horizon for water is somewhere upwards of 50 years. Tell us a little bit more about why you have that opinion.

A Longer is better. Because it takes so long to develop projects, to obtain the permits and the financing, to construct them and get them into operation, that the longer term you can have is better.

Also, as I stated, the financing is usually 30 to 40 years. So at a minimum that would be the length of a project once it's built. But you have lead time you need to add on to that to get it going. 50 years, for example, which the state has adopted, would carry it beyond -- if you knew of a project today that you might need at the end of that 50-year period, you could begin the planning and the processing to get it underway.

If you were only planning for 30 years in the future, then by definition you don't know what's going to happen in the 31st year or you've put blinders on about it. It's just not a good way to go about it.

Most entities that I'm aware of have participated in and adopted the 50-year to 55-year planning horizon that the Texas Water Development Board is currently using. The exception would be both the

City of Austin and LCRA, to the extent we entered into a hundred-year contract.

Q Is looking at an amount in, say, for example, a five-year period, an amount used within the incremental five-year period, is that consistent with your opinion about the appropriate horizon for water planning?

A No.

Q Could you please explain?

A Well, fundamentally if I'm going to look five years in the future, that's a little bit of water that really doesn't solve my problem at all. I need to look 50 years or more in the future in order to do a cost-effective planning process and be able to understand what my water is going to cost and where I'm going to go to get it. I don't know of anyone, anywhere who uses a five-year planning process for water supply.

Q Do you know of an instance in which a user attempted to contract for an incremental need within a five-year period?

A I'm sorry, repeat the question.

Q Sure. Do you know of any instance in which a user attempted to contract for an incremental amount which was needed within a five-year period?

A Well, in an emergency situation, if I were -- if I had a pump break or a pipeline burst or a dam fail

in my system, I might go somewhere else and buy water for five years to fill in in an emergency. But in terms of -- as soon as I got that fixed, I'd go back to my prior status. So I -- that would be the only circumstance that I could foresee.

Q You testified earlier that the first step in identifying a water demand is to analyze and consider population growth and the projections and how they impact water demand growth. Did you analyze any population growth in Travis and Williamson Counties?

A Yes.

Q And is that demonstrated in Exhibit 52?

A Yes.

Q So what does Exhibit 52 tell us about the population projections for Travis and Williamson Counties?

A Well, for the county totals, if you look across the top -- top two lines of the graph, the data would indicate that there's a significant growth. You can compare decades -- these numbers are basically decade by decay from the Water Development Board. So between 2020 and 2070, Travis County's population is going to go up by about 60 to 70 percent. The Williamson County population is projected to almost triple in the same 50-year period.

Q And if you look at the 2015 to 2020 increase column on this table, how did you derive that information if the population projections are made in decades?

A Because these projections are made on the even decades, to get the five-year period from 2015 to 2020, I had to estimate the 2015 numbers. So I simply averaged the 2010 and 2010 -- excuse me -- 2020 numbers, then I subtracted that average from the 2020 number, and that gives the 2015 to 2020 increase column, which is the fourth one over basically.

Q So is the bottom line, if you wanted to just look at the increase in projected population from 2015 to 2020 for both counties, is that number demonstrated the 246,849?

A Yes.

Q Okay. Did you graph this information?

A Yes.

Q Is that what's on Exhibit 53?

A Yes.

Q You have, I see, in the middle of Exhibit 53, two projections. Why don't you tell us what you did here.

A Are you referring to the graph?

Q Correct.

A All right. In the middle of the page, there's a colored graph. Yes, the -- in essence, the top two lines, the green line and the blue line, are the Travis County projections from the year 2000 to the year 2070. The bottom two lines are the Williamson County projections from the year 2000 to 2070. The reason there's two lines for each is that they -- in the case of the top two lines, I'll use that as an example to explain it.

The blue line are the projections that were made for the 2011 regional water planning process, which was finalized in 2011, the water plan issued and that's the current water plan today as we stand. The Water Development Board, however, has issued the population and demand projections for the next round, which is ongoing right now, which will terminate in 2016.

So to read the graph that -- you see the label 2011 Travis, which is the blue line, then look at the label for the green line is 2016 Travis. All that is is an undate by the Water Development Board based on their current underring of what the populations are going to be. And if you look on the right-hand side, you can see the green line goes one more decade because in the -- in this round, they are extending the whole

planning process by 10 years. And every other time they do a plan, they extend it another 10 years into the future. That maintains a minimum 50-year planning horizon.

Q And when you look at -- and the ones on the bottom, the purple and the yellow, those are Williamson County. Correct? The purple and the red.

A The purple and the red, yes.

Q And when you look at the trends that are depicted here, what does that tell you?

A It tells me that just what I said from the prior exhibit, from the table. The bottom line, the projections have been and continue to be that both county's populations will continue to grow fairly rapidly. And, in fact, as they've updated the projections, compared to five years ago, they think it's going to grow even more than what they previously thought. And that's why the two curves -- you know, the current curves are higher than the prior curves.

Q You prepared information on the bottom of Exhibit 53 for a major -- the major WUG population. What does "WUG" stand for?

A "WUG" is water user group. It's an acronym used by the Water Development Board planning process.

Q And why did you track the population grown

specific to particular users?

A Again, in thinking about who the potential customers might be, I didn't want to just rely on the county total. I wanted to look and see what Austin, Cedar Park, Leander, in fact Georgetown and a number of others when I first started, but the purpose is to track the -- essentially as I began to focus on those four entities, what were their demands going to be.

Q Okay. And so the next step is to actually take those population projections and see how they translate to water demand productions?

A Correct.

Q And is that what is demonstrated on Exhibits 54, 55 and 56?

A 55 and 56 show that. 54 is -- well, I think the answer to your question is "yes."

Q Okay.

A Let's stop there.

Q Thank you.

So Exhibit 54 is just sort of the raw data. Is that correct?

A Correct. And that was the distinction I was going to make. This is -- this is an example of when I go to the website and download this massive spreadsheet and then sort the data by county and by water user

group, which are the second and third columns of this table, this is the data you get for the 2020 to 2070 decades. So if you look at the bottom of the page, the sum of those columns is down there at the very bottom. This is simply the raw data that I used from here on out.

Q Okay. And the tables in 55 and 56 basically graph the raw data. Is that correct?

A Correct.

Q So let's look at Exhibit 55. You want to tell us how to read this?

A It's very similar to the other graph. This is total demand by county, so this is everything. This is municipal, industrial, irrigation, mining, all of -- all uses. The upper two graphs are for Travis County. The lower two are for Williamson County. I duplicated the numbers at the bottom. It might help read the graph.

Q Okay. And is the trend that you saw with regard to population, that when the 2016 numbers came out they were higher than the 2011, is that trend apparent here when you look at the water demand growth?

A Yes, it's perhaps not as dramatic, but you can see, for instance, in the top two the gray line is slightly above the blue line. So five years after they made the projections, they made them again and they were

higher than what they did before.

Q Okay. If you look at the table at the bottom, how do we calculate what the total demand is then for Travis and Williamson County for 2020?

A Well, you go to the column entitled 2020 at the bottom and you add -- the ones I would use is the 2016 Travis of 291,000 and the 2016 Williamson of 121,000 that add -- you need to add those together, and that's about 410,000.

Q Okay. Did you do any graphing just strictly with municipal demand, the demand that End Op is going to provide the water for?

A Yes.

Q And is that on Exhibit 56?

A Yes.

Q So you read this chart very similarly to the previous one. Correct?

A Yes. I expanded this one a little bit. As I was noticing that the projections changed, I thought, well, what did they project back in 2006. So this chart has three planning projections on it, 2006, 2011 and the current 2016 projected demands. You essentially read it in the same way. You can see the differences between the demands made at the different planning periods, and you can see that in the latest round they've extended to

the year 2070. Before they stopped at the year 2060, but now they're going all the way to 2070.

Q Is the same trend that we have been seeing when the new projection come out apparent -- consistent on this chart as well?

A I'm sorry, could you ask it again?

Q When the 2016 numbers came out, are they higher than what the 2011 projections are?

A Not -- not always. For example, if you look at the -- let me be sure I'm answering you right. Yeah, the -- this is just municipal. This is not total demand. So if you look at the upper chart, in the year 2060, the gray line is the 2011 demand, the blue line -- or excuse me -- the source of the gray line is the 2011 demand projections. The blue line is below that. So unlike what we've seen in some of the other graphs, they're projecting a slightly lower municipal demand as they updated the demands.

Q And into the future, the demand is continuing to grow. Correct?

A Correct.

Q So how much is the total municipal demand in Travis and Williamson County for 2020?

A Well, again, you go to the column labeled 2020 and I would use the 2016 numbers, which are the bottom

two rows. Yes, that's right, the bottom two rows. So 228,000 plus 112,000 more or less, so 340,000 --

Q Okay.

A -- approximately.

Q What does that tell you when you compared it to the total demand that we just looked at on the previous exhibit?

A It's the, by far and away, the largest share of the total demand. I think the total demand was north of 400,000, this is 300,000, so it's about three-quarters of demand.

Q Okay. Have you conducted any analysis relative to a user's demand in terms of percentage of growth?

A Yes.

Q Is that what you can see in Exhibit 57?

A Yes.

Q And this is called 20 Municipal WUGs, and you've ranked them. Why did you rank them by 2070 demand?

A Simply as a matter of convenience. I was curious as to if I looked at the total demand at the end of the planning period, in other words, the farthest in the future that I had numbers, who was going to grow and by how much? So I simply took the raw data for each of these 17 water user groups, sorted and stacked it based

on the column that's headed 2070 from largest to smallest and essentially allows me to assess how much water each of them might need at the end -- you know, during and at the end of this 50-year period.

Q And so if you look at the column -- the second-column-to-last column on the right, that is in acre-feet, the growth in demand from 2020 to 2070 in acre-feet?

A Acre-feet per year, yes.

Q And then the furthest right-hand column is the actual percentage of growth during that time period?

A Yes, it's -- for example, to read that column, the 74 percent calculation is the column just to the left of that, 121,000 divided by the 2020 demand of 165,000. So that's how the table works.

Q And so was it a coincidence that the potential customers that you have identified are listed at the top of this table?

A Not at all. This table and others led me to those customers.

Q Okay. And so what does this tell you about the demand for Austin, Round Rock, Leander and Cedar Park, the four potential customers that you've identified?

A Well, the easiest way other than the fact that their demands are growing -- and I'll make an exception

to that in the second. Look at the second-to-last column, the 2020 to 2070 growth in demand.

Austin from 2020 to 2070 is projected to grow by 121,000 acre-feet, more or less, in demand. What that means is a project like ours would only be a small part of their current or future demands if you look at it from an incremental basis for the next 50 years.

When I looked at Round Rock, Leander and Cedar Park, Round Rock and Leander -- Round Rock is 39,000 acre-feet, Leander is 34,000 acre-feet in round numbers, those are smaller amounts over the next 50 years than the amount we are requesting from the district for our permits. But if you combine the two of them, they obviously exceed the amount.

The reason I looked at combining them is all of these entities -- all four of these entities take their water from the Highland Lakes. Cedar Park, Leander and Round Rock are all participants in a regional water treatment and delivery system called the Brushy Creek Regional Utility Authority. And so providing water to one of them my benefit the other, and I think it's very likely that a combination of one or more of these customers would be a very likely customer.

The exception that I spoke about a second

ago, if you look at Cedar Park, which is the sixth row down, you know, the sixth row down, the total demand over the next 50 years was only 2,000 acre-feet, about 9 percent. Cedar Park is landlocked from an expansion perspective. There's other entities all the way around it.

Pretty much if you look at the water demands across time, you should have fairly constant, a little bit of rise as they do infill. And what this tells me is that Cedar Park alone may not be as strong a candidate to be a customer as the others. They may still be because they share facilities with the others, but that's what I got from this table. It essentially -- the high probability customers remain Austin, Round Rock and Leander. Cedar Park is still a potential customer, especially if you group them together, but it's probably not as high or not as likely that they would be a customer as the other three.

Q Okay. If you took this project to the city -- the End Op project to the City of Austin, how do you think they would evaluate End Op's project?

A I think they would ask the same three questions I asked, "Do you have leases? Do you have permits, and can you provide a price?" They'd want to know how much water we could deliver, at what point in time, at what

price.

Q You testified earlier that, in your opinion, it's not appropriate to look at an incremental need in a five-year period for purposes of water planning or contracting. But nonetheless, did you actually calculate a demand growth for the 2015 to 2020 years?

A Yes.

Q And is that what is on Exhibit 58?

A Yes.

Q So tell us what the bottom line is about this information that you've compiled here.

A Based on my understanding of what the remand question was and how it might be answered explicitly, I took the -- actually this table shows all demands, but the one -- the rows that I relied upon are only the municipal. So the top series of rows is Travis County, the next one is Williamson, the bottom series of rows is the combined total.

So if you look at the combined municipal row -- and I'm sorry, the rows aren't numbered -- is about the 15th one down, but that first row under combined, you see there the calculations by decade -- or excuse me -- the projections by decade and also my calculations of the 2015 and then the 2015 to 2020 increase, as well as over on the right-hand side the

2045 to 2050. I had to calculate the 2045 column because, again, it was an odd decade. And I thought it would be easier to read -- maybe it's not -- but I pulled the numbers down into the smaller table at the bottom to reflect, I think, what would be a technical, literal response to what I understand the remand to be.

Q So if you look at the five-year municipal need total for 2015 to 2020, that's the 339,704 number. Correct? It's very small numbers, I understand.

A Yes, the -- and that comes from right above that. That column you'll find all four numbers that we're fixing to talk about are in the row labeled Combined Municipal going across the page.

Q Okay.

A So I just copied them down to the bottom to highlight them.

Q So this is every user in Travis and Williamson County of municipal -- for municipal use, the demand between -- in that five-year incremental period is approximately 340,000 acre-feet? Is that how you read that?

A I believe that's the need five years from now, not the incremental. That's the total need of all users five years from now, not the incremental need.

Q And so --

A The next row is the incremental need.
Q The 31,510 --
A Correct.
Q -- acre-feet?
A Correct. That's -- if you look in the municipal -- well, yes, the answer to your question is "yes."
Q And so that is less than the 46,000 acre-feet that End Op is asking for?
A Correct.
Q In your opinion, does that mean that End Op only needs a permit for 31,510 acre-feet?
A No.
Q Why not?
A Again, for the reasons we've been talking about, the normal planning horizon goes all the way out to 2070 or beyond for all of these entities, all of whom are participants in this regional planning process.

I believe that our project, because of the -- essentially the risk that the current supplies are placed under by the current drought, plus our ability to deliver an economically attractive alternative to them, that these customers would look kindly upon the full amount and, in fact, might even ask us why we couldn't deliver more.

Q So is it your opinion that the 31,510 acre-feet is not representative of the amount that End Op would be able to contract for?

A Correct. I think we could sell a lot more to one or more of these entities.

Q And then if you look at the 30-year out numbers, specifically the incremental demand from 2015 to 2045, that number -- do you have an opinion about that number as compared to the volume of End Op's use?

A Essentially it's almost ten times what we've requested. If you look -- as I understand the remand, the 30-year number was for the export permit. And the demand in just the next 30 years, the incremental demand, the increase in demand, is 450 -- 451,000, you know, roughly ten times what our permit request is.

Q Okay. You testified earlier, Mr. Thornhill, that you thought that we were in the worst drought of record. Is that correct?

A Yes, that's what I think.

Q Have you prepared any exhibits demonstrating and supporting this opinion?

A Yes.

Q And are those Exhibits 60 through 86?

A Yes.

Q Okay. So let's take a look at Exhibit 60.

What does this tell us about the drought?

A What 60 is is a snapshot in time of about -- looks like a couple weeks ago -- of the status of drought in Texas. This is available off the TCEQ website. It says Drought Impact on Surface Water because it comes from the TCEQ website, but this is a commonly used graphic to display the extent and severity of drought.

Essentially anything on -- just to explain how you look at it, anything that is not colored, all the white area, means there's no drought using the methods they use to compute a drought, no drought in existence. But anything that's colored, yellow, orange, red or brown, means some sort of drought exists. And the darker the color, the dark brown is the most extreme drought.

Q And this is a snapshot in time. Correct?

A Correct.

Q And are there different kinds of droughts?

A Yes.

Q Can you tell us a little bit more about that?

A Well, depending on what academic you talk to, there could be hundreds of kinds of droughts. But I boil them down, and I think the generic use of droughts, is you can have a -- a precipitation drought where you

simply have reduced precipitation and people are measuring the fact that the rainfall this year is less than it was last year or something like that.

You can also have an agricultural drought, I would call it, where farmers and those dependent on soil moisture measure the soil moistures and are very concerned about that because you could have a -- well, I won't explain.

And then the third kind of drought is the one that I think is most pertinent to this discussion, and that is if you are an owner of reservoirs and you are dependent on the water stored in those reservoirs, once the water level in the reservoirs begins to fall, you never know if they're going to -- you never know if they're going to go empty or not, and so you're constantly monitoring the status of your reservoirs, and I would call that a hydrologic drought.

Q And what causes a drought?

A Fundamentally, drought is a result of reduced precipitation. Higher temperatures result, which also drive up demands, and things like that happen. But fundamentally, a drought is reduced precipitation.

Q Are there impacts on the availability of surface water in times of drought or as a result of drought?

A Yes.

Q And what are those impacts?

A In essence, if you picture a raindrop falling onto the ground and running off into a river and that river then feeding into a lake, if it doesn't rain, that doesn't happen, so the lake level falls. It reduces inflows -- which is the term of art -- reduces inflows to the rivers and/or storage reservoirs that are available to capture those inflows.

Q Are there any other impacts on the availability of surface water?

A In a drought you mean or --

Q Well, you talked about -- so let's take a step back. You talked about inflows being reduced when there's no rain or less rain into the lakes and the rivers. And then when there's less inflows in there, what ultimately ends up happening in those lakes and those rivers?

A Well, the lake levels fall, which is what -- I'm sorry if I didn't say that. The impact is that like on the Highland Lakes, or Lake Travis and Lake Buchanan, if the inflows are reduced, that means there's not as much water coming in to make up for evaporation and releases and uses by customers, the lake levels begin to fall. That's certainly what we're seeing today. If it

rains and floods a lot, the lakes stay full, and you're generally not in a drought.

Q And are you allowed -- is every drop of water in the lake or the river available for surface water supply use?

A No.

Q Can you tell us a little bit more about that and approximately how you evaluate what is available versus what is actually in there?

A You have other uses that you have to meet, both regulatory driven and as a result of your operations. For example, permits today are usually contingent upon meeting certain environmental issues downstream. So many times you have to let a little bit of water go or a lot of water go out of your dams and reservoirs to meet those downstream needs.

The primary issue, I think, is the net of all those demands and the net of the municipal or industrial or a combination of demands you put on a reservoir is driven by the derivation of firm yield for that reservoir. And firm yield is a term of art that's used to describe how much water you can dependably get out of that reservoir if you had a repeat of the Drought of Record. The Drought of Record is essentially from the mid '40s to the mid to late '50s; '46 to '57 is what

I use. And so that tells you that -- a number. It says that if we had a repeat of the drought of the 1950s and you pumped continuously on your lake during that drought, this is how much water could you dependably get.

The TCEQ and its predecessor agencies have adopted that as the criterion upon which they issue municipal water permits to reservoir owners, firm water basically to reservoir owners. So LCRA's Highland Lakes, the amount of water that's available from them is dependent upon the derivation of the firm yield of those lakes. Firm yield is set by the drought standard that you've adopted to compute the firm yield, and historically that drought has been the 1950's. In my opinion, the current drought is worse than that, and the firm yield is falling.

Q Have you evaluated, in connection with coming up with your opinion that we are experiencing a Drought Worse than the Drought of Record, did you prepare any tables or graphs charting the severity of the drought over time?

A Yes.

Q Okay. And are those in Exhibits 61, 62 -- well, I believe it's just 61. What does this tell us about the severity of the drought?

A 61 is hundreds of snapshots. The prior graph, which was the State of Texas colored in, was one day out of one week. They do that weekly. If you look across the lower scale here, it's from the year 2000 to today. Those colors are the same colors -- or they are supposed to be the same -- depiction of the same drought conditions that are shown on the prior map but over this entire period of time.

So again, it says that if the color extends all the way to the top of the chart, that means 100 percent of the state was impacted by drought. So where you see white areas, again, there was perceived to be only partial or no drought. But over on the right-hand side, for example, if you look at about the year 2010 to the far right-hand column, you see that over 90 percent of the state in round numbers has been in some sort of drought for the last four years.

So you read this chart basically by, number one, how high up on the graph does it go. You also -- a handy tool I do, I just look at the purple. Purple is the absolute worst drought. It's called the exceptional drought. And if you look at the year 2011, 80 -- I believe the actual number is 88 percent of the state was in the exceptional drought category. The entire map that we previously looked at would have been

colored, almost 88 percent of it, dark brown. And so that's consistent with our understanding and the understanding of the public and my analysis of it, that 2011 is the worst -- that year is the worst year of drought in our recorded history as long as we've been keeping records. People say there were worse droughts long ago, but since 1940 that's clearly the worst drought we've ever had.

Q So what does this information mean for water plans?

A This is just a tool to increase awareness. It tells you that, yes, droughts happen. It tells you that you should be concerned. It's a good communication tool for the public to show them both the severity and the timing of these droughts. In terms of direct application, there really is none.

Q Okay. When do you think the current drought that we're in started?

A Everything I'm going to talk about is going to be what I would call a hydrologic drought as it affects the firm yield of a reservoir, the Highland Lakes upstream. In the case of the Highland Lakes, I believe the current drought that we're in started in March of 2008. That was the last date that both reservoirs were completely full.

Q Have you studied the impact of drought on surface water storage?

A Yes.

Q Is that what you have depicted on Exhibit 62?

A Yes.

Q And tell us what this is.

A This is a download from the -- a Water Development Board cite. The web address is at the top of the page there. But anyone can go there and look at this information. I simply downloaded it and printed it.

The Water Development Board tracks reservoir contents in 114 major reservoirs in Texas, and that's any reservoir that's more than 5,000 acre-feet in capacity. They put this plot out there -- I think they update it every week. I may be wrong about that -- where the color of the dot depicts the content of the reservoir relative to its permitted content; in other words, how empty is it? So a blue reservoir is essentially full. A dark brown reservoir could be empty. So the lake --

Q Tell us where the Highland Lakes are, the lakes that are the primary water supply source for the potential customers you've identified.

A Well, I wish I had circled them before we