IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION COMMISSION FOR THE PURPOSE OF CONSIDERING:

APPLICATION OF LOS LOBOS RENEWABLE POWER, LLC FOR APPROVAL TO INJECT INTO A GEOTHERMAL AQUIFER THROUGH TWO PROPOSED GEOTHERMAL INJECTION WELLS AT THE SITE OF THE PROPOSED LIGHTNING DOCK GEOTHERMAL POWER PROJECT, HIDALGO COUNTY, NEW MEXICO.

CASE NO. 14948

ORIGINAL

REPORTER'S TRANSCRIPT OF PROCEEDINGS

COMMISSION HEARING

VOLUME 1

BEFORE: JAMI BAILEY, CHAIRPERSON
TERRY WARNELL, COMMISSIONER
ROBERT S. BALCH, COMMISSIONER

March 19, 2013

Santa Fe, New Mexico

This matter came on for hearing before the New Mexico Oil Conservation Commission on Tuesday, March 19, 2013, at the New Mexico Energy, Minerals and Natural Resources Department, 1220 South St. Francis Drive, Porter Hall, Room 102, Santa Fe, New Mexico.

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ALSO PRESENT: Florene Davidson

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EXHIBITS MARKED, OFFERED AND ADMITTED

(9:25 a.m.)

CHAIRPERSON BAILEY: I now call Case Number 14948, which is the application of Los Lobos Renewable Power, LLC for approval to inject into a geothermal aquifer through two proposed geothermal injection wells at the site of the proposed Lightning Dock Geothermal Power Project, in Hidalgo County, New Mexico.

Ask for appearances.

MS. HENRIE: Madam Chair, Michelle Henrie for the Applicant, Los Lobos Renewable Power.

I apologize. We are not quite set up, and I also don't see the Division attorney or opposing counsel here yet. So maybe we could take a five-minute break.

CHAIRPERSON BAILEY: Let's take a five-minute break, and then we can reconvene at 32 after.

(Break taken, 9:26 a.m. to 9:38 a.m.)

MS. HENRIE: Thank you.

CHAIRPERSON BAILEY: I've already called the case. It's time for appearances.

MS. HENRIE: Madam Chair, Michelle Henrie for Los Lobos Renewable Power, LLC, who is the Applicant.

MR. LAKINS: Good morning, Madam Chair,

members of the Commission. My name is Charles Lakins. I'm here on behalf of Protester AmeriCulture.

MR. BROOKS: Madam Chair, members of the Comission, I'm David Brooks. I'm here on behalf of the Oil Conservation Division.

CHAIRPERSON BAILEY: Do you have an opening statement, Ms. Henrie?

MS. HENRIE: Yes, Madam Chair.

OPENING STATEMENT

MS. HENRIE: My client is working on building the state's first utility-scale geothermal power plant. So the project is intended to put green baseload geothermally generated power on New Mexico's grid.

The project has been in the works since the late '70s, when our predecessor in interest secured the lease development in 2,500 acres of BLM geothermal minerals just south of Lordsburg and north of the town of Animas.

We have submitted two applications, G-112 applications, which are applications to convert existing and already drilled geothermal production wells into injection wells. So as the project has progressed, we have had to learn more with each well drilling and have now tried to configure the project around producing from

one well, 45-7, which is down in the corner of that aerial (indicating), and then inject into Wells 55-7, 53-7 and 63-7.

So the current pending applications -- two applications. One is for Well 53-7, which is a little more northerly, and 55-7 to the south, to convert those two wells into injection wells.

The applications were protested by a neighbor to the project, AmeriCulture, and they're here today.

The protest lists, really, two reasons -- the grounds for the protest. The first is the contention that 55-7, Well 55-7, is in direct hydraulic connection with wells on part of the AmeriCulture production wells, which is ACS 21, towards the north. So these wells are in direct hydraulic connection. And the second round of the protest is that there would be migration of fluids in connection with the injection, and the implication being that those two facts would somehow harm AmeriCulture.

This protest is really based on one -- and I emphasize one -- well test of the AmeriCulture State Well #1, one well test, one report that reported data preliminary. It's acknowledging built-in errors with the data collection. It acknowledges problems with the

assumptions and all sorts of other things that my experts will talk about. But based on that one test, AmeriCulture seems to feel very strongly that there is a structural boundary or a constraint or something that is lying between AmeriCulture State Well 1 and the AmeriCulture Federal Well, which -- let's see. It's not on the chart, but it's over to the west of State Well #1.

That is one opinion. There are other interpretations of that data. We will present those today.

You will also probably hear about a tracer test that my client performed a year ago. There were problems with that test. I believe that that information is outside of the scope of this proceeding, and I plan to object.

I think you will also hear about water rights, and, again, I think that is an issue outside of the scope of this proceeding.

So with that lead-up, we will make our presentation. We believe we have met the grounds for the G-112 applications, converting these wells into injection wells, and would like to present those to you today.

We also have with us the draft conditions

of approval, which the Division filed last week. We have, as a team, taken a look at those and have some comments on them and will be prepared to submit those as well.

Thank you.

CHAIRPERSON BAILEY: Do you have an opening statement?

MR. LAKINS: Yes, ma'am.

OPENING STATEMENT

MR. LAKINS: Madam Chair, Commission members, a few things. First off, I'm really curious as to what statutory or regulatory aspect of New Mexico law applies here, because there's no question that the Protestant has no water rights. And it would appear that this proceeding is, realistically, being conducted under Section 71.5.2.1 of the Geothermal Resources Act, which essentially says: "All diverted groundwater" -- the permit from the State Engineer is not required if: "All diverted groundwater is reinjected as soon as practical into the same groundwater source from which it was diverted resulting in no new net depletions to the source."

So it would seem, from my understanding of, realistically, the facts and the application, that is what is being proposed here. However, under that

particular section, I see a real problem, because part of that section requires an opinion from the State Engineer. It says: "Provided that the Division shall provide to the State Engineer all information available regarding the proposed diversion and reinjection and shall request the opinion of the State Engineer as to whether existing groundwater rights sharing the same groundwater source may be impaired."

So I don't see here before us today any opinion from the State Engineer, which statutorily is required in order to proceed, in order to approve what's being asked of this Commission to do. That's a problem, because our groundwater rights have been impaired and may be even more significantly impaired.

If you back up not to 1975 but to 2009, there was a permit application to the Water Quality Control Commission for production and injection wells for this project. The Water Quality Control Commission issued permits. Those are still in place.

What's very, very significant here is that one of the wells, 55-7 well, that is being asked to be turned into, in essence, a Class V injection well, was not included in that process at all. Now, 53-7 was, yes, and 45-7 was, yes. And, in essence, what I see here is that Los Lobos is asking to take permitted wells

that they received the permit for back in 2009 and switch the purpose of use.

The real, real, real big problem, though, is that Well 55-7 was not included in that permit application. So we've got a public notice problem, because this is an injection permit, which, as I understand, the way that the Commission is proceeding and even under the proposed conditions of the Division will require this injection to meet all water-quality control standards, basically a discharge permit. But there was no discharge permit application made for 53-07. We've had no mandatory public notice for that. That's a problem.

We also have a real concern about the connectivity of these wells, the unknown geology of this area, and even the statement of the Applicant's expert that says their geothermal production and injection wells may be in hydraulic communication with our wells.

Now, when the protest was made -- of course, a protest is not required to set out your whole entire case. A protest can be a one sentence saying, We protest, and that's valid. And so the protest, which was done by my client before I was involved, said, there is a concern. There's also more concerns that we want to bring to the Commission today, including where these

wells are located here (indicating), because this is where we're at (indicating), right up over here. We have a domestic well. We have a geothermal well. We have several wells.

And when this tracer test was done, interestingly enough, this injection of the tracer dye was done up here (indicating), neighboring our wells. We basically had serious problems with the amount of fluid that came -- the tracer dye that came into our wells way up here (indicating) when what was going on was, in essence, a dry run, if you will, for this 45-7, 55-7 and 53-7.

So when this tracer dye was done, it was done way up here (indicating), when this is where we're talking about down here (indicating). And what we will show is that the natural flow of water is from south to north. And when this tracer dye was done and these wells were being pumped and the dry run of this project was being conducted, it essentially reversed the natural flow of the underground water stream and brought this tracer dye into our wells. We have a domestic well and a geothermal well there. Those are concerns.

Because of the unknown geology of what has happened, it has shown already that there is a serious problem with what's going to happen. It's not so

cut-and-dry.

The other part of this is that because of the unknown geology, we can't be certain that where these wells are injecting into is the exact same source as where this proposed production well is, and that these three wells (indicating) are basically isolated from everything else. The report that Los Lobos had when they did their dry-run tests indicates, when these wells were being pumped, there were wells being affected all over the place. That's a problem.

So what we see as a real problem is, one, the hydrology. Then also what we see as a real problem is, what is the real ability of this geothermal resource to produce? Because what we will -- what our experts will show, based upon the analysis of the known geothermal resource, produce about 300 gallons a minute of hot water coming up from the middle of the ground. They're proposing to basically take three million gallons a minute, pull it out of a source and reinject cold water in, which, ultimately, is not going to get all reheated. That's their theory, that this water's coming out; it's going to go back down, like a big pot on the stove where you've got a straw in and everything gets reheated.

That's not the case of the known geology of

the area, and we have a real concern that as cold water is injected into the source, it will diminish our geothermal rights.

There is also a problem with the chemistry of the water. And the chemistry of the water is known, in large quantity from tests that have been conducted out there, and there is a very big concern that the water that's being taken out, where it's going to be injected will affect our potable drinking-water source to exceed water-quality control standards. In other words, they're going to contaminate a known public drinking water spot. That's a problem.

So there are several issues. There are several problems. There are several bases for our protest. And at the end of the day, we're going to ask the Commission to deny these applications. And, in particular, I think it's very important, even if the conditions of approval are issued, that it be recognized that Well 55-7 has never been properly permitted as a Class V injection well through the New Mexico Administrative Code requirements for public notice.

Thank you.

CHAIRPERSON BAILEY: Mr. Brooks.

OPENING STATEMENT

MR. BROOKS: Thank you, Madam Chair,

Commissioner Balch, Commissioner Warnell.

This is, I believe, probably the first hearing that has ever been held under the Geothermal Resources Conservation Act. I can't say that for sure, but if there has been one before, it was more than 13 years ago.

That creates something of a problem for Your Honors, because there is a lack of precedent, since the Act has never been construed or applied by any court, insofar as -- to my knowledge, it has never been construed or applied by the Commission.

I would like to say, first of all, where the Division stands in this. The Division takes no position as to whether the permit for which Los Lobos has applied should or should not be granted.

The Division has presented proposed conditions of approval in the interest of efficiency, with the hope that the Commission, when it makes an order in this case, can write an order which serves as a permit without the necessity of remanding the matter to the Division staff to write an actual permit.

Your Honors are doubtless aware that there are, kind of, two cultures in the Oil Conservation Division; one that is developed around oil and gas flow, in which many things are done adversarially and by

hearing orders, and another around the environmental law concepts in which permits are written administratively and only ultimate issues are resolved by hearing.

We would urge, in the interest of efficiency, that you proceed, if you decide the granting of a permit is appropriate, to issue an order which will serve as a permit and include such of our proposed conditions of approval as you, the Commission, deem appropriate.

The second issue I wish to address briefly is: What is at issue in this case? With all respect to Mr. Lakins, I disagree that the water rights are in any way at issue in this case. I believe that this Commission has no jurisdiction over water rights and if AmeriCulture's water rights are impaired, that that would be something they should take up with the Office of the State Engineer or the district court and not with this Commission.

But at the same time, that does not mean that the flow or availability of water is not an issue, because in the case of geothermal resources, it is the heat that is the resource that this Commission is charged with conserving. And, of course, if it were true -- which we don't believe it is, but we're not presenting any evidence on the matter. If it were true

that the operations proposed by Los Lobos would deplete the availability of water to AmeriCulture's well, then that might enable -- that might disenable them to access the geothermal resources, which might have waste implications and might have correlative rights implications that this Commission would have to consider.

We believe, though, that the primary issues that this Commission must wrestle with are, number one, water quality. And although I have filed a brief indicating that the procedural provisions of the Water Quality Act do not apply to this case, I do believe it would be appropriate for this Commission, in assessing water quality, to rely upon the water-quality standards developed by the Water Quality Control Commission. Those standards were developed after an extensive administrative process. And they were developed under the auspices of the United States Environmental Protection Agency for the purpose of implementing the Clean Water Act, which this agency is charged with the responsibility for implementing in New Mexico, excluding tribal lands, which are not involved in this case.

There is a serious question here, in my mind -- and I do not know what the evidence will show at this hearing. If the evidence were to show that this

injection will not cause water to exceed standards, but would cause water to be impaired for usability for the particular and peculiar purposes of AmeriCulture, what standard is this Commission charged with applying in addressing that argument? I would point out that its powers under the Geothermal -- environmental powers under the Geothermal Resources Act are broad. And this Commission is charged, under 71.5.8, to require wells to be drilled and operated, et cetera in such a manner as to afford reasonable protection to human life, health and the environment.

On the other hand, of course, this Commission does not have jurisdiction over the common law of trespass issues. That would be, again, something that AmeriCulture should take to the district court.

If the evidence presents that issue, the Division would welcome an opportunity to brief that issue, which we have not done, because we do not know if it's involved here.

After water quality, the other thing this Commission needs to be concerned with is waste or in protection of correlative rights. And while we disagree with Mr. Lakins -- what Mr. Lakins said with regard to State Engineer issues, we agree that there is a potential issue regarding temperature. We do not know

what the evidence will show regarding that, but, of course, if Los Lobos, in its injection -- if it were shown that it would have the effect of cooling the reservoir, then that would involve potential waste issues and potential correlative rights issues that this Commission would have to address.

Thank you.

CHAIRPERSON BAILEY: Ms. Henrie, would you like to call your first witness?

MS. HENRIE: Thank you, Madam Chair.

My first witness is Mr. Ted De Rocher.

For the record --

CHAIRPERSON BAILEY: Please stand to be sworn.

TED DE ROCHER,

after having been first duly sworn under oath, was questioned and testified as follows:

MS. HENRIE: Madam Chair, for the record, we pre-filed exhibits, and I believe you probably have those in the black binders here. So we will be referring to those throughout.

DIRECT EXAMINATION

BY MS. HENRIE:

Q. Would you please state your name?

A. Ted De Rocher.

Q. And where are you employed and in what capacity?

A. I'm employed with AltaRock Energy. I'm vice president of Operations, and it's a geothermal stimulation consulting company.

Q. And would you please summarize your education and your employment background?

A. Sure. I have been involved in the geothermal industry since 1991. I have a Bachelor's Degree in Environmental Science and a Master's Degree in Natural Resource Management and a Master's Degree in Hydrogeology, and I did additional coursework in aqueous 2 chemistry.

And my work experience is primarily in operations of geothermal facilities, operations in environmental compliance and process chemistry. So, I mean, broad categories.

Q. And, Mr. De Rocher, where is AltaRock located?

A. Our corporate headquarters is in Seattle, Washington.

Q. And where is your work?

A. It's primarily where geothermal is located, and so the Great Basin, Nevada, California, Utah, and New Mexico, potentially. And we've done a lot of work in the Pacific Ring, in Indonesia and Nicaragua.

Q. And you said you've been working with geothermal for 22 years?

A. Yes, 22 years.

MS. HENRIE: Madam Chair, I would move to qualify Mr. De Rocher as a witness -- move to qualify the witness as an expert in geothermal resources, geothermal industry and geothermal technology.

CHAIRPERSON BAILEY: Any objection?

MR. LAKINS: No, ma'am.

CHAIRPERSON BAILEY: Then he's accepted.

MS. HENRIE: I'm sorry?

CHAIRPERSON BAILEY: Then he is accepted.

MS. HENRIE: Thank you. I thought that -- thank you.

Q. (BY MS. HENRIE) Mr. De Rocher, are you familiar with the Los Lobos project?

A. On a very cursory level, yes.

Q. And were Exhibits Numbers 1 and 2 prepared by you?

A. No.

I was going to ask -- I guess they will be sharing common binders on everything.

Thank you.

Q. So did you prepare those exhibits?

A. No, I did not.

Q. You did not. Have you had a chance to review them?

A. Yes.

Q. Do you feel that they are illustrative of what you plan to describe to the Commission?

A. Yeah. They're in a general nature, generic description of a geothermal system at large and binary power plant technology, but very generic.

Q. Will you please explain to the Commission the technology that will be used at the Lightning Dock Geothermal Power Plant?

A. From my understanding of what is proposed is a binary type of a power plant. And, essentially, if you're looking at Exhibit 1, the right-hand diagram kind of shows the basic concept. It's called a binary because there are two circuits, two systems.

The first one is where you would be producing hot geothermal fluid from the geothermal reservoir; run it through a heat exchanger. That would be the bottom, left-hand corner of the diagram. And as that heat is extracted from that working fluid, it is then reinjected back down into the geothermal resource. And it doesn't come in direct contact with the working fluid. It kind of works like the back side of your refrigerator. It's just a an-cooled -- it's a

heat-exchange mechanism.

And then the second loop, which is why they call it binary, is the actual working fluid, which -- that working fluid is heated in the heat exchanger, and it is then delivered towards the turbine. And at the turbine, there is a pressure drop, and it allows the gases -- the working fluid to expand, drive the turbine. And on the exit side of the turbine, this gas is then recondensed and then repumped back to the heat exchanger. So there are two reverse circulation systems, I mean, in its simplest form.

On the back side of the turbine, in order to facilitate the condensation of the working fluid, additional heat does have to be removed from that system. And some systems utilize a cooling tower or use the evaporation of water to remove that heat, but in the proposed operation, they'll be using the air-cooled condenser system. And that's really common in areas where loss of water through evaporation is of concern, where water is of limited availability. And in the majority of the desert and the Great Basin, that's the case.

Q. So, Mr. De Rocher, in binary systems, generally speaking, is there any consumption of geothermal fluid?

A. In a binary system, consumption, no. It's a

diversionary thing. And your -- I'm trying to figure out; I didn't want to get ahead of things. But as an operator, you want to manage your resource. And so, therefore, you want to make sure that you pull your -- you inject your -- let me go back to some temperatures here.

If you go to the -- do you guys have this diagram on the next page? This will explain a little better.

Typically on a geothermal system, the average ones in the Great Basin, production fluids are running like 280 to 320 degrees Fahrenheit. And after it goes to the heat-exchange system, through number two, it's typically reinjected between 140 and 180 degrees Fahrenheit. And that kind of change is dependent on the flow rate through the heat exchanger and also temperature outside. The hotter it is outside, the less heat can be removed from the fluid when it is extracted; just nature of the process. So when it's cold in the winter, you can pull a lot more heat out.

Since the fluid you're injecting, let's say on number five here, is cooler, you want to make sure that you inject it far enough from where you're producing that it has time to go back down to the rock, get reheated before you pull it back up. If you inject

too close, you will short-circuit, and your production fluid will cool off and you can't operate.

But if you put it too far away -- this goes back to the question on consumption. You're not really consuming it. But if you put it too far away, you run the risk of it not returning directly to offer pressure support to your wells, and your production well pressures would run the potential of declining. And, therefore, you can't produce as much as fluid and you're not managing the resource, or you put yourself out of business that way, too. So it's in your own best interest to manage where you are injecting relative to where you are producing, and that's never a perfect fit.

And in my experience through years, you are constantly changing the operation through time. And at several places I've worked, we have changed production wells over to injection wells and injection wells over to production wells as we learned where the best balance was achieved to maximize our production.

Did that answer your question?

Q. I believe it did.

Let me go back to a couple of things. I believe you said that all of the geothermal fluid that is produced gets reinjected?

A. Oh, yeah. Yeah. Oh, I see what you're saying.

Yeah. The fluid that you produce to the surface, yeah, you reinject it. There is no -- in this particular system, there is no use of that water, so there is no loss of water to that system. And there is also no direct contact with the working fluid, and so, therefore, there is no need for other, I would say, chemical additives or changes -- changes -- there is no exposure or anything to the working fluid, if that's what you are asking.

Q. So as the water -- as the geothermal fluid comes up, it stays in the pipe the whole time? It doesn't --

A. Yes.

Q. -- touch the air; doesn't see the sunlight?

A. Yeah. And if issues occur in terms of like sealant on a heat exchanger, you will notice that there are lots of instrumentation in the power plant, and you shut down things accordingly and fix it. It's equipment that has to be maintained.

Q. Great.

And you also talked about fluid management, this relationship between the produced fluids and the reinjected fluids.

A. Uh-huh.

Q. And it sounds like it makes business sense to

manage those fluids properly.

A. Oh, it's essential.

Q. It's essential. Can you elaborate on that?

A. Well, as I was mentioning before, if you -- as you produce the fields, you're going to -- there are always some changes, because things are at a certain state of equilibrium initially. And now that you're inducing a pump withdrawal in one area and a pressure injection in another area, you're going to change that balance between water levels in the region and also -- it's just the nature of the business. But they quickly reach another equilibrium state.

So by monitoring water levels in the region and chemistry in the region, you can properly assess the degree and percentage and relative amount of water that's making it right back. I mean, so, as an operation, your monitoring plan is critical to your proper management of the field.

And so that's the only way for you to externally check what's going on, other than temperatures on your production well. If you're cooling off your fluid, you're injecting too close; you don't want to do that.

Q. So in your experience -- and you've got, I think you said, 22 years of experience with geothermal

projects --

A. Uh-huh.

Q. -- it is possible to tweak the systems to manage the resource so that you don't lose heat and you do have that proper long-term sustainability?

A. Oh, yeah. Not only is it possible, I can't think of an operation that doesn't do it. You're always adjusting your operation, because, like I said, when you first start, you really don't know -- it's as I mentioned earlier. Geology is an unknown science, and you adapt to what you measure, and you have to change your operation accordingly. But that's the purpose of monitoring both the process equipment and the well field monitoring programs, both water level and temperatures and chemistry. You get a -- it helps you manage your field more efficiently.

Q. There's been concerns raised about overproducing the reservoir.

A. Uh-huh.

Q. What are your thoughts on that?

A. I would say that is a legitimate concern at every geothermal resource. You want to try to design your facility to the ability to -- for the resource to offer sustainability.

Since there is a very large investment

capital in building a power plant and drilling wells and continuing to operate, your loans are over a 20- to 30-year process, and it takes a long time to repay back that capital. And, therefore, it's your -- it's essential and it's in your own best interest to keep yourself in business and not overproduce the resource and manage it properly. So heat management and managing the fluid to extract that heat is your business.

Q. You talked a bit about what happens when power plant operations start and what happens to the water table.

A. Uh-huh.

Q. Can you describe -- I think it's called equilibrium. The water table eventually reaches equilibrium. Is that --

A. Oh, yeah. I guess that was a generic term for the depth below surface to where the water level is in wells in the region. Since you're changing sinks, you know, where things are being extracted, where things are pushed up, you're going to change that pressure balance. It's just the nature of the business. But it doesn't continually -- if you are producing from and injecting back to your same location, it's not going to continue to change with the climate [sic] or -- it will reach a point of equilibrium.

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And then where I said monitoring the temperature is important is that I've been in a few facilities where we did have, initially, you know, four to nine degrees Fahrenheit per year of regular temperature decline. We were going to go out of business pretty soon if we don't change the way we do things. So we ended up updating our geologic model, ran an additional tracer test, figured out where to drill new injection wells or change some of our production strategies, and we were able to change how we operated and where we put fluid, and eliminate the rate of temperature decline. It's the function of the data you have available and what you learn as you go forward.

Q. And how do monitoring wells fit into this evaluation of data?

A. Sure. You need both wells that intersect the geothermal resource and wells that are in the regional water table, because most geothermal systems are -- because the water is hotter, it's less dense, and it tends to -- in the simplest fashion, it tends to buoy up towards the surface. And so there is a gradual intermixing with geothermal fluid and the regional groundwater, and it's just a natural outflow pattern. And so by monitoring the chemistry in the region, we can get a feel for this mixing, and also you can get a --

and monitoring temperature and also water levels. You can get a feel for if you're changing the hydrologic balance.

I guess that would be important if -- in some systems, if you're not putting the water back you'll have a water well that continues to decline. And, therefore, you don't want that, because then you won't be able to continue to pump it. So water level is very important for an operation.

Q. So with the Los Lobos project, would it make sense to monitor AmeriCulture wells, as well as other wells?

A. Oh, yeah. I mean, I think anybody in the region should be involved in a monitoring program. It's prudent. It's prudent for the people that aren't directly involved in the operation, but it's also prudent for the operator. You need to work with your neighbors.

Q. AmeriCulture has argued that there is a structural boundary such that the water that is going to be produced from 45-7 --

A. Okay.

Q. -- is on one side of the structure, and the reinjection locations, including 55-7, are going to be on a different side of that structure, and that the

structure acts as sort of a barrier. It's the teacup theory. We heard of that in the legislature last year. The water's coming out of one cup and going into a different cup. Pushing aside for a moment whether that theory is accurate or not, in your opinion --

A. Right.

Q. Let's say it is true. How would that affect long-term operations of the power plant project?

A. Well, if that was true, there would be no long-term operations. You'd notice it right away. You might have some initial drops right away in your production if you're producing here (indicating), and initial mounding over here (indicating). But you'd want to watch that over a longer period of time, you know, and you'd be able to see if that trend is continuing.

There is always some initial -- the changes initially occur the most rapidly in the first, you know, ten days or so. The first couple days are the greatest amount. And after that, the rate of change should stabilize, and the rate of change should decline. So it would be a declining rate of decline.

To answer your question more succinctly, you would notice right away if there was a separate teacup, I guess. So, yeah.

Q. Do you think you would be able to notice that

within a 30-day pump test?

A. Oh, yeah. Yeah. You should be able to project -- you know, because some things may -- initially, you'd say, Wow, this well dropped a lot; what's going on? But sometimes if there are geologic constructs that delay the rate of response, it may just be more a torturous path, and things would respond later.

Most power plants -- we call it initiation tests or long-term tests, are run in between 21 and 31 days. The majority of data you would produce in your first 17 to 15 days, but you just want to see the shape of that tail to -- of water level change, so you can project further in the future more accurately.

Q. So if Los Lobos did a 30-day test pumping 45-7, injecting into 55 or some of the other injection wells and saw that there was -- that the teacup theory was correct, there were two teacups --

A. Oh, yeah.

Q. -- would it make financial sense for Los Lobos to move forward and build a power plant based on that -- those contemplated uses of the wells?

A. Well, financial --

Q. Is there --

A. How about, not financial sense to me.

Q. Yeah.

A. I would not do that if I saw continued drop in the water level.

Q. Would you advise one of your clients to do that?

A. No. No. But continual drops. I mean, you'd have to analyze the data and say, Hey, looks like it's going to stabilize at about this level. How deep do we set our pumps? How might it affect regional water wells? So we'd have to -- you know. And, I mean, there is a lot of assessment involved in the data, but extended tests are always more prudent if you want to have a long-term operation that's successful.

Q. In the geothermal industry, is it common to convert production wells into injection wells and vice versa?

A. I would say incredibly common, but it all depends on the project that is initially permitted. I've been in projects where you just don't give it a specific location. They say, Hey, we'll have 15 injectors and 7 producers, and you kind of have a generic blanket, and you fill it out as you learn the geology.

But if you're in a situation where you've been operating for a while and it's been a production

well and your updated information indicates, I'm going to be able to more efficiently use my geothermal resource by injecting this well into this over here, yeah, I've done that in a couple places. And I've also had some places where we intentionally inject in an area to bring up reservoir pressure support, and then we let it heat up for a bit, and then a month or so later we produce it. And we call it a huff-and-puff strategy. We've done that on a few fields, too.

See, you're always switching how the wells operate. But also -- yeah, I mean, that's common, but it really depends on the situation. There are a few fields I've been in where we've been fortunate, haven't had to change a thing. So --

Q. Let me go back to equilibrium again; what happens when the power plant gets turned on and then fluctuations in the water table.

A. Or during the pump test.

Q. Or during a pump test.

A. Right.

Q. Let's talk about plant operations, though. When it's on operation, it's on production, it's on injection, it's 24/7, and we get to a point where a reservoir reaches equilibrium. I believe you testified earlier that there is no water actually being consumed.

Water is displaced from the reservoir, but it's not actually taken -- permanently displaced from the reservoir. What goes out comes back in.

A. Oh, yeah. I mean, in this particular operation, utilizing air-cool technology, as part of the operating procedure and how the power plant functions, there is no use of water at the surface from the geothermal fluid produced. I mean, other than the mine heat. You don't -- on this other figure, some other facilities I've worked at, you -- if the water's clean enough, you can actually take some of the water off and use it to supplement your cooling tower evaporation. But that's -- I don't think that's the proposed operation that proposed here.

Q. So one question: In your experience, as the water gets to the point where it reaches the equilibrium, there is some fluctuation. Some goes up; some goes down.

A. Right.

Q. What are the ranges of magnitude? Is it a matter of inches? Is it a matter of 250 feet?

A. Okay. More -- it depends how -- wow. It's like, how much air is in room? Okay. Bear with me here. It really depends on the reservoir properties you're producing from. Okay?

So I've had experience in producing from alluvium, which is incredibly permeable, and the water -- excuse me -- very little pressure drop -- or water-level drop when the wells are produced. But I've also seen some areas that have a lot of very low permeability, high silt, like Imperial Valley, where you have a significant drop in your water level, several hundred feet, and then you also have some significant mounding where you're trying to inject. So I can't answer that question until you do an extended test and monitor what's going on.

Q. The extended tests will give us a prediction of what will happen when the plant actually goes into operation?

A. Right, for these particular wells. But your information is always going to change and update as you learn more about your resource. I mean, that's -- unfortunately, it's not a perfect known up front. But there has been a lot of work on this site from all involved parties. This area has been studied a long time, so there is a lot of information there. So --

Q. Can you describe what correlative rights means?

A. Wow. In it's simplest form --

MR. LAKINS: I'm going to object. He's not qualified in a legal -- to give legal opinions. That's

a legal question.

MS. HENRIE: Okay. Let me rephrase the question.

Q. (BY MS. HENRIE) In your experience in the geothermal industry, are correlative rights something that is commonly a principle of geothermal development?

A. If there are adjacent leaseholders on a common geothermal system, yes.

Q. And so I'm not asking for a legal opinion. I'm asking in your experience. What does the principle of correlative rights mean?

MR. BROOKS: Madam Chair, I'm going to object to that, because the Geothermal Resources Act has a definition of correlative rights, and it may be improper for this Commission to apply it as meaning anything other than what the statute says.

MS. HENRIE: Well, maybe let's read that definition into the record.

Madam Chair, if I may, because it's come up, and I'd like to get this into the record.

I have in front of me, from the Geothermal Resources Conservation Act, 71-5-3, which is the definitions page, and it does have a definition of correlative rights, which, if I may, I'd like to read it into the record.

CHAIRPERSON BAILEY: Go ahead.

MS. HENRIE: "Correlative rights means the opportunity afforded insofar as it's practicable to do so to the owner of each property in a geothermal reservoir to produce his just and equitable share of the geothermal resources within such reservoir, being an amount so far as to be practicably determined and so far as to be practicably obtained without waste, substantially in proportion that the recoverable geothermal resources, under such property, bear to the total recoverable geothermal resources in the reservoir and for such purpose to use this just and equitable natural heat or energy in the reservoir."

Thank you.

Q. (BY MS. HENRIE) Mr. De Rocher, would you describe for us how the concept of reservoir capacity differs in the geothermal context than how it is used in the oil and gas context?

A. It'll be conjecture on --

MR. LAKINS: I'm going to object to that. We haven't qualified this man to know anything about oil and gas.

CHAIRPERSON BAILEY: Would you like to rephrase your question, then?

Q. (BY MS. HENRIE) I'm sorry for the silence. I'm

just thinking about this. I guess the point I was wanting to make -- Mr. De Rocher, maybe you'll just tell me whether you agree with me. Given that geothermal is a renewable resource, reservoir capacity is different than if you're dealing with a non-renewable resource, such as oil and gas?

A. Sure. By definition, sure.

Q. Okay. Have you had an opportunity to review New Mexico's geothermal regulations?

A. I visited the website, and I -- you know, they have a lot of forms to fill out. I'd say I find the majority of it covers -- it's quite similar to the regulations and operational conditions I've -- and forms I've had to submit with other operations. It's quite similar.

Q. Have you formed an opinion on the water quality in the Lightning Dock Geothermal project area?

A. I've just had a cursory review of it. I would say -- water quality, it's a relative term. I would say, as a geothermal fluid, it's remarkably clean. And as an operator, I wouldn't have to worry about corrosion issues, minimal scaling issues, if at all. I mean, I would love to do some testing, but it's a very clean fluid for geothermal fluid; I mean, very clean. And by that, I mean the dissolved mineral content is quite low

compared to the majority of the other fields I've worked at.

Q. Do you have an opinion on whether the technology being proposed -- the process being proposed by Lightning Dock will prevent waste of the geothermal resource?

A. And that means by heat?

Q. Resources --

A. Yeah. I would say you are utilizing it, so, I guess, technically, you're not -- you would be wasting it if you don't use it.

This is the most efficient manner I can think of. Because of the small scalability and the unknown nature of the full extent of the resource -- you know, for the purpose of the discussion here -- I think the modularity offered through binary is the most efficient way to approach it. You start small and work your way up as the resource conditions -- as you learn the resource conditions.

The reason I quantified it by heat, it may not be the most efficient way to extract it thermally, given your temperatures in production are quite high. There are slightly more efficient methods where you use steam fractionation. You can extract more enthalpy from steam to drive a turbine than just through the binary

exchange mechanism, but that would have some consumptive water-use issues. So given the water availability constraints, this makes the most sense. Your options are limited.

Q. Have you formed an opinion on whether approval of this application would adversely affect any other geothermal lease owners?

A. Huh. I would say if a proper monitoring program is implemented and the project is operated and managed appropriately, following the monitoring plan and responding to such, because you are going to see changes, I don't -- it has the potential to not adversely affect the project. I mean, we've done it on many other projects, right in towns, right in cities, right in agricultural areas, and there are not mutually exclusive ways of utilizing geothermal resource.

MS. HENRIE: Madam Chair, I will go ahead and pass the witness. I would like to reserve the right to recall Mr. De Rocher later in the proceeding.

CHAIRPERSON BAILEY: Yes.

Mr. Lakins.

MR. LAKINS: Madam Chair, thank you.

CROSS-EXAMINATION

BY MR. LAKINS:

Q. Mr. De Rocher, I'd like to turn your attention

to Exhibit Number 1 --

A. Oh, yes. Sure.

Q. -- that you talked about. Is it your testimony that in the binary cycle power plant, not a single drop of water that's produced is lost before it's injected?

A. Not as the design mechanism for, you know, how -- how it's designed to run. This particular diagram is not accurate and representative of the project, this first one. The second one's a little more.

Q. Okay. Well, let's go to that one.

A. But as part of operations, occasionally you have to test your wells and flow them to the surface to evaluate their condition. You do well maintenance. There are times where you have to do some preventive maintenance on your power plant and drain out the fluids in the existing pipelines and into storage areas. So there would be some loss of water, but small amounts. But as part of the design operation, it's not designed to consume water, if that's what you were asking.

Q. But in your experience in dealing with these types of power plant designs, do you always have exactly 100 percent of the amount of water that's pumped reinjected?

A. Well, the vast majority of the time.

Otherwise, we'd have leaks all over the place.

Q. Do you want to take a break?

A. Oh, no. I'm doing fine.

Q. Have you actually seen the proposed diagrams, essentially schematics, that have proposed what's -- what's going to be built?

A. No, I have not.

Q. Are you aware of the proposed amount of pumping for the project?

A. Other than what you initially said, no, but I have some rough estimates based on resource temperature and the amount of energy that would be extractable from that net; meaning minus the power it would take to pump and the power it would take to put back down in the ground. I have a lot of experience of -- I just have some rough rules of thumb. And it's roughly 1,500 gallons a minute per megawatt net, given a 290 to 305 resource temperature.

Q. Now, the last question you were asked, if you had an opinion if the proposed project would affect other geothermal lease owners, and you said there was the potential for it not to. Is that what -- is that correct?

A. Well, yeah. I think she said adversely, you know, and that infers negative and significant. And so

I was -- every project I've worked at has changed -- like I said, changed the balance of things. It's just the nature of whenever you introduce -- you know, you could drill a new water well, and you're technically affecting the balance of things out there.

So long as you have a proper monitoring program to be able to observe those changes, and you manage and operate the project so you can adapt to those changes if they're considered bad or if it doesn't allow you to optimize your management of the resource or extract some heat from the resource, yes, I'd say. I've done it before, and you can do it in other projects. So, yes, I feel you can design and operate and manage a binary facility that would not adversely affect other people in the area.

Q. Okay. Let's flesh that out a little bit, because you said you can design a plan.

A. Right.

Q. Have you seen any monitoring plans proposed?

A. Not yet. That's something --

Q. So you don't really know if the pumping -- let me finish the question; I see you're anticipating it.

A. Yes, I see -- I understand.

Q. Let me finish the question. So you really don't know if the pumping, as proposed, would or would

not adversely affect anyone, any other well in the area; is that correct?

A. You are correct, and that's why a longer-term test always makes sense.

Q. In the book that's there in front of you, I think that's the Los Lobos exhibits. Yes?

A. Yes, sir.

Q. If you can turn to Exhibit 2B, please,

MS. HENRIE: I'm going to object. That's not this witness' exhibit.

MR. LAKINS: Well, it's your exhibits.

THE WITNESS: I'm sorry, sir?

MS. HENRIE: This witness was responsible for Exhibits 1 and 2, which is the first -- the color diagrams. I'm not sure that he's even had a chance to review the applications.

MR. LAKINS: Well -- may I?

CHAIRPERSON BAILEY: Yes.

MR. LAKINS: What he has talked about is equilibrium. He has talked about ranges of magnitude; he has talked about reservoir capacity, all of which go to factual specifics about any given project. What I was going to draw his attention to was the proposed amount of pumping, which is a necessary fact to able to evaluate and speak to equilibrium.

CHAIRPERSON BAILEY: Based on his qualifications under which he was admitted as a witness and based on his comments concerning equilibrium and the other factors, I believe that we should be able to hear his opinion, if nothing else, on Exhibit 2B.

Q. (BY MR. LAKINS) I'd like to draw your attention to Exhibit 2B and A -- 2A and B.

A. Okay.

Q. Are you there?

A. Well, just give me a little bit of time, sir.

Q. Okay. I'm not going to ask you to study that whole thing --

A. I appreciate that.

Q. -- because there are a lot of pages, but on the front page of each --

A. Yes, sir.

Q. -- kind of just below the middle --

A. Yeah. I see it's 3,000 -- three million gallons a day.

Q. For one well?

A. Right.

Q. And look at the other wells.

MR. LAKINS: And I did misspeak on my opening. I think I did say three million gallons a minute, and I did intend to mean a day.

Q. (BY MR. LAKINS) So the totals together of up to six million gallons per day?

A. Okay.

Q. Okay? You with me?

A. Sure.

Q. So do you know any specific information about -- let me rephrase that question. Do you have an opinion of what it would take to reheat a geothermal resource that you would need to reheat six million gallons a day to the production temperature?

A. That's a thing you could calculate on the heat capacity of water. And these permitted amounts are -- whenever I'm permitting for wells, I have an estimate of what I think I might need, and I also have a maximum I might need in the future. And it doesn't necessarily mean that we would be moving that much mass, but ignoring that -- I mean, it's a calculable amount that it would take to reheat it, but if you're asking -- I'm not exactly sure what you're asking.

Q. All right.

A. Because if you're asking how fast, how much water has to mix, that's determined on the reservoir properties, on the size, the depth of circulation. There are a lot of unknowns on that.

Q. I understand that. Now, you just said you

could calculate the heat capacity --

A. Yes.

Q. -- of the reservoir.

A. Well, if I had a calculator and a little time and some paper, yes.

Q. How much time would you need? Could you rule-of-thumb it? In your 20 years of experience, you can't just kind of rule-of-thumb it?

A. Not that calculation. I'm not trying to avoid the issue. I just -- no, not right now. Sorry.

Q. Would it be fair to say that it would be -- a fairly substantial heat capacity of the reservoir would be required to reheat three to six million gallons a day?

A. It would take what it would take to reheat the water, and it's significant. It depends on the resource size and the circulation pattern of the fluid.

Q. You don't know anything about the specific geology of the Lightning Dock Geothermal resource, do you?

A. No. They asked me to come and support the project or answer the Commission's questions relative to operations of the facilities and the general process description.

Q. Let's talk about equilibrium, then, and this

teacup that we've been talking about. Could you describe for me your understanding of this teacup that you and Ms. Henrie were talking about, teacup?

A. Well, they brought it up. I've never -- I've never worked at a facility where things are isolated like that.

Q. What do you mean?

A. Where you pull out of one and it's completely separated from another area, and there are essentially two sealed containers, a teacup. So if that's what you're asking --

Q. I'm trying to understand your understanding of the discussion you had when it came to the teacup.

A. Right.

Q. And so what was your understanding of the teacup? That it was two isolated areas?

A. I mean, that's -- my interpretation of teacup would be that it contains the water in a sealed fashion. Otherwise, it would leak all over you when you drink it. I mean, so that was -- I was using that analogy from the question that was asked of me.

Q. Okay. So is it your understanding of teacup, how the teacup works, that the injection and the production locations are in separate teacups, separate locations?

A. Separate locations, of course. You don't inject in the same place you produce from.

Q. You don't know if the proposed production well is located in the same or a different geologic area, the teacup?

A. No. Given my cursory review of the project, no, sir.

Q. Now, wouldn't it be an assumption, pertaining to equilibrium, that the production and the injection wells would have to be hydraulically --

A. Not necessarily. In a generic sense, not this project specific, but anything -- whenever you change the system dynamics by reducing pumping or reducing injection, you're going to see a system response. And that's what I meant by you will establish a new equilibrium. Not knowing -- that's very generic, but it's the truth.

Q. So reservoirwide?

A. Correct.

Q. And reservoirwide could mean any other given well within the reservoir?

A. Yeah. You may observe a response, or you might not. I don't know.

Q. Some wells could see a substantial drawdown?

A. Or minimal drawdown.

Q. Or it could be minimal drawdown? Some could see the water level go up?

A. Yes, they could. It depends.

Q. You could see a change in chemistry?

A. Potentially, yes.

Q. If you're having to inject under pressure, you could induce hydraulic fracking?

A. No. I think you would have -- that wouldn't be prudent, and you'd want to have permit restrictions on -- that assess the relative frack rating relative to the casing depth. And you'd want to make sure you have a minimal injection pressure, to not exceed that. That's a very common practice at all the operations I've worked at.

Q. But you don't know anything about the specifics here?

A. No. Honest, I wouldn't want to speak out of turn. So --

Q. So as far as this particular project goes, or any given project, it's possible to not reach an equilibrium, isn't it?

A. Hmm. If you are operating at a steady state, meaning you're pumping and injecting at the same rate, you're going to reach equilibrium within a short period of time. Now, equilibrium may be a -- in terms of water

levels, yeah, you'd have a pressure response and a new stabilizer rate quite quickly. So --

Q. But that's based on the presumption that your injection and production are basically in the same reservoir? Yes?

A. No.

Q. No?

A. Because let's say you do have this -- a two teacup. The teacup on one side has to -- will have -- will reach a point where the rate at which you're withdrawing will balance out the rate at which it's recharged in one cup. And the other one will mound up and displace at the rate of which you're injecting, You know, but not -- I don't know. I'd say there would be -- it would be a diff- -- a new equilibrium, yeah, but you would notice that change.

Q. Because what you just described to me --

A. Yeah.

Q. -- was kind of like what you're saying, that you could be drawing from one area that's going to get drawn down.

A. Uh-huh.

Q. And you could be injecting into another area that's going to be drawn down.

A. Possibly, yes.

Q. So that would depend upon the geology of the area?

A. Yes, sir.

Q. Now, you agreed with Ms. Henrie that geothermal is a renewable resource, yes?

A. Oh, yeah.

Q. But it's not infinitely and unlimitedly renewable, is it?

A. No.

Q. And if the reservoir has just, for example's sake, an inflow of 300 gallons a minute of hot water --

A. Uh-huh.

Q. -- and you're withdrawing six million gallons a day and cooling it off and injecting it, doesn't that have the potential of actually degrading the geothermal resource?

A. If you extract more than the heat is able to be recovered, by definition, you are not -- you're not operating it properly, and you would have the potential of declining -- degrading the thermal resource at that time. But given most geothermal systems -- I mean, they're based off a large body of rock, not a -- that is imparting its heat regionally. I think, you know, things would come back over -- beyond our lifetime, you know, or even within a couple of years, if you stopped,

to where it was before. But from an operative standpoint, I would never build a power plant where I am exceeding the rate at which the heat could be replenished. That would be stupid.

Q. Now, you also said that, in your opinion, from your cursory review of the water quality, it was remarkably clean by geothermal standards, yes?

A. Oh, yeah. I've worked at places where the total dissolved solids are ridiculous. I mean, as the water cold -- cools, you could watch solids flake out. And, you know, this is really great water to work with, The geothermal fluid itself, from the -- yeah.

Q. But you haven't analyzed the water quality as it pertains to New Mexico water-quality standards for potable water or ag water or anything of that nature, have you?

A. You said have I analyzed --

Q. Gave a cursory look and said --

A. Right, right, right. I see what you're saying. Right, right.

Q. You haven't -- you haven't gone beyond that, and you can't tell me if the water meets any particular New Mexico drinking-water standard?

A. No, in at any level. But I'd say, generically, at every place I've worked, the geothermal fluid was

always above drinking-water standards and some dissolved constituents. It's just the nature of it being hot water in with rock and dissolving those minerals out. Hotter water dissolves more minerals; it will be dirtier. And some things are more soluble, and so those constituents will be preferentially imparted or dissolved into geothermal fluid, which is the nature of geothermal fluid.

Q. But just as an example, you can't sit here today and say the fluoride in the water is above or below New Mexico drinking-water standards, as an example. You can't tell us that?

A. Wouldn't surprise me, though; geothermal fluid.

Q. Were you provided with the Shomaker report from the pump test that was done?

A. No. I mean, I've been in meetings when people have talked about it, but I have not looked or referred to it. It wasn't a hydrogeologic assessment that was my responsibility.

Q. So you're familiar with the proposed project -- just look behind you -- to pump from Well 45-7 and inject into 53-7 and 55-7, those two (indicating). You are aware that's the proposal?

A. Oh, yes.

Q. But you don't know if pumping from 45-7 and

then injecting into these two wells would in any way adversely affect the reservoir itself; you don't know?

A. No. That's the purpose of a long-term test. And long-term doesn't mean years. I mean, it's like a month, and then you collect a body of data and you evaluate it. And that's a pretty standard procedure.

Q. Now, one of the things that you talked about was, essentially, adapting and adjusting the operation?

A. Oh, yes.

Q. What does that mean? Changing your well --

A. Yes --

Q. -- locations?

A. Well locations. If you're not producing from the right location, you'll notice it quite quickly in your production well. If you're not injecting in the right location, you'll see responses. And that's the purpose of a monitoring program.

I mean, yeah. It's -- it's -- no operator wants to hear that. It's expensive to drill new wells, but it's a resource you're trying to manage. It may even involve reworking existing wells, you know, changing the direction of the bottom-hole completion, changing the depth that the casing is set. There are a whole bunch of things that are -- I've had to do it at many other sites [sic].

Q. So you don't know -- if 45-7 is pumped, you don't know that the recharge could be coming from these injections or from somewhere else, do you?

A. No, not yet.

Q. Do you know anything about AmeriCulture's operations and the locations of their wells?

A. Roughly. I mean, I had one afternoon site visit to drive around and see everybody, in general, and just get a feel for the area, so this diagram made more sense to me.

Q. Well, tell me what you know.

A. Well, I know -- I think the operation's right up here (indicating). And I think they utilized some geothermal well mixed with some groundwater to maintain a temperature to raise the tilapia, but I don't know the location of the wells or the relative volumes of the temperature of the geothermal fluid. I don't know the specifics on that. The aquaculture's great. I think it's a great use of the resource.

Q. You don't know if the proposed project would affect AmeriCulture's wells?

A. No, not until you do a longer-term test. And even if it does, it doesn't -- I mean, you expect some form of regional response, so there are always mitigative measures. I mean, if you have that -- if it

turns out a well drops, you know, 40, 100 foot, if you can deepen the well, set pumps deeper, or even if it -- it depends whether a new equilibrium is established, you know. A pump test would tell you that. An extended test would help you a lot.

Q. If the well lost heat, you couldn't replace the heat?

A. No. And if that's the case, you have affected your neighbor, and you've got to come up -- that's the purpose of the permits and the monitoring plans and how you work with your -- work with your neighbor.

I've been at facilities where we -- the resources impacted were on an onion dehydration facility, and we had to deliver some of the power plant's steam resource over there to help them out. They were there -- you've just got to work with the people trying to co-use the resource.

Q. Based on your years of experience --

A. Uh-huh.

Q. -- what would you do to test whether production from 45-7 and injecting into 53-7 and 55-7, if the water would then be completely recharging 45-7; what would you do?

A. Well, first, it would be nice to see a figure that lists all the different wells in the region, and it

would make sense to monitor water levels in the region and get water chemistry from the region before you start and see if there are some trends available out there ahead of time. And during the -- during whatever the proposed tests are, whether you're pumping from here or injecting there or whatever are your proposed tests, you wold continue to monitor the wells in the region, their water level and their water chemistry. And then you have to work with the hydrogeologic experts to understand what could -- what kind of construct underground could be creating those observed responses.

Q. Would you do a tracer test?

A. Well, to me, that would make sense. That would be -- that would be something I would do. But I would put it where I'm injecting, and that way you see if it returns back to your producer.

Q. You would put a tracer in 53 or 55 and see if it's coming back to 45?

A. I mean, that would make sense, but it doesn't necessarily mean you have to do it. But, you know, it's another set of data.

I mean, I've used tracer tests lots of times. It's been essential in some projects to let me know the rate of return and the percentage of return. You can calculate a lot of reservoir properties in terms

of like sweat-pore volume. On a tracer test, you would have an initial concentration, that you're observing, from what you first put in, versus what's pulled out, and that concentration should rise up and decrease your time from what's pulled up. And then since it's going to be a recirculatory pattern, you'll start having ways of return.

And then there are mathematical techniques to analyze these. I wish you knew more about the mathematic technique, but there are ways that you can decouple those multiple wave forms to assess what they call a sweat volume. You can estimate reservoir volume that you're producing from that's exposed to -- between your injector and injection [sic] couplet. There are a lot of methods on tracer tests.

Q. Have you seen the tracer tests information that was done?

A. No. I -- I -- just quickly, there are blocks of -- lots of reports. I'll admit, there's been a lot of work on this project and a lot of data, and I honestly did not have the time to go through it and wasn't involved on this level of the project early enough to be able to review it.

Q. Let me ask your opinion on this. If you wanted to know -- if you were producing from 45 and injecting

into 53 and 57, from what I heard you describe, the tracer test would tell you that. Would you inject way up here (indicating)? Would you put tracer in a well up here (indicating)?

MS. HENRIE: Objection, relevance.

MR. LAKINS: Well, he's talked about testing.

A. I'll put it this way: My initial opinion would be no, but I also don't know -- I don't know enough about the whole resource or historical programs or historical effort of what they're trying to assess and understand. So I don't know the construct of the previously implemented tracer test. There is always a thought process involved. I wasn't involved with it.

Q. One thing you had talked about was intermixing.

A. Sure.

Q. Could you describe for me what that means?

A. Well, in a generic sense, if you have a geothermal system that is ascending from depth and outflowing towards the surface, there is always going to be a boundary where you're progressively mixing with more and more groundwater. It's just the nature of a geothermal system.

Some are fortunate enough to have direct conduits up to the surface and rupture rights to the

surface pretty unmixed and form a hot springs terrace and evaporate and do all the things that people go to the national parks to see. But most of them are a gentle upwelling and a continued diffusion of dispersion through the shallower valley field.

Q. In that scenario, sort of model you described, of an upflow and then an outflow intermixing --

A. Sure.

Q. -- if you were discharging from the outflow, the hot, and injecting into the plume, wouldn't that result in your injected water not being reheated?

A. It wouldn't be the most efficient thing to do. There might be some indirect path you don't understand or don't know, or there might be other sinks elsewhere. I mean, that's a big what-if. But I would say, intuitively, that it may not be the most efficient thing. It just takes more -- there aren't many holes in the ground here.

I mean, I've worked at projects where we had over 170 wells in the ground, and even then we were still learning, you know. You just -- you adapt your operation as information comes in, and you adjust your operation accordingly.

Q. Now, one thing you had talked about was also proximity of wells.

A. Sure.

Q. In your experience, what kind of proximity have you used?

A. Wow. That's purely dependent on the assessed reservoir properties. I've worked in fields -- it's a hard-rock dominated, fracture-controlled flow system. And you could have wells relatively close to one another, but they're on really -- you know, the water flow would preferentially flow along these fault paths and then get back. So even on a surface location being proximal, you actually are, on a hydrologic connection, more distal. But I've also been in areas where it's so permeable and the water flows radially, like a shallow groundwater would be in sand, that you'd have to space your wells pretty far apart. Otherwise, you'd have negative influence on the adjacent wells. So it really depends on the reservoir property.

Q. In a hard-rock -- a hard-rock-type scenario, that's actually where you're injecting the water, not where you're -- not where you're withdrawing geothermal out; correct?

A. Oh, both, and the other exchanges. I mentioned the alluvium. There are resources out there where you produce and inject from very permeable reservoir material -- post --

CHAIRPERSON BAILEY: Mr. Lakins, do you have any other questions?

MR. LAKINS: I'm done, Your Honor. I'm done. That was my last one.

CHAIRPERSON BAILEY: You are done with your questions?

MR. LAKINS: Yes, Madam Chair.

CHAIRPERSON BAILEY: Why don't we take a ten-minute break, and then the Commissioners can ask their questions.

MR. BROOKS: Madam Chair, I do have one or two questions.

CHAIRPERSON BAILEY: Okay.

MR. BROOKS: Do you want to take them now or after the break?

CHAIRPERSON BAILEY: After the break.

(Break taken, 11:01 a.m. to 11:10 a.m.)

CHAIRPERSON BAILEY: We'll go back on the record.

Mr. Brooks, would you care to cross-examine?

CROSS-EXAMINATION

BY MR. BROOKS:

Q. I don't like to mispronounce people's names. How do you pronounce yours?

A. De Rocher.

Q. Mr. De Rocher, good morning.

A. Well, thank you.

Q. When you testified that the water that is withdrawn from the reservoir and then reinjected stays all the time in the pipe, never expounds [sic] -- and you did testify to that?

A. Yes. Through the power plant service equipment, yes sir.

Q. Now, were you talking about the power production phase of the operation after the facility is built and it becomes operational?

A. Oh, yes. As part of the continual operation, the binary system itself is designed so you don't consume fluid.

Q. Okay. Are you familiar with the procedure that is going to be used in testing, which is the immediate focus of this permit application?

A. Well, yeah. I think I mentioned, also, when I testified, that during well workovers and well testing, you would have surface discharged into collective basins, collective sumps. And so during well workovers, that would be the only thing I could ascertain as part of --

Q. What about in the preliminary testing that is

going to be done immediately as we talk of granting this permit?

A. Right, sir.

Q. Is the withdrawn water going to go through a pipe directly into the injection well --

A. No, sir.

Q. -- or is it going to fill up a reservoir?

A. It is my understanding that they're going to be -- in order to get an accurate measurement of the enthalpy of the fluid, part of the things you have to do is discharge that through a separator, since it's way above boiling. And then you can measure the steam fraction, which will -- most of that -- a lot of that will evaporate. And then you also have the liquid flow that -- that is the underflow from the separator. And you would measure that out of a weir assembly. That would be collected in a catchment basin, and then that fluid would then be pumped back to the injection well.

Q. So in that process, as you distinctly said, there would be a possibility for evaporation?

A. Oh, not a possibility; there would be some.

Q. So there would be some quantitative loss?

A. Oh, yeah. During well testing, yes, sir, and well workovers.

Q. Since the reservoir doesn't -- since the water

goes into a reservoir --

A. Yes, sir.

Q. -- and then goes back out of that reservoir, there would also be a possibility for constituents to be added to that water; would there not?

A. If there was any form of contamination or constituents already in the containment sumps, yes.

Q. Thank you. That's all I have.

CHAIRPERSON BAILEY: Mr. Warnell, do you have any questions?

CROSS-EXAMINATION

BY COMMISSIONER WARNELL:

Q. A few questions or clarifications I was hoping you could provide. You mentioned pump tests.

A. Yes, sir.

Q. Can you define what you mean by a pump test?

A. That would be where -- let me think how to say this. I guess a generic term would be a flow test. This is where you're testing the capability of the well to flow under a variety of back pressures.

So in this situation, these wells will be -- a pump will be set downhole. I think that's the plan. And then the water will then be sent out against the valve.

Bear with me. I'm sorry. Bad soda.

And what you would do then is, you would see the volumetric capability of the well as a function of the back pressures. But, of course, it's dominated by, you know, the pump size you put in the well. So let me think this out here.

The pump test would mean you just continue -- in this situation, you would be continually extracting water and see how the water in the wellbore that it is producing from, how low that water level drops down. And then the reason that's of interest is, if you're not pumping at all and -- say the water level is a couple hundred feet below the ground surface, but once you start pumping and you have your pump set, let's say, 1000 feet deeper within the water table, if you have a very restrictive delivery of fluid to that well, you'll run the risk of that water dropping down below your pump, or really close to your pump. And since that's hot, it will boil around your pump, and you won't able to produce the fluid.

So you want to assess how hard can I draw that fluid out, and that will tell you how deep you've got to set your pump and how hard you can pump the well for a pump test.

Q. So when you're doing this pump test, how are you testing the water depth?

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A. Oh, very good question. When we set the pump, we also have a quarter-inch tube that you set from the surface down along the -- it's attached to the string in which the pump bowls are attached to on the bottom. And that gives you the -- it's open at the bottom, and so any water table above where the bottom of the pump is set exerts that equivalent amount of pressure. And, therefore, you can measure at the top of the tube, with a pressure gauge, the changes in water level.

And we do that in all the wells -- all the fields where we have pumps set, so we can see if there are any changes occurring or the pump's not performing right. Or sometimes the well -- things aren't stable and things change with the reservoir rock and your deliverability to your well changes over time. So as an operator, you always want that in there to be able to monitor what you're doing.

Q. Okay. Thank you.

And you also mentioned mounding. Could you explain to me?

A. Sure. Same thing. Now you're doing the opposite. If you're pulling water out of the ground, you have the potential of drawing water levels down, depending how resistant it is for the water to access the wellbore. The opposite occurs from where you're

injecting. If the receiving rock is really, really permeable, you can inject quite a bit of water and not see any significant water-level change. It'll be -- it'll be able to take anything you can give it.

If the rock around that region is resistive, not very permeable, it will create some back pressure. And what that'll do is, it will make -- as you are shoving the water down into the ground, you'll increase the water levels adjacent to that well. So just like where you pull it out, it might drop down; it might mound up where you're putting it in.

And that's where monitoring injection pressure, wellhead pressures, are important from an operational standpoint.

Q. I believe you testified that you were on location for a number of hours?

A. Yeah. A week and a half ago or so, I drove out to the site with the plant manager just to see what it was all about. Never been there before.

Q. I'm curious. What did you observe when you were out there?

A. Oh, what did I take the time to go look at?

Q. Yeah.

A. I looked at every single one of the wellheads of the wells that the Los Lobos project has on their

site. I looked at some of the monitoring wells around the old greenhouses and went up here (indicating). I think right across here (indicating), there is another little monitoring well here, but I did not go up to the other project area. You know, I just sort of drove right around in this region (indicating).

Q. So those greenhouses houses that you referred to --

A. Yes, sir.

Q. -- are those pretty dilapidated?

A. Oh, yeah. Yeah.

Q. And then I'm curious. Right there --

A. Yes, sir.

Q. -- beside the greenhouses, to the west, by that 55-7 --

A. Yes, sir.

Q. -- there is a green pond or a pit there.

A. Right here (indicating)?

Q. Yeah, I believe so. Maybe down a little.

A. Yeah. Oh, this looks like vegetation, sir. And then right here would be the pond --

Q. Okay.

A. -- their catchment basin (indicating).

Q. Was there anything in that pond?

A. Yes. This pond has water in it right now.

Q. And in between that pond and the greenhouses, it looks like -- for lack of a better word, I'd call it a junkyard.

A. Fair enough.

Q. Old tires, all kinds of debris and material thrown in there.

A. Yes. I mean, that was my drive-through assessment, too.

Q. Thank you. That's all I have.

CHAIRPERSON BAILEY: Commissioner Balch?

CROSS-EXAMINATION

BY COMMISSIONER BALCH:

Q. Morning, Mr. De Rocher. Thank you for your testimony this morning.

I was looking at your rule of thumb, and you said about 1,500 gallons a minute for one megawatt and about 250 degrees --

A. About 290 to 300.

Q. 290 to 300 degrees?

A. Yes, sir.

Q. And the water in the area is about 250?

A. Oh, I -- it was my understanding, of the production fluid, that one of the more recent wells is around 300.

Q. Okay.

A. Yes.

Q. So it's in that ballpark?

A. Yes, sir.

Q. How sensitive is the binary plant to the reduction if the heated-produced water -- if it drops ten degrees?

A. Oh, you -- I need to -- wish I had a pencil.

Q. You can give me a broad range.

A. Yeah. I would say it's -- at those elevated temperatures, around 300 to 270. It's -- I don't know the exact percentage, but it's a few percentages of -- of -- of a negative response. If it drops down a little bit, you've just got to pump a tiny bit harder.

But the colder the fluid gets, the more -- the less heat energy is available in the fluid, and the more you have to pump. And, therefore, because the fluids have less heat energy in them as they get colder, then you've got to pump more. Now you're spending more energy to move that same amount of fluid. So the colder it gets, the more sensitive it becomes to decreasing temperature.

Q. Is there kind of a bottom temperature at which the binary plant is no longer efficient?

A. Wow. That's a good question. For the most economic efficiency -- basically, you design your

working fluid -- for the other half of the binary cycle, you design your working fluid so its properties, when it's a liquid or a gas, are optimized around the temperatures that are available to be extracted through the heat exchange. And there are other -- you can change the working fluid, and you might have to change the turbine blade design if you've seen a significant change of resource temperature. You can adapt to that.

The lowest I've heard it being really effectively used is around 245 or 250. Below that, you start doing things that are a little more exotic, like an ammonia water cycle. There have been facilities in Iceland and Germany that used that power cycle down to 190 degrees Fahrenheit.

Q. I kind of back-calculated from the six million gallons per day and came up with about 4,500 gallons per minute --

A. Okay. So that would be --

Q. -- of produced water, so about three megawatts or so capacity.

A. I guess. I mean, that's roughly, rule of thumb. Yeah, that could be four or five.

Q. So 4,500 gallons per minute, is that kind of in the set of producing geothermal wells that you're familiar with?

A. Oh, wow. I see what you're saying. You're saying: Is 4,500 gallons a minute an expected -- or can you expect that kind of deliverability from a production well? That's pretty high from one, but it really depends on the reservoir properties. I've had wells that produce more fluid. And I wasn't going to go back to energy, because I've also got hotter wells that produced more net energy, but I've had wells that -- they were up to about 6,000 gallons a minute, and they were just pump-limited to how big of a pump and how many holes you could fit in hole. But I'd say 2,500 to 3,000 is a pretty average number for, you know, over hundreds of wells that you kind of expect.

Q. So a six million maximum injection into the two wells is probably a little --

A. Oh, I see what you're saying. Yeah. For injection, what it can take. Hmm.

Q. But the equivalent's about production of 4,500 or so --

A. Right, right.

Q. -- gallons per minute?

A. Again, it depends on the permeability of the host rock adjacent to the wellbore and the well completion itself, how well connected it was along that, if there was any, you know, slough material or damage

when they drilled.

Usually you can inject more than you can produce, because you have the head above versus the drawdown you're pulling from. And so you have that additional pressure opportunity to inject more. That's roughly 65, 70 percent in a lot of the wells that are quite permeable. About 70 percent of what you can inject is what you kind of expect to produce. Again, you go rule of thumb on those.

Q. So you're talking a little bit about some of the economics of --

A. Yes, sir.

Q. -- building one of these plants with the 20-, 25-year loan, that you mentioned?

A. Right, right.

Q. Is there a kind of design line? I know it's a sustainable resource, but is there a design line for a plant like this?

A. Yeah. It depends on your power sale agreement, and typically it's 20 or 30. I've only run into a few that are 25. But I've worked at quite a few facilities that had 30 -- 30-year power sales agreement, and four of these facilities are still running and renew their power sales agreement and are going another decade.

Q. So going back to the question of equilibrium --

A. Right.

Q. -- are these plants run such that they will deplete a resource in X amount of time, or so you can sustain it as long as you'd like?

A. Oh, yeah, yeah. Basically -- it's not like it's a finite bucket and your goal is, within 20 years, to suck that thing dry. It's not like that. You basically have a minimum rate at which you -- a maximum rate, I mean, at which you withdraw heat. Otherwise, you cool off your system too rapidly to be able to efficiently and effectively produce electrical power. So you have to balance your producibility and injectability load relative to the sustainability of the resource. You have to either back down or -- I've been in a couple facilities where we've actually been able to expand. You adapt to what you see as you change.

Q. The reservoir tells you how big the plant can be?

A. And then even after 20 years -- I guess a good example would be the Beowawe well in Nevada. It started out -- it's about 14 degrees Farenheit cooler, the average temperature now, after 32, 33 years, but we also know that when we shut back in, the regional delivery of heat will warm that back up, back to where it was before, in a couple of years. Right now, even after

30-something years of operation, with proper changes of fluid management, they've been able to accept about a one-and-a-half to two degree Farenheit.

Q. So for one of these binary plants, about how long -- again, I'm guessing that this equilibrium is really kind of a moving target.

A. Right. Right.

Q. How long does it take to kind of get to a place where you know your temperature and equilibrium and you can maintain?

A. Oh, Wow. I would say water level -- in terms of the depth of water above where your pumps are set or the water level adjacent to where you're injecting, you would know that within -- within -- let's say 95-percent accuracy within a month. Okay? But you don't know your longer-term trends until you've operated for a while whether you have a half a degree or a quarter degree. It depends on, you know, on temperature decline.

You know, water levels and water-pressure support are much quicker to respond than the temperature removal from the system you're using. If you observe a rapid temperature decline right away, that's not good, you know.

Q. Okay. So once you've done your month-long test --

A. Yes, sir.

Q. -- is it possible to sort of infer or back-calculate the actual --

A. Oh, yeah.

Q. -- services of the resource?

A. Yes. Well, you would be able to estimate whether the rate at which you were pumping and injecting, how much of a relative effect that had on the resource from that. You could project anticipated changes in water level and maybe some projected rates in temperature mining. But could you fully, effectively determine the size? I would say you could have more information to get a better understanding and infer that. But could you quantitatively determine that yet? No.

Let's say you have a situation where you're pulling -- let's say you're pulling a lot of water out, and it cools off really quick. It might just be you're not in the proper location to intersect the fluids to have an optimal recharge. It doesn't necessarily mean your reservoir is small. You just might not be locating in the right place. So I would say it will tell you a lot of information, but you're not done yet.

Q. At some point, ten years in, don't you have a better idea?

A. Every month you operate, you have a better feel, you know. And every time you do more drilling and more well testing, tracer tests -- you know, the more time you implement studies to collect more information you would learn more.

Q. Thank you. Those are my questions.

CROSS-EXAMINATION

BY CHAIRPERSON BAILEY:

Q. Exhibit 1 --

A. Yes.

Q. -- first page shows that the binary plant has a cooling tower.

A. Yes, ma'am.

Q. You said that that is incorrect, that no cooling tower would be used, right?

A. Right. That's why I felt the back side was more representative of the proposed project.

Q. So there would be dependent on air cooling --

A. Yes, ma'am.

Q. -- for condensing the fluids back for reinjection?

A. We're using air cooling to cool down the working fluid that actually runs through the turbine. What you're not doing, you're not cooling -- you're not cooling the two heat exchanges, basically. My apologies

here, but the back side. The heat exchanger in which the produced geothermal fluid comes in heat exchange -- you know, the -- the vessels. It comes in indirect contact. It conductively imparts its heat energy over into the working fluid.

On the other side of the loop, where the working fluid now is heading on its way past the turbine, an exited turbine, and has gone from number three to number four, well, now that working fluid has to be further cooled a little more to make it more efficient to extract more available energy from the heat exchange element when it gets back in contact with the geothermal loop. And, therefore, that heat energy has to be removed from the working fluid, and that's where you'd have the large bank of air-cooled heat exchangers.

Q. So the geothermal fluid for reinjection --

A. Right.

Q. -- would see what kind of a temperature loss?

A. Oh, very good. The typical design point -- you would size the heat exchanger to take about 25 to 30 degrees temperature drop per bank of heat exchangers. It seems to be an efficiency standpoint relative to how much steel you put on the surface. You just line up multiple of those banks to drop your fluid down to -- it depends on your working fluid requirements, but most of

the temperatures I've seen have been between 180 degrees Fahrenheit, that you're reinjecting, and as low as 140. In the winter, you can inject cooler temperatures. But in the summer, you cannot as efficiently cool down your working fluid, and, therefore, the working fluid is entering the heat-exchanger portion and is not able to extract as much heat energy from your geothermal fluid. And, therefore, the geothermal fluid is being injected at a higher temperature.

Q. So it's seasonal changes --

A. Yes.

Q. -- that are inherent, because you're down in the boot heel where it gets extremely hot in the summertime?

A. Unfortunately. That's why I've stated this methodology is not the most efficient way to utilize the heat resource, but it is the most efficient way to utilize and not impact the available water resources.

Q. So does that mean that there is seasonal fluctuation in the amount of power that we generated from the fluids?

A. Yes, and changes through the day. Your lowest amount of heat that would exit the power plant onto the grid would be during the hottest time of the day in the summer, and your greatest amount of power would be

during the coldest part of the day during the winter.

Q. So would there be an increase in pumping during the summertime?

A. Not usually. Usually you try to keep the system in a -- in a steady state of operation. Pumping the wells harder during the summer -- nah. I think -- you know, that's an interesting concept. No, I don't know of anybody that operates that way, but, you know, I never thought of pumping less hard when it's more efficient, let's say, in the winter, but pumping more hard in the summer to extract more heat.

I guess it depends if you've spent the money and invested the capital and have extra heat-exchanger banks available where you could do that kind of change of production rate, you know, in the summer as to the winter. I never thought of it that way.

Q. So the impact on other geothermal users may not fluctuate with the seasons?

A. Right. Under normal -- hmm. Under normal operating circumstances, you would maintain the same rate of pumped geothermal fluid through the binary system, but the water being injected in the winter would be cooler than the water injected in the summer. The summer would be -- the water would be hottest.

Q. Those are all the questions.

CHAIRPERSON BAILEY: Do you have redirect?

MS. HENRIE: Just a couple of questions.

Dr. Bailey, you may have just changed the state of geothermal operations around the country (laughter). That was interesting.

REDIRECT EXAMINATION

BY MS. HENRIE:

Q. Mr. De Rocher, let's go back to the teacup theory we've been talking about.

A. Okay.

Q. In your experience, have you ever experienced -- ever had any encounter with anything that resembles the teacup theory, two separate --

A. Honestly, I've been in some reservoir situations where there has been significant drawdown one area because the communication between injection and that production well was very indirect, and, therefore, we changed the well -- changed our injection location. But I've never seen it where it's 100 percent sealed. There's always been some return.

MS. HENRIE: That's all for this witness.

I would like to move the admission of Exhibits 1 and 2, which are the color visuals of the binary plant.

CHAIRPERSON BAILEY: Any objection?

MR. LAKINS: No, ma'am.

MR. BROOKS: No, Your Honor.

CHAIRPERSON BAILEY: Then they are admitted.

(Los Lobos Exhibit Numbers 1 and 2 were offered and admitted into evidence.)

CHAIRPERSON BAILEY: Would you call your next witness, please?

You may be excused.

MS. HENRIE: My next witness is David Janney.

DAVID JANNEY,

after having been first duly sworn under oath, was questioned and testified as follows:

MR. JANNEY: I'm going to be presenting a brief PowerPoint presentation that includes the screen that you see behind me.

DIRECT EXAMINATION

BY MS. HENRIE:

Q. Before you get started, let's qualify you.

A. Very well.

Q. Please state your name.

A. David Janney.

Q. And where are you employed and in what

capacity?

A. I'm a senior geologist with AMEC Earth & Environmental, in Albuquerque, New Mexico.

Q. And can you please summarize your education and employment background?

A. My bachelor's degree is from the University of New Mexico in geology, and I've taken additional coursework in hydrothermal alteration and groundwater hydrogeology at the University of Idaho and UC Berkeley.

I spent approximately ten years in minerals exploration primarily in the Great Basin of Nevada, and for the last 20 years, I've been involved in the environmental side of geology, and I have worked on a number of projects that involve the evaluation of the hydrogeology of the site.

Q. Are you familiar with the Los Lobos project?

A. I've been familiar with this project since December of 2011.

Q. And what is your role in this project?

A. At this point, I'm primarily responsibile for permitting and compliance for Los Lobos, and recently have become involved in some of the geological and hydrogeological aspects of the project.

Q. And are you familiar with the geology of the subject area?

A. Yes, I am.

MS. HENRIE: I would like to move to qualify this witness as an expert in geology, including the geologic formations in the subject area.

MR. LAKINS: While I don't object to his qualifications as a geologist, I do object to his qualifications as an exert for the geology of the area. I don't think that's been established. He said he's familiar with it, but that doesn't make him an expert.

MS. HENRIE: Can I ask the witness to expound on his qualifications to be an expert of the geology in this area?

A. Well, in the course of my work over the past year, I have reviewed all of the logs for all of the production wells and all of the injection wells, as well as logs for AmeriCulture's three wells, in addition to some of the logs for Rosette state wells up on Section 6 to the north. So I have had a chance to review in detail all of the geologic logs that have been compiled for each of the wells on location.

Q. (BY MS. HENRIE) Have you had a chance to consult with other members of the team?

A. Yes. There is a senior member of the team by the name of Roger Bowers who has been involved as the principal geologist on this project since the mid-1980s,

and for a great period of time, I was in direct communication with him on a regular basis about the geology of the area.

Q. Have you read any reports about the geology of the area?

A. I've read some of the reports that Mr. Witcher has authored, and I've also read Elston and Logsdon's book, from 1983, about the geology of the Lightning Dock Geothermal project in Hidalgo County, New Mexico.

Q. Have you had a chance to visit this project area?

A. Yes, I have.

Q. On more than one occasion?

A. Yes.

Q. Any other information you'd like to bring to the Commission's attention?

A. Not at this time.

MR. LAKINS: Voir dire?

CHAIRPERSON BAILEY: Yes.

VOIR DIRE EXAMINATION

BY MR. LAKINS:

Q. Mr. Janney, you haven't published any articles about the geology of the area?

A. That is correct. The articles I have published have been related to other subjects.

Q. Your entire information is based upon review of others' work?

A. That is correct.

Q. And as far as your own specific work that you have done, explain for me what exactly you have done on the ground out there to examine the geology of the area.

A. Well, the site is entirely covered by alluvium, so you cannot observe, on the project site, any particular aspects of bedrock geology.

Q. Okay. So your familiarity is based all upon others' work?

A. Well, I have walked the ground out there. I've been to each of the wells a number of times, and I have observed the alluvium that covers the site.

Q. Have you written anything whatsoever that's been subject to a peer review?

A. On this site, no.

MR. LAKINS: Madam Chair, I object to tendering him as an expert in geology in an area that he has never written anything, never had anything subject to peer review, and his familiarity of his -- of this witness with the area is based upon the work of others. That, in and of itself, does not qualify someone as an expert for the geology of that area.

MS. HENRIE: Madam Chair, I disagree. I

don't think you have to be published to be an expert. This is a very important witness for us. He's very qualified. He put together the chart you see behind him. What's important is that he has studied those well logs very carefully over the last two years, spent a lot of time working on this project, and is probably the best person to talk about the geology out there.

MR. LAKINS: Madam Chair, while it sounds like Mr. Janney has been qualified as a fact witness, I don't see him qualified as an expert witness.

CHAIRPERSON BAILEY: His testimony will be accepted.

MS. HENRIE: Thank you, Madam Chair.

CONTINUED DIRECT EXAMINATION

BY MS. HENRIE:

Q. Mr. Janney, before we go to the PowerPoint, would you please identify Exhibit 2? Let me hand that to you.

A. That's the G-112 application we filed for injection into Well LDG-53-7.

Q. And is there an additional exhibit there as well?

A. The same G-112 application for injection into Well LDG-55-7 and an accompanying attachment.

Q. Can you look at those quickly and tell me

whether anything is missing?

A. I believe these are the completed G-112 packages. However -- they are complete.

Q. Do they include well logs and some of the additional information that gets submitted in connection with these packets?

A. Well, the specific well log is not attached to the G-112 form. That's another separate form that's required to be submitted to the OCD. I believe that's a G-105, which is part of the entire G-112 or permit to inject application package.

Q. Can you identify the location of Well 53-7?

A. Yes. Well 53-7 is located on the north end of the property controlled by Lightning Dock Geothermal, or Los Lobos Renewable Power.

Q. And can you identify the location of Well 55-7?

A. Well 55-7 is immediately west of the greenhouse complex, down -- approximately 2,500 feet south of Well 53-7.

Q. For each well -- each of these subject wells, 53-7 and 55-7, have you also filed with the OCD a plat showing the location of the proposed injection well, the location of all other wells within the radius of one mile and indicated a perforated or open-hole interval for each of the said wells, together with ownership of

all geothermal leases within that one-mile radius?

A. Yes.

Q. For each of the subject wells, 53-7 and 55-7, have you also filed with the OCD the log of the injection well, if it's available?

A. Yes.

Q. And those logs were available?

A. Yes.

Q. For each of the subject wells, 53-7 and 55-7, have you also filed with the OCD a diagrammatic sketch of the proposed injection wells showing casings strings, including diameters, setting depth, quantities used and tops of cement, perforated or open-hole interval, tubing strings, including diameters and setting depth, and the type and location of the packers, if any?

A. Yes.

Q. For each of the wells, 53-7 and 55-7, did you or your office send the OCD G-112 application -- and that's without the plat, the log and the sketch -- to all other geothermal lease owners within a one-half mile radius of the proposed injection well?

A. Yes.

Q. Have you had the opportunity to review OCD's draft conditions of approval that they filed on March 13th?

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A. Yes.

Q. And will you be prepared to walk the Commission through those at the appropriate time?

A. Yes.

Q. You have prepared a PowerPoint presentation. Is that presentation the same as Exhibit 3? Let me hand you Exhibit 3.

A. It's been slightly modified since that exhibit was submitted.

MR. LAKINS: Madam Chair, I'm going to object to any exhibit that we have not been previously provided, the one I was just told was modified. And also, in the PowerPoint presentation which we were provided and which may be what the Commission has as well, there is no slide five, which may be the cross section. The fact that we were not provided a slide five, I would object to using even any slide five here today because it hasn't been provided.

MS. HENRIE: Madam Chair, the exhibits that were tendered are the exhibits that we're going to tender. The slide show will vary and that's for purposes that are illustrative, but not being moved into evidence. So what you have in your binder is, in fact, the exhibits that we are prepared to tender. The fact that we've made some charts --

And, Charles, that chart, I believe, was available when we had our expert exchange.

We were not proposing to tender the chart as an exhibit. We brought it for the Commission to look at, to help explain the geology of the area.

MR. LAKINS: If it's only a visual aid, I'm okay. It's just that I was concerned that there was something being tendered that I hadn't been provided.

CHAIRPERSON BAILEY: I think that's been explained.

MR. LAKINS: Yes, ma'am.

Q. (BY MS. HENRIE) Great. Please proceed with the PowerPoint.

A. Okay. I think everyone knows where the project is located, but it's down in the southwest corner of the state, approximately 50 miles southwest of Lordsburg.

And we're really here to talk, today, about two particular issues that AmeriCulture raised in its letter to the OCD of December 26, and those are primarily issues of water quality and water quantity. And in that letter, dated December 26, 2012, AmeriCulture stated that AmeriCulture State Well #1 is in direct hydraulic connection with the production interval in Well LDG-55-7. In addition, he stated that "any injection scenario that forces AmeriCulture to

subject its fish to disposed fluids from a geothermal power plant or fluids that are substantially different in water chemistry is totally unacceptable."

So the entire point of this presentation today is to discuss the direct or indirect hydraulic connection between our production wells and our injection wells and the AmeriCulture state wells, and to discuss the similarity in chemistry between our production and injection wells and the AmeriCulture state wells.

I'm just going to provide a brief overview of the geology of the area. The Animas Valley, or the Animas Basin, is a closed basin, so all of the water that falls into that basin stays in that basin.

The Lightning Dock Geothermal project is located here at the star (indicating), and it is bounded to the east by the Pyramid Mountains and to the west by the Peloncillo Mountains. Also, this is part of the basin rings. This is a graphic province of southwestern New Mexico, and so the ranges to the west and the ranges to the east are uplifted relative to the valley. So this is a similar situation as to what we have with the Sandias being the horst, or the high, and the valley down in Albuquerque being dropped down relative to the height of the Sandias.

There are a couple of things that I would like to point out on this particular figure. Regional groundwater flow is from southeast to northwest, in this general direction here (indicating), and there are also a number of fluorite mines, mid-tertiary fluorite mines, that occur in the Pyramid Mountains east of the Lightning Dock Geothermal site. And these fluorite deposits are mid-tertiary in age and are partially responsible for the high-quality concentrations that we see in groundwater throughout the valley.

So with that, I'd like to go to the site slide and briefly discuss the wells that we are planning to use in the upcoming test and for full-scale production and injection. As you know, we propose to pump from LDG-45-7, which is down here on the southwest end of our cross-section line. And it is very close to the proposed power plant that Los Lobos intends to build.

To the east of that are the former -- are the greenhouses that are owned by Rosette, Inc., that were formerly used for production of roses, and the AmeriCulture aquaculture facility is located in this area here (indicating).

So we propose to pump at a rate of approximately 1,500 gallons a minute for the upcoming

aquifer pumping test, and inject after the water goes into the centralized pond, which is south of LDG-55-7, into 55-7, as well as inject into 53-7 and 63-7.

I might add that 55-7 is the oldest well on the location. It was drilled in 1984 and completed in early 1985, and subsequently Raser, or Los Lobos Renewable Power, have drilled the 45-7, the 53-7 and, most recently, the 63-7.

I think it's interesting to note that well 63-7, that was completed last year, was designed and permitted as an injection well, and when that well was submitted to OCD and the injection application submitted to AmeriCulture, there were no protests on using that well as an injection well. It's only subsequently, that we have proposed injecting into 53 and 55, that AmeriCulture raised a protest of injection into those two wells.

On the north end, we have the AmeriCulture State Well #1, which is their shallow production well, and AmeriCulture State Well 2, which is their deeper geothermal well, which, to my knowledge, has never been produced. We currently understand that AmeriCulture pumps from AC State 1 to supply its heat source for its aquaculture operation and blends that water with cold water that it gets from its cold-water well out in

Section 12, approximately a mile and a half to the west of their location. So that well is approximately a mile and a half out to the west.

We've also included a Rosette State Well #3 on this particular cross section because it's relevant as far as its completion depth is concerned, the formation it's completed in and the type of water that is extracted from that well.

I'd like to point out that the Rosette State Well 3 and the AmeriCulture State Well 1 are both completed in shallow alluvium, at a depth of between 400 and 440 feet below ground surface, and all of our proposed production and injection wells are completed in either tertiary volcanics or the underlying Paleozoic rocks. So Lightning Dock or Los Lobos has no wells that are completed in a shallow alluvium. So just on that alone, there could be no direct alluvial connection between any of the AmeriCulture wells -- the AmeriCulture State 1 well and the Los Lobos deeper production and injection wells.

So I'd like to go to the cross section that was represented by that yellow line in the previous slide, and, again, we're going to start down on the southwest and move to the northeast. LDG-45-7 is drilled to a depth of approximately 2,900 feet, and it's

cased to a depth of approximately 1,680 feet. And the top of the production interval there is in the tertiary volcanics, and the bottom portion of the production interval there is in the underlying Paleozoic sediments.

Next is LDG-55-7. Again, this is the oldest well in the area. The production casing goes down to a depth of approximately 1,030 feet, but, again, the production interval in that well ranges on the bottom of the tertiary volcanics to the upper portion of the underlying Paleozoic sediments.

Moving further to the northeast, we come to 55-7. As you can see, the production casing on that well is also down into the tertiary volcanics below the alluvium. That production casing is set at a depth of approximately 1,747 feet.

Moving to the 63-7, the most recently drilled well, that well is drilled to a depth of 3,400 feet, and the production casing in that well is set to a depth of 1,400 feet.

So let's move further to the AmeriCulture wells. AmeriCulture currently pumps out of State Well #1. It does not use State Well #2. So its production interval -- this well is drilled to a depth of 400 feet, and its production interval is between 300 and 400 feet, if I understand the construction details on that well

correctly. It has never, to our knowledge, set a pump in State Well 2. And Rosette State Well 3 is here, for a point of reference, in that it was one of the wells that was monitored during the aquifer pumping test that Los Lobos performed in January of 2012.

Q. Before you move off of that slide, can ask you a couple of more questions?

A. Certainly.

Q. If you will take a look at Exhibit 4, I'd just like you to identify what Exhibit 4 is for the record and let us know the relationship between Exhibit 4 and the chart that you've just presented, the cross section you've just presented.

A. These are all the State Well records and logs that Los Lobos submitted to the Office of the State Engineer for Wells 45-7, 53-7, 55-7 and 63-7.

Q. And is AmeriCulture State Well 2 there as well?

A. Yes. The last one is AmeriCulture State Well 2.

Q. And is this information up to date for the visual [sic] that you've just shown us on that slide?

A. Yes. All of this information on the slide is a matter of public record and is on file with both the OCD and the Office of the State Engineer.

Q. Even though you didn't include this as a slide,

people can look at these well logs to recreate the information?

A. That's correct.

Q. Thank you.

A. Yeah. This is a general geologic representation of what we have in these wells. Some of the details -- the detailed mud logs have not been included in this for the purposes of ease of presentation.

Q. Thank you.

A. So I want to reiterate, based on this slide, that our production interval from the 45-7 is in the uppermost portion of the tertiary volcanic section and the lower portion -- excuse me. It's in the lower portion of the tertiary volcanic section and within the upper portion of the underlying Paleozoic rocks. And it is also in the lower portion of the tertiary volcanic section in 55-7 and the upper portion of the Paleozoic rocks in 55-7.

We also believe that the injection interval in 55-7 will also be primarily in tertiary volcanic rocks, but we also believe that the injection level out of the 63-7 would be in the lower portion of the tertiary volcanic rocks, as well as the upper portion of the underlying Paleozoic rocks.

You can also see, from this particular cross section, that the elevation of the contact between the alluvium and the tertiary volcanic rocks in Well 55-7 and Well 63-7 is higher relative to that contact in 53-7 and 45-7. And we do indeed believe that there is a structure, a fault, that separates the block that Wells 55-7 and 63-7 are located in from the block to the west that Wells 45-7 and 53-7 are in.

However, the aquifer pumping test that was conducted in January of 2012 does not indicate that that fault is any kind of major impermeable barrier or boundary to flow. And, particularly, in the alluvial section, there would not be any flow restrictions in the alluvium based on that fault, because that fault is older than the alluvium and has not created a boundary or offset the alluvium.

So with that in mind, I'd like to proceed to some laboratory analytical results. And I apologize, it's going to be very difficult for you to see these.

Q. Now, this slide is not in the exhibits, so you're going to have to rely on what's on the screen.

A. But the purpose of this slide is to show in milligram-per-liter concentrations the similarities between the waters from the samples that were collected from all of the wells that we propose to pump from and

inject into, as well as compare some of the AmeriCulture water quality to our water-quality samples.

And it's going to be really difficult, I'm afraid, for you to read this. But these samples were collected over a period of time ranging back to 2008. And, perhaps, some of the samples that Mr. Witcher collected are even older than that. They are in the 2001 to 2003 range.

But the purpose was just to show you the milligram-per-liter concentrations here. It's much easier to graphically represent the similarity or dissimilarity between waters at Lightning Dock by a couple of diagrams, one in particular called the Piper diagram, which uses these milligram-per-liter concentrations directly to graphically represent where these concentrations of anions and cations fall on a ternary diagram.

Another commonly used practice for graphically representing water quality is the Stiff diagram, which also shows concentrations of anions and cations in a little bit different fashion. They're actually converted to milliequivalents per liter.

Because it's so difficult to read this slide, I'm going to move on, but just for instances of comparison here, one of the constituents that's commonly

referred to is the fluoride concentration in the geothermal waters of the system. And, in general, the concentration of fluoride in the Los Lobos wells ranges from about 8.36 to about 14.2 milligrams-per-liter fluoride. And just as a comparison, the flouride concentrations in the AmeriCulture state wells range from about 8.3 or 8.99 to about 10.1 parts-per-million fluoride. So there are no substantial differences, really, in flouride concentrations within the geothermal reservoir there.

And that is one of the elements that exceeds New Mexico Water Quality Commission control maximum concentration limits. I believe the MCL -- the WQCC is 1.6 milligrams per liter. So you can see that the Los Lobos wells and the AmeriCulture wells exceed that MCL concentration by at least four times.

The TDS is also represented on the bottom here, second to the -- third from the bottom there, and as Mr. De Rocher stated earlier, this is very clean, relatively speaking, geothermal water. Our total dissolved solids values in the Lightning Dock wells range from about 1,000 parts-per-million total dissolved solids to about 1,400 parts-per-million total dissolved solids. And the AmeriCulture wells range from about 890 parts-per-million total dissolved solids to

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approximately 1,100 parts-per-million total dissolved solids.

So I'd like to move on here, and --

CHAIRPERSON BAILEY: Before we begin that second thought, let's have some lunch.

THE WITNESS: Yes, it is that hour. I apologize. I was not watching the clock.

CHAIRPERSON BAILEY: Let's reconvene at 1:15.

(Break taken, 12:03 p.m. to 1:15 p.m.)

CHAIRPERSON BAILEY: Back on the record.

Mr. Janney was about to discuss the Piper plot.

A. Thank you. This particular Piper plot was compiled by John Shomaker & Associates. John has not returned from lunch, but they are one of the hydrogeologic consultants that Los Lobos has engaged to assist them with this project. And a Piper plot is a widely used method of graphically representing water quality and waters of similar chemistry.

And as you can see from this -- and this Piper plot includes water quality from a number of Los Lobos wells, as well as AmeriCulture State Well #1 and Rosette State Well #3. Keep in mind that AmeriCulture State Well #1 is the well that they are currently

producing from, and the Rosette State Well #3 is the well off to the northeast, on Section 6, which is a state lease.

I just want to show, with this graphical representation that includes four Los Lobos wells, again, AC State Well 1 and Rosette State Well 3, that all of the dots fall basically within the same field on this Piper Plot, indicating that as far as these cations and anions are concerned, these waters are really identical quality. And that is the snapshot graphical representation.

You can see that they're sulfate-rich waters, and they fall both on the ternary -- ternary diagram, near the sulfate end member, and they're also rich in sodium, as you can see, relative to calcium and magnesium on the axis here.

So this answers, as least as far as this Piper plot is concerned, the claim that there are substantial differences in water quality between the water that Los Lobos will produce and inject and the water that AmeriCulture currently pumps for its aquaculture facility. Based on this Piper plot, there are no substantial differences in water quality between the Los Lobos geothermal fluids and the AmeriCulture geothermal fluids.

There is another common way of representing water quality. In this particular case, it's a Stiff diagram. Stiff developed the Stiff diagram; I believe it was in 1941. And Piper came along behind him a little bit later, in 1944, and developed his diagram.

But Stiff used a milliequivalent-per-liter conversion from the milligram-per-liter concentrations that are represented on the Piper diagrams. And in that initial slide I showed you with the Excel table, those concentrations were represented in milligrams-per-liter. So you use a conversion factor until you come up with milliequivalents per liter for the anions and the cations in the geothermal fluids of Lightning Dock.

And on the left-hand side of this diagram -- there we are; -- we're out at the positive 15 milliequivalents-per-liter axis, over here on the left (indicating). And as you can see, for all of the waters in the Los Lobos wells, including 45-7 -- we have two samples from 45-7, one sample from 53-7, two samples from 55-7 and one sample from 63-7. As far as the milliequivalent-per-liter concentrations of cations, sodium and potassium are concerned, they all fall very, very close to the 15 milliequivalents-per-liter line on this particular Stiff diagram.

So that shows, as far as sodium and

potassium ions are concerned, that those concentrations are nearly equal in all of the Los Lobos wells.

Moving to the right -- and I apologize; it's a little bit hard to see. But calcium is represented by this point (indicating) on the Stiff diagram. And if you remember back to the previous slide, these particular waters are rich in sodium with respect to calcium, so it's not surprising that the sodium and potassium are further to the left near the 15 milliequivalent-per-liter mark on the axis. But you can see that the calcium concentration falls right at about one to two milliequivalents per liter for all of the Los Lobos wells.

These waters are not rich in magnesium at all. The magnesium concentrations are even lower and less than one milliequivalent per liter throughout all of the Los Lobos wells.

On the anion, or the negative side of the Stiff diagram, we have represented chloride here, which is up at the top. And you can see that the chloride concentrations are very similar all the way down for Wells 45, 53, 55 and 57.

Carbonate and bicarbonate are next. I apologize; I did not have a full analytical steep [sic] for this initial 45-7 sample. But the point in bringing

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this sample to the diagram is to show that the fluoride concentrations are nearly equivalent for all of the Los Lobos wells.

So let's go over and compare the Los Lobos water quality to the water quality in AmeriCulture's wells. As you saw here with the Los Lobos wells, we're running right about 15 milliequivalents per liter for sodium and potassium, and for these particular samples represented here, the range is approximately 13 to 15 as well. So with respect to sodium and potassium, the waters are very, very similar.

In comparing the calcium between AmeriCulture State Well 1 and State Well 2 and Rosette, we also see the calcium milliequivalent-per-liter concentrations are very, very similar. They're ranging in between two and three milliequivalents per liter in the AmeriCulture wells, as they do in the Los Lobos wells.

And magnesium, again, for the AmeriCulture wells, falls very near the zero line, as does the magnesium concentrations in the Los Lobos wells.

Going to the negative side of the Stiff diagram, let's first look at chloride. And as you can see, the chloride concentrations for all of the AmeriCulture wells and the single Rosette well are

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between two and three-and-a-half milliequivalents per liter, and those are very similar to the same concentrations, you can see, for that constituent in the Los Lobos wells.

You can also see that the AmeriCulture wells are enriched in sulfate. This far right point on the Stiff diagram is sulfate, and when you compare that to the sulfate concentrations on the Los Lobos wells, you can see that those concentrations all centered right about ten milliequivalents per liter.

So with respect to all of those cations and anions -- sodium, potassium, calcium, magnesium, chloride, carbonate and bicarbonate and sulfate -- those concentrations are very similar, and there are no substantial differences in water quality between the Los Lobos wells and the AmeriCulture wells. Even though the AmeriCulture wells, with the exception of AmeriCulture State Well #2, are completed in the shallow alluvium, the water quality is still very, very similar because of the upwelling geothermal fluids in the area.

So lastly, I'd like to talk about fluoride. We passed over that the first time through here. But as I stated on the initial slide that was difficult to read, the fluoride concentrations in the Los Lobos wells generally range between about 8.3 to 14.2 milligrams per

liter. And as you can see, by representing this point (indicating) on the Stiff triangle, the fluoride concentrations in the AmeriCulture wells are very, very similar. They're a little bit lower, but they are not substantially different. They range from about 7.5 to 9.88, as I recall.

So we have two different graphic ways of representing water quality. One is the Piper diagram; one is the Stiff diagram. And as you can see from these graphical representations, which can be correlated back to the initial Excel spreadsheet that showed the milligram-per-liter concentrations, these waters are of very similar quality, and there are no substantial differences in these waters.

So in conclusion, I want to go back to the two things that AmeriCulture stated in its letter to David Brooks, dated December 26th, 2012, and indicate that as far as Los Lobos' production or injection wells are concerned, there may indeed be a hydraulic connection between the Los Lobos wells and the AmeriCulture -- not only the AmeriCulture State Well, but the Rosette State Well #3 to the north. But there is no aquifer pumping test data at this point that suggests that production and injection in any of the Los Lobos wells will have a significant drawdown on any of

AmeriCulture's wells.

And I want to go back to a statement that Ted made when he was a witness. We fully expect to see changes in the elevation of the water surface when we do our initial testing and when we are actually in full-scale production and development. But we expect that in that period of time, between approximately 20 and 30 days, that equilibrium is going to be re-established. So we expect perturbations, but that's why we have a monitoring plan, and we will make adjustments according to the changes that we see while we're testing or while we're in production.

Secondly, we have laboratory analytical results for all of the Los Lobos production and injection wells and a number of AmeriCulture's wells. And based on that chemistry, that laboratory analytical data, there are no substantial differences in water quality or chemistry between the Los Lobos production and injection wells and the AmeriCulture wells.

And I wanted to reiterate at this point, that since this is going to be an air-cooled system, there are not going to be any chemical additives to the water that we produce and then inject. So there are not going to be any substantial changes -- or any changes at all, really, in water-quality chemistry or water quality

while we produce and inject back into the formation.

So with that, I'd like to close.

Q. Thank you, David. I have some more questions for you.

Could you relate these conclusions back to the teacup theory, the idea that there are two separate aquifers or that there is a structural fault or something that is keeping the water from moving around?

A. Well, I think if you go back to the aquifer pumping test that Los Lobos conducted in January of 2012, during that pumping test, 45-7 was pumped at a rate of approximately 1,000 to 1,500 gallons per minute. And injection was taking place in LDG-57 -- or 55-7, and there was also minor pumping from 53-7. At that particular time, LDG-63-7 had not been drilled yet. But the depth to water was monitored in Rosette State Well 3 when that pumping test was conducted, and there was minimal drawdown in State Well 3. So that does indicate that there is a hydraulic connection. And that hydraulic connection can be seen in alluvial wells like State Well 3, relative to pumping from a deep bedrock well like 45-7.

So that test was not run to equilibrium. However, based on the drawdown in 45-7 that was documented and subsequently summarized by Dr. Shomaker,

it appeared that at the end of that ten-day period of time, we were nearing equilibrium, and, therefore, we would not have expected to see much additional drawdown in Rosette State Well #3 out to the north.

So that indicates that there is connectivity. There is porosity. There is permeability, and no significant boundary conditions exist.

Q. And let's talk about the analytical data as well. What does that suggest with regards to the coffee-cup [sic] theory; the fact that the water is all the same, that the water appears to be -- you said very similar, no substantial differences?

A. Well, I think the aquifer pumping test data and the laboratory analytical data support one another, in that there is mixing taking place. This geothermal system is upwelling through fractures, conduits, faults, if you will, and it's mixing with the cold alluvial water that's moving from south to north through valley. And within that zone of mixing, which may be that entire 640 acres, as long as you're in the hot part of that mixing zone or the elevated-temperature portions of that mixing zone, those water qualities are going to be very similar.

It's not until you get outside, into the

colder water, that you see substantial differences in water quality.

For instance, if you move down to the south, you may see fluoride concentrations on the order of two to four-and-a-half parts per milligrams per liter relative to the 9 to 14 that we see in the center of the geothermal upwelling area. But, then again, those fluoride concentrations are also elevated with respect to WQCC and MCLs.

Q. With regard to State Well 1, do you know at what depth the pump is set?

A. I believe it's at 240 feet.

Q. And has OCD issued other injection well permits, you know, this G-112 process? Have other wells been approved for injection by Los Lobos?

A. Yes. 63-7 is currently approved for injection.

Q. And I think you mentioned that AmeriCulture did not protest 63-7?

A. They did not.

Q. There was previously an injection well called 51-7. Do you know where that was located?

A. It was actually closer to the AmeriCulture facility. Let's see. I believe it would have been generally in this area here (indicating).

Q. Are you aware, when AmeriCulture protested the

State Engineer diversion permit a couple of years ago, did they protest Well 51-77?

A. I do not believe that they did.

Q. And has 45-7 been approved for injection?

A. Conditionally.

Q. And so you went through the G-112 application process. Did you mail notice to AmeriCulture?

A. That is correct.

Q. Was 45-7 protested?

A. It was not.

Q. So, Mr. Janney, in your opinion, would granting the pending G-112 applications, the injection applications for Wells 55-7 and 53-7 -- if OCD grants those applications, would it be in the interest of conservation?

A. I believe it would be.

Q. Why do you say that?

A. Well, there is no aquifer pumping test data to suggest that the overall temperature of the geothermal reservoir is going to be compromised by pumping from 45-7 and injecting into 55 or 53, or 63, for that matter. The system will reach equilibrium with time, and based on current aquifer pumping test data, we think that period of time is in the range of 20 to 30 days.

Q. And in your opinion, would granting the pending

G-112 applications -- again, that's for the 53 and 57 -- or 55. Excuse me. Would the granting of those applications prevent waste?

A. Well, during the testing portion, this 30-day test, certainly we're going to have some losses from boiling or flashing and evaporation when we discharge from the 45-7 into the 55-7 centralized pond. But other than that particular loss of heat and the water resource, there will be no waste as far as the pumping and/or production facility is concerned. Once we get to production and injection, it's an entirely closed-loop system.

Q. Okay. I think you mentioned that the Burgett-Rosette facility is not in operation right now?

A. That's correct.

Q. Are you aware of any other geothermal users other than AmeriCulture?

A. No.

Q. Are you aware of how AmeriCulture deals with its spent geothermal fluid?

A. To my knowledge, the AmeriCulture State Well 2 produces hot water that's blended with cold water from their well out to the west, in Section 12, at approximately -- inflow to the system rate of 100 gallons a minute. And to my knowledge, that water is

just discharged to the land surface on the west side of the facility.

Q. So let me back up. I think you said State Well 2. Did you mean State Well 1?

A. Yes. Thank you.

Q. So State Well 1, you said, blends with freshwater runs in --

A. That's right.

Q. -- fish facilities. After the water is used in the fish farm, your understanding is, it's discharged?

A. Discharged to surface.

Q. And when AmeriCulture did well tests on State Well 1, pump tests, closed the well, are you aware of how that water was discharged?

A. I believe that was also discharged to surface.

Q. So in terms of waste, there is some waste of the resource already going on after --

MR. LAKINS: Objection. Calls for a legal conclusion.

MS. HENRIE: That's fine.

Q. (BY MS. HENRIE) Let's see. Let me talk again about Wells 53-7 and 55-7. They're already drilled, right?

A. Correct.

Q. In your opinion, are those wells cased,

cemented and equipped in such a manner that there will be no danger to any natural resource, any geothermal resources, usable underground water supplies and surface resources?

A. That is correct. I have reviewed the casing schedule on each of those wells and the cement bond log on the 55-7 and believe that to be true.

Q. Has OCD accepted logs for these wells that show the same?

A. They have.

Q. In your opinion, would the proposed injection through 53-7 or 55 contaminate any underground sources of drinking water?

A. I do not believe that that will take place.

Q. And in your opinion, would the proposed injection cause waters of the State of New Mexico to exceed applicable water-quality standards?

A. It would not. I mean, we have yet to establish background concentrations for some of the constituents of concern. We have a discharge permit that establishes what wells would be monitored and the frequency that they would be sampled. And through the course of sampling over time, we will establish background concentrations where constituents are concerned.

Q. Where background native natural waters already

exceed the water quality standards --

A. Such as fluoride.

Q. -- like in fluoride, these injections will not cause a greater exceedance because the water is pretty much the same?

A. That is correct. There should be no substantial change in fluoride concentrations through commercial production and injection.

You have to allow for a certain amount of variability in natural systems like this, and I think the fluoride concentrations that we see in the samples that have been collected from our production and injection wells in some ways bracket most of that range. But we could see lower concentrations of fluoride in some of our wells after they've been pumped for a while, and we could somewhat higher concentrations. But I wouldn't expect those changes to exceed ten percent of what we've already seen.

Q. So it's within the order of magnitude?

A. Oh, it's much lower than the order of magnitude change.

MS. HENRIE: Madam Chair, I don't have more questions for this witness. I'll go ahead and pass him for cross-examination.

CHAIRPERSON BAILEY: Do you have questions

for cross-examination?

MR. LAKINS: Yes, ma'am.

CROSS-EXAMINATION

BY MR. LAKINS:

Q. Now, Mr. Janney, you are aware that AmeriCulture has a domestic well, A-444, right next to their facility?

A. I wasn't aware that that was currently being used to supply water to their residents.

Q. That's not what I asked. You are aware that there is a domestic well right next to their facility?

A. Well, I'm aware of all the wells within a half-mile radius of the wells that we've proposed to inject into or produce from. I have seen those on the maps that we've submitted with our injection applications.

Q. You're familiar with their domestic well, A-444?

A. I've seen it on the State Engineer's well database output, but I have not physically inspected that well in the field, and I am not aware of its completion details.

Q. Are you aware of the fluoride content in that well?

A. I am not. I have not seen any chemistry from

that well.

Q. So all of your information that you rely upon, based on your opinion that the proposed injection would not contaminate any underground drinking water, did not include the chemistry for the domestic well that AmeriCulture has; is that correct?

MS. HENRIE: I'm sorry. I need to object. I don't think we've established that this well actually is used as a source of drinking water.

MR. LAKINS: It's a permitted well. Whether it's being used today or it's not being used today, for whatever purposes it may not be used or may be used, it's a permitted domestic drinking-water well.

MS. HENRIE: That's not being used.

CHAIRPERSON BAILEY: I think Mr. Lakins has a point, that it's a permitted domestic well, so whatever the question is.

Q. (BY MR. LAKINS) Do you need me to repeat the question?

A. Please.

Q. Okay. So your opinion that the proposed injection would not contaminate any underground drinking water does not take into account the chemistry of AmeriCulture's domestic well on their property; is that correct?

A. I'd like to see that chemistry before I drew that conclusion.

Q. So I'll take that as a yes?

A. I have not considered the chemistry of that well.

Q. And it's your opinion that there would be no more than a ten-percent change in the chemistry?

A. Well, I don't want to get into a statistical discussion of what kind of changes we would see, but based on what we have collected from our wells currently, there is a greater than ten-percent difference in some of those concentrations, but it's certainly not twice. Everything is less than twice what we see in our lowest fluoride concentration levels versus our highest fluoride concentration levels.

Q. Okay. Because you said ten percent. That was your testimony a minute ago, and I just want to know where you stand.

A. Full-scale production and injection, I would expect to see ten percent or less change in fluoride concentrations in our wells.

Q. Now, it was a conclusion of yours that your proposed geothermal production and injection wells may be in hydraulic communication with AmeriCulture State Well #1?

A. Well, I think they are. I think the aquifer pumping test data shows that they are.

Q. And on the diagram behind you, which you had used as a slide, the AmeriCulture State Well 1 is the one that is totaled up to 400 feet, correct?

A. Correct. It's an alluvial shallow well.

Q. So the shallow well, then, is -- or may be in hydraulic connection with all the deeper wells?

A. Everything is connected. You cannot say that -- you cannot say one level of connection is greater than another level of connection.

Q. Because on your direct, what you said -- correct me if I'm wrong in remembering what you said. From my notes -- was that the proposed injection intervals would be separate from and not impact the shallow wells.

A. Well, what I believe I said was that the wells that Los Lobos produces and injects into are all completed either in tertiary volcanic rocks or Paleozoic sedimentary rocks. And the wells that AmeriCulture currently produces from, State 1, is completed in alluvium. But certainly there is water flowing from the fractured bedrock into the alluvium.

Q. So you can't say for certain, then, that the proposed injection interval is separated from the

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shallow wells?

A. I can say that the completion interval in our production and injection wells is in bedrock and is substantially deeper than the bottom of the casing in AmeriCulture's shallow alluvial wells.

Q. But you do recognize that they are still hydraulically connected?

A. Yes. And my response to that is, so what? I mean, we're going to reach equilibrium with this system after a certain period of time.

Q. Tell me, how do you define equilibrium?

A. Water levels are going to be static for a period of time. The pumping and injection is going to be balanced in such a way that it maximizes the heat and moves from the geothermal system to produce power. And I'm not going to go down that road extensively. If Mr. De Rocher wants to comment further on that, I'd be happy to bring him back.

Q. Well, you testified that equilibrium would be breached. That's your testimony. And so --

A. Based on the aquifer pumping test data that we saw from January of 2012, it appeared that we were getting close to reaching alluvium at the end of that ten-day period.

Q. I'm just asking you to define what you mean by

equilibrium.

A. Well, as far as groundwater level is concerned, that we see no substantial drawdown or mounding once we reach a certain point. Those things are relatively static. It's not to say we're not going to see drawdown, or we're not going to see mounding where we inject. It's just that those two things are finely balanced.

Q. So you don't know if equilibrium could mean that AmeriCulture's State Well 1 runs dry?

A. That would be extremely unusual.

Q. You don't know?

A. It is my professional opinion that that will not happen.

Q. But you did see changes in water levels in the surrounding wells when you did the pumping test?

A. Certainly. We saw a drawdown of nearly three feet in State Well 3. However, the injection and production rates were not well balanced at that point in time. And I think even Mr. Witcher, in his report, acknowledges that when they did the aquifer pumping test on their State Well #1 back in 2001 and 2003, that the amount of drawdown they saw in 55-7 was less than a tenth of a foot.

Q. How many pump tests have you been involved

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with?

A. More than I can count on two hands.

Q. On this project?

A. Well, I haven't directly been involved in any of them. However, I have looked at the data that was collected in January of 2012. And Dr. Shomaker, in the back of the room, has done a summary of that data, and he will speak to that in detail after my testimony.

Q. When that pump test was done, was that permitted by any state agency at all?

A. We submitted a work plan for that pump test to the OCD. That was part of the tracer test.

Q. The tracer test.

A. Yes.

Q. So the pump test was part of the tracer test?

A. The tracer was injected at the start of the pumping test. Yeah. I mean, the Office of the State Engineer routinely allows people to do ten-day aquifer pumping tests. It's routine as far as they're concerned, and they don't have any restrictions at all about discharge of that water. It's routinely discharged to the surface. It's as a matter of fact when developing a well field.

Q. Okay. Well, you don't have a water right to withdraw any water from that geothermal reservoir, do

you? It's a pump under the ground, under the State?

A. We have a lease right.

Q. I'm sorry?

A. We have a lease right from the Rudigers at this point.

Q. I'm talking about the State Engineering. You were saying --

A. We do not --

Q. Hold on. Let me finish the question.

You said that the State Engineer --

MR. LAKINS: I would ask that you not answer his questions when I am talking -- when I am asking the witness a question.

MS. HENRIE: Fair enough.

MR. LAKINS: I ask that you please not coach him on what to answer.

A. We have a leased right. We have a transferred water right from the Rudigers.

Q. (BY MR. LAKINS) I'm sorry?

A. We have a leased right from the Rudigers to -- and it is a consumptive use. They have foregone some of their agriculture-production water in lieu of providing it to us in a lease agreement.

Q. Let's get back to the pump test/tracer test. You said that the pump test was part of the tracer test?

A. They were conducted simultaneously.

Q. And was the proposed work plan only the pump test and included in the proposed work plan for the tracer test?

A. That's been over a year. I'm a little hazy on the details, to tell you the truth, but I know that we had indicated we were going to pump from 45-7 for a period of time while that tracer test was being conducted.

CHAIRPERSON BAILEY: Yes, you may approach the witness.

MR. LAKINS: I'm sorry, Your Honor. I'm sorry.

What I've just handed to the witness, Madam Chair -- I apologize -- is basically a copy of my exhibits, less the PowerPoint presentations.

Q. (BY MR. LAKINS) So I'm going to ask you, Mr. Janney, if you would, please turn to Exhibit Number 7 that you have marked there.

MS. HENRIE: May I ask the relevance of this line of questioning?

MR. LAKINS: He's talking about pump tests. I'm going to ask him about the pump test that was conducted in conjunction with the tracer test that he has testified to.

MS. HENRIE: He's already also testified, Madam Chair, that he was not involved in the pump test, and Dr. Shomaker is a subsequent witness who might be more appropriately asked these kind of questions.

CHAIRPERSON BAILEY: Then Mr. Janney can respond he has no knowledge or does not have experience.

MS. HENRIE: Fair enough.

Q. (BY MR. LAKINS) Now, if we turn to Exhibit 7 there, Mr. Janney, could you point out to me in there where it talks anything about the pump test that's being done?

MS. HENRIE: I have to object. I mean, I'm sorry, Madam Chair, but the permitting things through OCD or speaking with Staff about upcoming events, the fact that one item doesn't include information in it is not definitive of the fact that discussions didn't happen or anything else. I mean, to put this in front of my witness and say where does it say something, when we know it doesn't, because perhaps that's not what the intended purpose of this document was for. I still don't understand why we're doing this.

MR. LAKINS: Well, because Mr. Janney has said that the pump test was part of the plan, the work plan, for the tracer test.

A. Well, I also stated it's been over a year since

I've seen this, so --

Q. (BY MR. LAKINS) Well, the second page of Exhibit 7, that is your signature; is it not?

A. It is.

Q. And It's only two pages, right?

A. That is correct.

Q. If you could point out -- just take a moment to look it over, and tell me where in your two-page document it speaks to the work plan for the pump test.

A. It does not.

What's the relevance?

MS. HENRIE: (Indicating.)

Q. (BY MR. LAKINS) Now, in Exhibit 7 there, you said that "the research and data collected through the proposed temporary tracer test will assist LDG in evaluating the properties of this geothermal reservoir," right?

A. You're reading verbatim.

Q. Well, what did it tell you?

A. I did not do any of the data analysis. It was not my position to do any kind of data analysis on this. That has all been done by Los Lobos staff.

Q. So you can't speak to any results from the tracer test at all?

A. That's correct, I cannot.

Q. Well, when you were proposing to do this, what was it that you were trying to figure out?

A. We were trying to see if the dye placed in the dye injection well was going to turn up in 45-7 as we pumped it. It did not.

Q. Well, why did you pick a well so far away --

A. I did not choose the well locations. I have no knowledge of the design of this aquifer -- or of this tracer test. I did not design this test.

Q. Because everything on here says to talk to you about it. That's why I'm asking.

A. I submitted it on behalf of my client.

Q. Well, the tracer test did actually result in the Rhodamine being discovered in AmeriCulture's well, yes?

A. That's correct.

Q. And so would that not tell you that when you were pumping, you were actually drawing the water from the northern wells in a direction essentially opposite to the natural flow of groundwater?

A. Well, what that tells me is, he was pumping the well that he discovered the tracer in and that it was pumping off his State Well 1 through the Rhodamine from its point of injection in Rosette State Well 7 through the shallow alluvial aquifer into the draw [sic].

I don't think you can draw a direct connection between the pumping of 45-7 and the dye showing up in State Well 1. I think that's a direct result of pumping the shallow alluvial aquifer. But I would ask Dr. Shomaker to further comment on that when he is a witness.

Q. Are you aware of any state agency whatsoever that actually permitted the pumping test?

A. I'm not aware that one was required. As I indicated, it's standard operating procedure to conduct ten-day pumping test as far as the Office of the State Engineer is concerned. This is not something that -- well --

Q. Now, you were qualified as an expert in hydrogeology, correct?

A. I am not a hydrogeologic expert, as Dr. Shomaker is.

Q. But you were qualified --

A. I'm a geologist.

Q. Okay. And you were qualified as an expert in the geology of the Lightning Dock area?

A. At this point, yes.

MR. LAKINS: Where is that example?

Q. (BY MR. LAKINS) Would you be so kind as to put your PowerPoint back up there?

A. Well, I'd rather refer to the slides that were submitted as our exhibit.

Q. Would you be so kind as to put your PowerPoint slide number three back up there?

A. Yeah. I'd rather use that one right there (indicating) --

Q. All right.

A. -- because there were some last-minute changes last night that didn't get incorporated into that slide.

MR. LAKINS: Madam Chair, may I grab the light -- the connector for connecting --

THE WITNESS: What do you want me to do?

Q. (BY MR. LAKINS) I'll just put it up there if you're not willing to.

A. Well, I mean, we can make some simple changes once it's up there, but --

MS. HENRIE: I object. If we could --

A. -- that's not what we submitted as an exhibit. What we submitted as an exhibit is in that ring binder, and that's what we should be addressing.

Q. (BY MR. LAKINS) Well, the one that you put up there, is it different from the --

A. It is different.

Q. Well, the one I have is from the binder.

A. That's the one I'd like to use.

MR. LAKINS: May I?

CHAIRPERSON BAILEY: No. No, sir.

MR. LAKINS: Okay.

A. So do you have questions about the exhibit that's in the binder? If so, I'd like to refer to my exhibits.

Q. (BY MR. LAKINS) Let me just ask you: As a visual aid, did you refer to the map from --

A. Absolutely.

Q. -- Deal and Wolfgang in preparing your exhibit?

A. Yeah. This general geologic map was provided to me by Cyrq. I did not put this together. I added things to it. But, yes, in adding things to it, I cross-referenced some of the geologic features that occur on Elston 1983.

Q. Okay. Because when we look at your Exhibit 3 -- or your slide three, then, that's in your exhibits -- do you have that there?

A. I do.

Q. Because what I understand is, this was your exhibit. Now you're saying this actually wasn't an exhibit that you made?

A. I did not produce this geologic map. I do not know the source of this map. It was provided to me, and the source was never identified.

Q. Oh, okay. Well, would you agree with me that in that slide three, that TKv, the Pyramid Peak volcanic rocks, are in the wrong location?

A. No, I wouldn't.

Q. How about the Tv --

A. If you cross-reference what Elston has on his map, you have to see that things are undifferentiated, and they are indeed similar to what he shows on his map as far as the volcanic units related to the Muir caldron are concerned.

Q. So it's your testimony that the rocks that are on this map shown as the Tv, the undifferentiated volcanic rocks, are correctly located?

MS. HENRIE: Objection. Which Tv rocks? All of the Tv rocks?

MR. LAKINS: Well, the ones right in the very middle.

MS. HENRIE: Inside of the ring?

MR. LAKINS: Inside of the ring.

A. Those are undifferentiated volcanic rocks related to the period of these volcanics.

Q. (BY MR. LAKINS) Could you kind of point out to me where Pyramid Peak is on that map?

A. I believe Pyramid Peak is going to be about where the Tv is located, the northern Tv, on the Pyramid

Mountains.

Q. And do you agree that the outer -- the approximate middle of the outer ring of the fracture zone is correctly placed?

A. It's approximately located, but it was basically removed from that map and placed on this map. That would be the outer ring fracture zone. There is an inner ring fracture zone that is smaller.

Q. That's not on here?

A. It is not.

Q. Is that important?

A. I mean, we're limited to what we can display in a slide of this manner.

Q. Now, do you have an opinion about equilibrium in the heat?

A. I do not. I have not seen any of the heat-load calculations for this project.

Q. Well, again, if you've never seen any opinion about the heat flow, can you definitively state that correlative rights of other geothermal rights holders won't be impacted?

I ask you please not to take clues from your attorney.

A. I'm not. That's a response that requires some thought.

Q. Okay.

MS. HENRIE: Can I look at him?

A. As Mr. De Rocher previously stated, we expect to see some minor decline in heat when the system is started, but we expect to manage this geothermal resource in a way that minimizes any heat loss over time. It is not to our benefit to accelerate the loss of heat in this system in order for us to produce power for a period of 30 years and return the money on our investment.

Q. (BY MR. LAKINS) I understand that, but my question was a little bit different. Maybe I didn't state it real well. So let me try again. Okay? Because you said you have no opinion about the heat. Okay? So my question is: If you have no opinion about the heat because you haven't seen any data, can you sit here today and definitively say that the correlative rights of other geothermal leaseholders will not be affected?

A. I can say that based on the data -- based on the water-quality data and the aquifer pumping-test data that I have seen, there should be no substantial impact on that correlative right.

Q. On the heat?

A. On the heat, based on what I've heard from

Mr. De Rocher and others with the Cyrq team.

Q. Okay. Because Mr. De Rocher did say that you can overproduce a reservoir. You can draw too much heat out of it, right?

A. Why would Los Lobos want to do that?

Q. Now, what's the production of Well 45-7?

A. Well, I believe the maximum it's flowed is approximately 1,500 gallons a minute. Dr. Shomaker would have, perhaps, a more definitive answer on that.

Q. Let's turn to your Exhibits 2A and B, your exhibits.

Actually, let's go to your exhibits, the well record logs, which are your Exhibit 4. Okay?

A. I'm going to have to get up and get those.

Q. You there?

A. Yes.

Q. I'd like you to turn to the second well record log, which is from 53-7. You've got two. You've got 53-7, and you've got 53-7 sidetracked.

A. Uh-huh.

Q. Now, down at the bottom of 53-7, there is an annotation on there that the "formation description of principal water-bearing strata," including "water-bearing cavities or fracture zones," is unknown.

A. Tertiary volcanics. Yeah, that makes sense.

Q. It says in here that the principal water-bearing strata is unknown. That's what it says, right?

A. Well, if you look on the following page, you'll see a log of the strata that were encountered.

Q. And all of the right-hand checkmarks is that none of those are water bearing?

A. That's correct.

Q. So you don't know what the water-bearing strata is in 53-7?

A. All we can say for sure is it's below the bottom of our casing.

Q. Did you do the geology on this?

A. I did not do any geologic interpretation on this. This is all done by Prospect Geotech, professional mud logger.

Q. Turn to the next one, 55-7. Okay? And that's -- at the bottom of 55, that's one of your proposed injection wells, correct? Yes?

A. Yes.

Q. And your proposed injection interval on your G-112 is between 1,590 and 2,349?

A. Yes.

Q. And at that depth, there was zero water yield?

A. None significant reported.

Q. Okay. What exactly is volcanic alluvium?

A. That would be alluvium derived from the erosion of volcanic rocks. So there would be volcanic clastic sediments. So those deposits were originally laid down as volcanic rocks. They were eroded and redeposited as volcanic clastics.

Q. And on that same 55-7, on that next section up, the drilling information, it says there is no casing whatsoever below 1,050.

A. That's correct.

Q. So that well isn't cased?

A. Not below 1,050.

Q. So it's not cased below 1,050, but your proposed injection zone is 1,590?

A. Based on the temperature in the spinner logs that were run on this well, that seemed to be the primary zones of production and/or injection.

Q. How are you going to inject at 1,590 and make sure you don't inject between 1,050 and 1,590 if there is no casing?

A. Well, you can't be assured that there won't be any because of that -- the higher heat flow and the higher the spinner log gets.

Q. Well, what I'm asking is that -- you say you're going to inject at an interval of 1,590 to 2,349,

correct?

A. (No answer.)

Q. But you've got no casing below 1,050?

A. Right.

Q. How do you ensure, from 1,050 to 1,590, that you're not injecting into anything?

A. Well, you have to look at the permeability of the rocks between 1,050 and the zone of injection. If they're solidified, they're relatively impermeable.

Q. But you've got no casing there, though?

A. There is no casing, but that well is still completed in tertiary volcanic rock.

Q. Now, on the back of that 55-7 well log, where it talks about the geologic logs, did you do any of that?

A. No.

Q. Same company that did it for you?

A. No. I believe that this is extracted directly from the Steam Reserve Corporation log from when the well was drilled in 1984, '85.

Q. And from 1,338 down to 2,249, that whole area shows that none of that is water bearing, correct?

A. That's correct.

Q. Now, could you tell me what, between 1,765 and 1,769, this 40-percent solution deposit means?

A. I believe that those were karst deposits.
Q. What is the solution -- I just don't recognize the term "solution deposit." You know what I mean?
A. I don't. It was taken directly off of that log from 1984, 1985, for that interval.
Q. So this is mud-logger jargon, not definitive geologic --
A. In some cases.
Q. Is that fair to say?
A. In some cases.
Q. So it's not 100 percent accurate geologic information?
A. You have to consider the date of that geology.
Q. Do you know where the fault is located within the Lightning Dock area?
A. I don't think anyone really knows where the faults are located because they're covered by alluvium. The only fault that crops up is the Animas [sic] Valley Fault. That is a little bit east of the production wells.
Q. So as the expert geologist for this area, you can't say for sure where any faults are in there. Is that fair to say?
A. Well, I think, based on the logs that we've seen that are presented here (indicating), we can assume

that there is a fault that runs in this manner (indicating) in between the 45 and the 55, and perhaps there is another fault east of the 55 and the 63 that created a horst in that area, relatively drop down on either side.

Q. Let me just make sure I understand what you said a minute ago. You think there is a fault between 45 and 55?

A. It appears that way from log interpretation.

Q. How would a fault impact the underground flow of the water?

A. Well, it's a conduit upwell of geothermal fluids. It's not going to affect flow in the alluvium.

Q. You're not proposing to withdraw from and inject into the alluvium, are you?

A. Correct. We are not. But your wells are completed -- at least your State Well 1 is completed in the alluvium.

Q. So if you're not planning on withdrawing from and injecting into the alluvium -- so get that off the table -- how would the fault and the location of that fault between 45 and 55 potentially affect the water being injected being returned back to 45?

A. It depends upon the openness of the structure the openness of the fault. It may enhance flow. It may

be a boundary to flow.

Q. Could be either one. We don't know?

A. Correct. But, generally speaking, in this scenario, I believe the local knowledge is that there are places along these faults that are conducive to high-fluid flow, and there are places along these faults that are not conducive to high-fluid flow. The entire fault may not be open or may not be closed with the fluid flow.

Q. As you're sitting here today, can you say for sure that the three million potential gallons that are going to be injected into 55-7 are going to make it right back over to 45-7?

A. I think that's one of the reasons we need to conduct a test.

Q. So does that mean you can't sit here and say for sure that it won't happen? Your answer is, you need to test because you don't know?

A. I think, with proper design of the system, getting injection and pumping pressures balanced, that it's possible that all of the water that is injected into 55 will eventually come back to 45. What that period of time is, I cannot comment.

Q. It could take 150 years, for all we know?

A. Well -- I can't comment on that.

Q. Because you just -- we don't know, right? None of us know. Fair?

A. Fair.

Q. No further questions.

CHAIRPERSON BAILEY: Mr. Brooks?

CROSS-EXAMINATION

BY MR. BROOKS:

Q. I have some questions about the tests that have been conducted and the tests which you propose to conduct in terms of what their purpose and fact are. Would you be the person that could respond to that, or should I ask Dr. Shomaker?

A. Well, as far as flow rates and things like that and which wells are going to be monitored, I would expect Dr. Shomaker or Mr. De Rocher to have the most precise answers to those things.

Q. Are you familiar with what the State Engineer's Office would normally require or would be expected to require in order to make a conclusion as to whether or not an aquifer would require replacement water injection?

A. I am not, but I believe either Dr. Shomaker or someone from his office, perhaps Mr. Peery, would be.

Q. Okay. I believe you testified, did you not, that -- and I will pass over those questions to

Dr. Shomaker, because you've indicated he's the one to answer them.

I believe you indicated that you would not expect a drawdown of AmeriCulture's well as a result of the proposed operation. Now, were you referring, in terms of the proposed operation, to the proposed testing that you want to do right now, or were you referring to the geothermal production and power production that currently is active, or both?

A. Well, I -- I think based on the aquifer pumping test that was conducted in January of 2012, where drawdown was observed in State Well 3, while 45-7 was being pumped and injection was taking place in 55-7, that the minimal drawdown that was observed in State Well 3 was approximately three feet, would translate into some additional drawdown into the AmeriCulture State Well 1 at that period of time. What that drawdown was, I don't know. But if you extrapolate that curve out, I think you're in the range of 10 to perhaps 20 feet of drawdown in that well at that point in time.

As Ted stated earlier, we expect to see some drawdown, and we expect to see some mounding. But we expect, over a period of 20 to 30 days, that that system is going to reach equilibrium, and those mounded surfaces and those drawdown surfaces are going to be

relatively static as long as pumping and injection doesn't change in some of the other wells.

Q. And by relatively static, pardon me --

A. And there are even diurnal fluctuations in the water levels in these wells.

Q. Are you indicating that the other wells in the area, that you expect them to return to the levels where they exist before you start the pumping? Is that what you're saying?

A. Perhaps they will rebound that much.

Q. Perhaps?

A. Perhaps.

Q. But you don't know?

A. Well, I don't expect to see any substantial drawdown in any of the wells as a result of the pumping test that we proposed or production and injection.

Q. Thank you.

CHAIRPERSON BAILEY: Those are all your questions, Mr. Brooks?

MR. BROOKS: That's all.

CHAIRPERSON BAILEY: Commissioner Warnell?

CROSS-EXAMINATION

BY COMMISSIONER WARNELL:

Q. Mr. Janney, on your Exhibit 4, the four wells listed there at the top, 55-7, 53-7 -- I think I know

the answer to my question, but I wrote it down, so let me ask it.

A. I'm with you.

Q. All right. All four of those wells have been drilled, as was verified from the well records or the mud logs on the following pages; is that correct?

A. Correct. 63-7 being the most recent; that was completed last year. 55-7 being the oldest; that was drilled in '84 and '85.

Q. Okay.

A. And 53 and 45 have all been drilled since, I believe, 2008.

Q. And I can get that off the mud records?

A. Yes, sir.

Q. All right. Thank you. That's all I have.

CHAIRPERSON BAILEY: Commissioner Balch?

CROSS-EXAMINATION

BY COMMISSIONER BALCH:

Q. Good afternoon. As someone else said, long afternoon for you.

A. It's early yet.

Q. I have a couple of questions. I'm really interested about the geology, especially the cross section you have there on the board behind you. You base these off the log analysis?

A. Yes.
Q. What were the logs that were available for you?
A. Pardon?
Q. What logs were available?
A. The mud logs.
Q. Mud logs. Not geophysical logs?
A. There are geophysical logs, but they have not been incorporated into --
Q. This is based off the mud logs?
A. Yes.
Q. So I find it interesting that the four Los Lobos wells all have alluvium overlying volcanic clastics. Those are the Pennsylvanian ring [sic] work stuff that you mentioned?
A. The volcanic clastics are tertiary.
Q. They're tertiary.
A. Tertiary volcanic rocks.
Q. So brief flows, or --
A. Eruptive deposits from the Muir cauldron, flows, air fault tufts.
Q. So a mixture of various clastics.
As you move a little to the north and you see the two AmeriCulture wells and the Rosette well, they have alluvium on top of silicified sediments. And then you move -- at least in the AmeriCulture State 2 --

directly into volcanic -- tertiary volcanics as well?

A. That is correct. They're equivalent units here and here and here and here (indicating), as far as the tertiary volcanics are concerned.

Q. I don't see the tertiary volcanics --

A. In the pink.

Q. -- in the Los Lobos wells. I see rework volcanic clastics.

A. Well, it's a mixture of tertiary volcanic and tertiary volcanic clastics.

Q. Well, would it be overly presumptive to assume that the Muir cauldron was eroding down towards the Los Lobos wells from the AmeriCulture wells?

A. I think they're so proximate to one another that a distinction like that would be difficult. I mean, if they were miles apart, perhaps; if the AmeriCulture wells were, say, a mile to the east.

Q. The other thing that kind of stands out for me is the 1,000-foot offset between relatively close wells.

A. Well, we think there is a bounding fault there. There is a fault in that area. We dropped down things on the west side of the fault, 53 and 45-7, relative to it being uplifted on the east side of the fault.

Q. You mentioned that you thought there might be two intersecting faults for making --

A. I think the structural situation is unknown -- I mean the detailed structural situation.

Q. Right. I mean, I would just draw a simple fault almost where the yellow line is, going --

A. I'd put it a little bit further east and, perhaps, another one a little bit further west.

Q. So you think it's two?

A. I think it's entirely possible, based on the interpretation of the geology represented in this cross section that we have a high, or a horst, that is bounded on the east by a fault on which the 45 and the 53-7 are on the down-drop side; 63 and the 55 are on the upside relative. And as you move east, there may be another fault that drops down the rocks to the east.

Q. So in the four Los Lobos wells, it looks like you go alluvium, volcanic clastics and then straight to basement [sic]? I can't see if --

A. Well, I would say basement Precambrian at about 6,988 feet, but nonetheless.

Q. So what are you in there, in the blue? Is that the limestone?

A. It is, Paleozoic limestone, sediments --

Q. Same limestone that you see in the --

A. Paleozoic sediments.

Q. Okay. Same limestone that you see in the

AmeriCulture #2?

A. Yes, I believe that's the case.

Q. But you don't see that sandstone layer in the Los Lobos wells?

A. You know, it didn't get translated onto this cross section. I think everyone agrees, Mr. Witcher included, that there are some differences in interpretation between mud loggers that might have logged our wells and logged his wells. So we're just trying to make a generalized graphical representation of the major rock units that occur in the area in this cross section.

Q. On your cross section there, you have also indicated geothermal fluid flow zone that's the elliptical area on the --

A. It is.

Q. -- on the first part of the cross section, right?

A. Between the 45 and the 55.

Q. Do you see a similar feature in the LDG-53-7 and 63-7?

A. That has yet to be fully identified.

Q. That's part of what the test is about?

A. Yes.

Q. There are various samples for some of the wells

in your Piper plots?

A. That's correct.

Q. Do you know when those samples were collected?

A. I believe everything as far as the Los Lobos wells are concerned is 2008 or more recent, I believe.

Q. There are three from the AmeriCulture; they're close together.

A. Those date back to 2003 and 2011, and I think Mr. Witcher can comment on the dates of those samples.

COMMISSIONER BALCH: All right. Those are all the questions. Thank you.

THE WITNESS: Thank you.

CROSS-EXAMINATION

BY CHAIRPERSON BAILEY:

Q. At least twice you mentioned that adjustments could be made for smoothing the bases [sic] to reach equilibrium. What trigger points do you see to make those adjustments?

A. Well, if we saw significant drawdown in some wells or if we saw significant changes in water quality or water chemistry.

Q. And what do you call significant drawdown when there are so many unknowns?

A. Well, I would rather that Dr. Shomaker respond to that question, if I may, Your Honor.

CHAIRPERSON BAILEY: Then be prepared (laughter).

Q. (BY CHAIRPERSON BAILEY) All right. So you are unable to answer those questions?

A. I would prefer not to, and I would prefer to let Dr. Shomaker answer that question.

CHAIRPERSON BAILEY: Do you have any redirect for your witness?

MS. HENRIE: Yes, Madam Chair.

REDIRECT EXAMINATION

BY MS. HENRIE:

Q. You were asked about faulting in the 45-7, 55-7 area, and I just want to be clear that I understood you correctly that faults cannot only be barriers, but also as conduits to the hot water.

A. That is what we try to target when we drill geothermal wells. We try to target so we have high flow that becomes good producing and good injecting wells.

Q. As the hot geothermal water comes up through these fractures and hits the alluvium, what happens?

A. Well, it continues to rise because of the density contrast, but it begins to mix with cold water coming up from the south.

Q. And so going back to these faults and these fractures, given that you have testified that all of the

geothermal water in the area is substantially the same, would you presume that those faults are acting as conduits and that the water -- as between 45-7 and 55-7, the water chemistry shows us that the water is flowing back and forth?

A. Yes.

MS. HENRIE: I have no more questions.

Thank you.

Let me go ahead and move the admission of Exhibits 4 and 5.

CHAIRPERSON BAILEY: 3 and 4?

MS. HENRIE: 3 and 4. Excuse me.

CHAIRPERSON BAILEY: Any objection?

MR. LAKINS: No, ma'am.

CHAIRPERSON BAILEY: Then they are admitted.

(Los Lobos Exhibit Numbers 3 and 4 were offered and admitted into evidence.)

CHAIRPERSON BAILEY: You may be excused.

MS. HENRIE: Madam Chair, I wanted to suggest something that may be entirely unorthodox, and, if so, please forgive me. But I have been made aware that there are members of the public that have come to speak during the public comment period, and I wondered if we could just take a break in our testimony and let

people speak while they're here and then resume when they're finished.

CHAIRPERSON BAILEY: Please give me the sign-up sheet, and I will be able to call them by name.

(Discussion off the record.)

CHAIRPERSON BAILEY: As I said, we have five-minute limitations for any kind of public comment. Public commenters may be either sworn in for their testimony, or unsworn.

I would call Bryn Davis, first. Would you like to be sworn, or --

MR. DAVIS: However you'd like it, ma'am.

CHAIRPERSON BAILEY: It's your choice. Sworn means you get cross-examined.

If you would swear him in, please.

BRYN DAVIS,

after having been first duly sworn under oath, testified as follows and was questioned:

MR. DAVIS: May I sit?

CHAIRPERSON BAILEY: Yes.

MR. DAVIS: My name is Bryn Davis. I am the New Mexico operations manager for a company called Sapphire Energy. We are a large biofuel development facility in Luna County in this part of the area, so we're very supportive of technologies and work that

seeks to take our dependence off traditional energy sources.

With that, I have no relationship to Los Lobos. We are not partners. I am not employed by them. There is no connectivity to me between organizations.

I did want to bring up a comment specifically towards David Janney, and that is, unlike this facility that uses a tremendous amount of heat and not much water, since the water gets returned back to the aquifer, we do a lot of water use, and we spend a lot of time looking at the use of water, the flow of water, groundwater flow. And David Janney, as well as many members OF the AMEC Earth & Environmental group have been, for four years and are still currently, doing a lot of consulting work for us both in groundwater, in well logs, mud logs. And, frankly, they've had to look at well logs that I'm pretty sure the mud guys died before I was born, so having no direct experience in that. And we've had great success with that.

As a citizen, as a 30-year resident of this area, this effort to develop alternative energy with prudent plans, with prudent testing of water is critical to ensure success, and I'm very supportive of that. And as an engineer, I watch these things with great interest.

A side note is, this is a site that was one of the original locations that my company looked at for similar purposes. So I have some familiarity with the area as well.

But we're very supportive of a good alternative energy plan that makes use of resources in a nondetrimental manner in the state, and I think these guys are on that path, Los Lobos.

CHAIRPERSON BAILEY: Any questions of this witness?

Commissioners?

MR. LAKINS: May I?

CHAIRPERSON BAILEY: Yes.

CROSS-EXAMINATION

BY MR. LAKINS:

Q. Mr. Davis, you said you work a lot with AMEC?

A. I do.

Q. Do you work a lot with Mr. Janney?

A. I work with Mr. Janney and several members of his staff. We have -- I acquired a site, and -- I may be off on the count -- I had eight wells on the site. I've put four additional wells. Most of them are 1,000 feet. I have had to have those logs and documents interpreted, so we can understand placement of the wells in a short term.

We are located where there is a lava flow, where you actually have to almost pick between the fingers of the flow to figure out what is the most appropriate place to develop your water. And so, yes.

And they've done pump-development tests for us. We've run wells at 1,000 gallons, and they've worked to make sure there weren't drawdowns and used their engineers, their technicians, their hired geologists to help us go through that process.

Q. Were you made aware of this hearing through AMEC?

A. I was not. Actually, I think Mr. Janney -- I don't know where he is. He's probably quite surprised to see me show up, because I actually sort of came as a spectator due to the nature of alternative energy in this context in the region that I've called home for, basically, my adult life.

Q. Thank you. No further questions.

CHAIRPERSON BAILEY: You may be excused.

MR. DAVIS: Thank you, ma'am.

CHAIRPERSON BAILEY: Cob Rios.

Would you like to be sworn or unsworn?

MR. RIOS: Either way is fine with me, Madam Chair. I'll be sworn in.

COB RIOS,

after having been first duly sworn under oath, was questioned and testified as follows:

MR. RIOS: My name is Cob Rios. I'm a lifelong resident of Deming, New Mexico. As an active member of the community, I'm always interested when somebody comes into the area, and it's very important to me to know that they're being environmentally friendly and responsible. And it's also important to me that they be a positive impact on the economic development of our community.

Since my communications began with these folks, they've always been professional and community oriented and interested in knowing that they're taking all the right steps to be of benefit to us in the New Mexico area that I'm from.

One of the things that I've seen in my community is an interest in energy, with some of the young people from the school that I graduated from down in Deming. Seeing this thing take place throughout the community, in talking to young people just in general about their interests, it's come to my attention from them -- because I need to go and try and promote it throughout the community. I'm very interested in hearing that junior-high kids are talking about geothermal energy. I don't know where they're getting

all this information, but I know it's being introduced into the community in a positive way when it starts coming back from that direction.

So I think that everything that they've done down there has been responsible, and I'm very interested to see what happens next. I feel I have a very good feeling about what they're doing and going about doing their business down there amongst us regular folks down there, and I'm very happy to know that they're in the area.

CHAIRPERSON BAILEY: Any questions of this commenter?

MR. LAKINS: Yes, Your Honor.

CROSS-EXAMINATION

BY MR. LAKINS:

Q. Mr. Rios, did you participate in Water Quality Commission permitting hearings some years ago for this project?

A. No, I did not.

Q. Do you have any idea how this project might potentially affect AmeriCulture?

A. I've done some personal research into what [sic] these geothermal plants operate, how they operate. And the sheer value of what it takes for them to be productive is enough that -- it's a good starting

point to start looking at these guys. They wouldn't be down there if it wasn't beneficial to them. The investment is large, and the ability to produce power in a geothermal manner has to -- it goes along -- it is always going along -- the way that it's done, it can't affect the surrounding area or else it doesn't work. That's been my conclusion from all of the studies that I've looked at and research that I've done on a personal level.

Q. Okay. So if I told you that AmeriCulture could essentially be put out of business if this project went through, would that change your opinion about anything?

A. Absolutely. And I fully respect AmeriCulture's being here and bringing this before the Committee [sic] here. I think it should be -- I think it's responsible on his part that he's done this and that he's taken those steps.

I think that the reason we're here is to ensure that Cyrq Energy follows the steps that they need to in presenting -- making their presentation to the right people here in New Mexico. And I'm proud to say that I'm a citizen of New Mexico. I've always found that we have people in the right places to govern all of these issues. So, yes, I think it's -- I fully respect AmeriCulture for taking the steps that they have to see

that they're not affected in an adverse manner. I don't believe, from what I've learned, that he will be. I think that Cyrq Energy can be a good partner and neighbor to him, and I think that they should be, one to each other.

MR. LAKINS: No further questions.

CHAIRPERSON BAILEY: You may be excused. Thank you.

MR. RIOS: Thank you.

CHAIRPERSON BAILEY: Dora Dominguez. Would you like to be sworn?

MS. DOMINGUEZ: Okay.

DORA DOMINGUEZ,

after having been first duly sworn under oath, was questioned and testified as follows:

MS. DOMINGUEZ: Good afternoon, Commissioners, Madam Chair.

My name is Dora Dominguez, and I have the privilege of serving as the director for the Office of Business Advocacy for the State of New Mexico. The Office of Business Advocacy is administered through the New Mexico Economic Development Department, and I report directly to Cabinet Secretary John Barela, who could not be here this afternoon, but wanted to make sure that our presence was known and that we were able to give a

statement on behalf of this project.

So for us, for the Office of Business Advocacy, the Cyrq Energy Corp. project represents one of the first cases that --

MR. LAKINS: Your Honor, I'm going to object. This is not public comment. This is government comment. I think there is a little bit of a difference.

CHAIRPERSON BAILEY: We allow agencies in this role as public commenters. They're not testifying. They are simply presenting a viewpoint.

MR. LAKINS: I withdraw.

MS. DOMINGUEZ: Thank you. I appreciate that.

One of the reasons that the Office of Business Advocacy was created was that, you know, we hold no vested interest either way in the cases and the companies that we go out -- we don't circumvent any of the regulatory processes that the State requires of any business, whatever the industry or sector. The purpose of the initiative has totally been to help companies, mostly, I have to admit, very small businesses.

This particular project has been of special interest because the location is in rural New Mexico. Cyrq Energy, for the Office of Business Advocacy, is one of the first ones that we thought, Oh, my gosh, look at

the regulatory process that they're going to encounter. We were there when the idea of bringing oversight of nonconsumptive geothermal energy projects before OCD was discussed.

We've had -- I don't know -- five, six, seven meetings, you know, four or five, I guess about two years ago, starting with the State Engineer. The partnership that was bridged between the Office of the State Engineer and OCD, I think, was very positive, and we've all learned so much.

And, again, we've been tracking this particular project, because we knew from the beginning -- we knew five years ago, when the department was first introduced to the project, that it was going to be a regulatory process, by definition.

We have been very impressed from the beginning of the outreach, all the community education that's been done. I, myself, served as the regional rep, based in Las Cruces, for three years, so I was familiar with the project just covering the region. Their outreach and education with the school systems to say, This is what we're doing, I think they've changed minds about what is possible in the areas of geothermal energy production and how New Mexico can truly, in one sense, be first in something very innovative and

something that will create jobs and provide opportunities to our rural communities in southern New Mexico.

So we continue to track this project. We are familiar with it and continue to hope for the best and hope that, you know, any regulatory hurdles that they encounter between now and full production can be managed and navigated and the learning process continue.

So thank you so much for the opportunity.

CHAIRPERSON BAILEY: Any questions?

CROSS-EXAMINATION

BY MR. LAKINS:

Q. How many jobs does this -- do you anticipate that this project will create?

A. You know, I went back and looked at my notes from when I was the region rep, and, you know, everything from about 100 to 200 in the construction phase; somewhere less than 100 after it -- once it's in full operation.

Q. Thank you.

CHAIRPERSON BAILEY: Thank you.

You may be excused.

MS. DOMINGUEZ: Thank you.

CHAIRPERSON BAILEY: Tom Carroll.

TOM CARROLL,

after having been first duly sworn under oath, was questioned and testified as follows:

MR. CARROLL: Madam Chair and Commissioners, my name is Tom Carroll.

I have a communications company called Carroll Strategies, and I handle the communications for Cyrq Energy.

And there are several people, locals, who wanted to make the trip today but could not because of the time and expense, and they have written letters. And I would just like to read a line or two from each of the letters.

The first one comes from Steven Gamble, the president of Eastern New Mexico University. He writes: "On behalf of Eastern New Mexico, I would like to express the University's support of the Lightning Dock Geothermal project that is to be heard Tuesday, March 19th. The project will benefit the state of New Mexico, its citizens and Eastern New Mexico University.

"A geothermal project will expand New Mexico's portfolio of renewable energy projects and will assist in diversifying the economy within our state."

The next letter is from Kasey Rudiger, a counselor and school psychologist at the Animas Public

School. She writes: "Cyrq Energy has made a significant investment in our community in this school. Cyrq Energy has sponsored events and helped promote a drug-free and healthy lifestyle like at the proms, 4H and Relay for Life. I personally appreciate Cyrq's contribution to our school and community."

The Next one is from Katy Estrada, a CPA in the area: "I am a resident and small business owner in the Animas Valley located in southwestern New Mexico.

"If the Cyrq Energy project would be allowed to continue with its influx of jobs and funds, the community can only benefit. I fully support Cyrq Energy and their vision of creating jobs by making a significant investment in our community. The Cyrq project has been properly permitted and needs to move forward."

The next one comes from a resident, Marsha Hill, from Lordsburg: "My name is Marsha Hill. I live and work in Lordsburg and have been a resident of Hidalgo County for 30 years.

"Small, rural communities such as ours do not stand a chance against larger communities, which can produce resources needed for businesses to invest in them. In our case, we have what other communities cannot provide, and that is geothermal energy. Cyrq

Energy has made a sound investment in Hidalgo County and has been working towards a permanent location. I firmly believe that they have the resources they need to provide our county with a major industry that will provide good-paying jobs, community support and clean alternative energy."

The next one comes from the superintendent of the Animas Public Schools: "The purpose of this letter is to inform you of the generous support that Cyrq Energy has provided to Animas Public Schools. In addition to offering monetary support, Cyrq also hosted students at their construction site, providing learners with invaluable educational experiences. Cyrq Energy is a strong supporter of Animas Public Schools, and we appreciate their partnership."

The next comes from the Lordsburg, Hidalgo County Chamber of Commerce: "Cyrq Energy has made a significant investment. This geothermal project will bring important economic development to our area. Our area has experienced economic strain in the past few years, and this can help us. This project has solid community support from the vast majority of people. We want this project to move ahead."

The next one comes from a resident, Jody Bailey. "I have been a teacher here in the Animas

School District for the past 26 years and have witnessed our school dropping from Class A, 600 students, down to Class 1A, less than 200 students schoolwide, when Phelps Dodge closed its operation. The support of Cyrq Energy and all of its contributions to our school have been a blessing."

The last one I have here is from John Hill. He is the chief of the Lordsburg Volunteer Fire Department. "The citizens of Hidalgo County are very fortunate to have Cyrq Energy located here. The company has been a positive influence in our area, and we often read in the paper of its support.

"For the past two years, Cyrq Energy has donated money to the Lordsburg Volunteer Fire Department for the lighting of the City of Lordsburg Christmas tree. We have been pleased to have a good neighbor such as Cyrq Energy that provides jobs in the county, as well as clean energy."

And if it's all right, Madam Chair, I have full copies of the letters. I didn't read the full copies, and I would like to give them to you to, pass them out. Is that a problem? Is there an objection?

CHAIRPERSON BAILEY: I'm asking our attorney here.

MR. LAKINS: On the record, I object to the

introduction of all those letters as hearsay. The people aren't here themselves.

CHAIRPERSON BAILEY: They will be given the weight that they are due. Let me put it that way.

MR. LAKINS: Yes, ma'am.

CHAIRPERSON BAILEY: Your five minutes are done.

MR. CARROLL: Okay. Should I not leave you the copies?

CHAIRPERSON BAILEY: Our attorney says you can.

MR. CARROLL: Can or can't?

CHAIRPERSON BAILEY: Can.

MR. CARROLL: Can.

CHAIRPERSON BAILEY: Any questions of this commenter?

MR. LAKINS: Yes, ma'am.

CROSS-EXAMINATION

BY MR. LAKINS:

Q. You did read one letter from Kasey Rudiger?

A. Yes, sir.

Q. She is the person who just leased the water rights from Cyrq; isn't that correct?

A. I'm afraid I do not know, sir.

CHAIRPERSON BAILEY: Any other questions?

Is that Kacie Peterson? Could you spell your name, please?

MS. PETERSON: K-A-C-I-E.

KACIE PETERSON,

after having been first duly sworn under oath, was questioned and testified as follows:

MS. PETERSON: Madam Chair, Commissioners, my name is Kacie Peterson, and I am employed by Cyrq Energy. I am a community relations manager, and I have been employed for the last two years. My primary focus with Cyrq Energy is to create a partnership within the community. And if you don't mind, I've prepared a scrapbook of our contributions. I believe this will show them --

MR. LAKINS: I'm going to object. This is an employee of the Applicant. This is not a public -- a member of the public making a comment, Madam Chair.

MS. HENRIE: Madam Chair, she's also a member of the community, lives in the community, and her family is from the community.

MR. LAKINS: She just testified that she wants to present a scrapbook of the work that she's done for the Applicant. That's not public comment. That's speaking on behalf of her employer, Madam Chair.

CHAIRPERSON BAILEY: I sustain your

objection, that this is not testimony from a public commenter. This is more in the nature of an exhibit that you would like to bring in.

MS. PETERSON: Would it make a difference, ma'am, if someone else delivered -- I just want you to see what good Cyrq has done. I don't have to say a word. You can just look at it yourself.

MS. BADA: That's not the evidence.

CHAIRPERSON BAILEY: It has nothing to do with the issue before us.

MS. PETERSON: Okay. Thank you.

MS. HENRIE: Madam Chair, may I ask? It is not technical testimony, and I believe that the rules are that if it's technical testimony, we do have to share it ahead of time and put it in our prehearing statements. But if it's nontechnical, perhaps we can call her as a witness as part of our presentation.

MR. LAKINS: She's not listed as a witness.

CHAIRPERSON BAILEY: I sustain your objection.

Scott Richens?

MR. RICHENS: Yes, ma'am.

CHAIRPERSON BAILEY: Would you care to be sworn?

SCOTT RICHENS,

after having been first duly sworn under oath, was questioned and testified as follows:

MR. RICHENS: My name is Scott Richens. I am a resident of Hidalgo County. I've lived in New Mexico for 47 years; in Hidalgo County, for -- that would be 35 years. And I've been in business as a small business owner, general contractor, in the area for the last 10 years, 11 years. I have performed work for both of these entities. I would love it if both of them could co-exist and continue. I believe both can bring economic value to the community, and I see no reason why that could not go ahead.

As a former member of the Animas School Board, I love the fact that families can be coming into the area for additional work and help build that portion of the state, the community, where I was raised and continue to try to live. And that's my testimony.

CHAIRPERSON BAILEY: Any questions of this commenter?

CROSS-EXAMINATION

BY MR. LAKINS:

Q. I didn't catch your last name.

A. Richens.

Q. You guys are a private contractor, a general contractor?

A. Yes, sir.
Q. And you've done work for Cyrq?
A. Yes, sir.
Q. And for AmeriCulture?
A. Also for AmeriCulture.
MR. LAKINS: No further questions.
CHAIRPERSON BAILEY: You may be excused.
Why don't we take a ten-minute break, and you can prepare your next witness.
(Break taken, 2:55 p.m. to 3:04 p.m.)
CHAIRPERSON BAILEY: Call your next witness, please.
MS. HENRIE: Madame Chair, I have to find him, actually. Dr. Shomaker is my next witness. I apologize.
Perhaps we could take care of a little housekeeping in the interim. We did share with AmeriCulture John Shomaker's report. I would like to enter it as an exhibit, if there's no objection.
MR. LAKINS: I have copies made here.
MS. HENRIE: Oh, okay.
MR. LAKINS: So the same thing. In fact, why don't we make it my 18. Does that sound good?
MS. HENRIE: That's fine.
MR. LAKINS: Make it 18.

MS. HENRIE: And I need to get them some as well.

Madam Chair, I'd like to call John Shomaker as my next witness.

CHAIRPERSON BAILEY: Please be sworn.

JOHN W. SHOMAKER, Ph.D.,

after having been first duly sworn under oath, was questioned and testified as follows:

DIRECT EXAMINATION

BY MS. HENRIE:

Q. Mr. Shomaker, please state your name.

A. John W. Shomaker.

Q. And where are you employed and in what capacity?

A. I'm employed by a firm called John Shomaker & Associates as a hydrogeologist.

Q. Would you please summarize your education and employment background?

A. Yes. I have a bachelor's and master's degree in geology from the University of New Mexico, a Master of Arts in Liberal Arts from St. John's College and a master's -- a Ph.D. in hydrogeology from the University of Birmingham in England.

Q. Are you familiar with the Los Lobos project?

A. Yes, I am.

MS. HENRIE: I would move to qualify Dr. Shomaker as an expert in hydrogeology, groundwater hydrology and geology.

MR. LAKINS: I didn't hear him say all of those things. I heard him say hydrogeology Ph.D., but all the other areas I didn't hear him say.

Q. (BY MS. HENRIE) Dr. Shomaker, would you please describe the courses you taught at UNM on groundwater hydrology?

A. Yes. I have two degrees in geology, and I work for both the New Mexico Bureau of Mines, as it's been known, and the U.S. Geological Survey. And then I taught the groundwater hydrology course at the University of New Mexico for several years in the late 1980s.

MS. HENRIE: I would move to qualify the witness, please.

MR. LAKINS: As what?

MS. HENRIE: An expert in hydrogeology, groundwater hydrology and geology.

MR. LAKINS: No objection.

CHAIRPERSON BAILEY: He is so qualified.

Q. (BY MS. HENRIE) Dr. Shomaker, I do want to clarify. There's been discussion of a tracer test, and I want to clarify your role with regard to the tracer

test that was conducted by Cyrq, or Los Lobos, in January of 2012. Can you tell us what your role was, if any, in the tracer test?

A. Yes. I discussed the design of the test with Mr. Barker, who is an employee of Cyrq, the petroleum engineer who actually designed the test.

The data collection was largely done by a consultant to Cyrq named Tecton. I can't remember the second part of their name. Tecton Geologic, I think. Our firm had a staff member there part of the time, Mr. Coates, in our office. And then after the test was completed, I prepared a summary of the data that I think is an exhibit in this matter.

Q. With regard to your summary, AmeriCulture, in its prehearing statement, has -- with reference to that summary, represented that Well 55-7 would not reach equilibrium. Further, that there were substantial drawdowns, as well as rises in the water level of wells within the vicinity. Your prehearing statement, as well as AmeriCulture's slides, 2 of 2, and the conclusions, stated: "Injection into 55-7 during pump tests shows water levels rising from 80-foot depth to surface over a one-week period." Can you comment on any of those representations that have been made?

A. I think the best comment is simply to refer to

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the illustrations in our summary of the data and see what actually occurred. I basically did no interpretation of that test. This is a summary of what was observed.

Q. So can you walk the Commissioners to the page that references 55-7?

A. I am referring to the report called B [sic], the "Tolerance for Closed-Loop Pumping and Injection Test." The date on our report is March 22nd, 2012. I don't know what exhibit number it would be.

Q. And I believe the date's down here at the bottom of the front page, and the exhibit is AC- -- AmeriCulture Exhibit 18.

A. I'm sorry, I've forgotten which well in particular you asked about.

Q. It was 55-7, and the representation was that the well would not reach equilibrium at all. In fact, it shows the water levels rising on the 80-foot depth to surface over a one-week period.

A. The report at Figure 6 shows the injection pressure at the wellhead for Well 55-7. And in this draft, injection pressure has been converted to feet, because I prefer to deal with feet of head as a groundwater hydrologist.

And this plot shows that the pressure

began -- rose at the beginning of the injection to something close to 80 feet of pressure at the wellhead, and then declined very rapidly. And after about, oh, the end of December -- I'm sorry -- about January 23rd, about halfway across the time axis, the pressure began to -- appeared to be at roughly an equilibrium. And after that time, you know, there were ups and downs in pressure but no continuing change.

I think the corresponding plot would be the drawdown during pumping in Well 45-7, which is illustrated at Figures 3A and 3B. And here we're looking at the depth to water -- depth to water, in Figure 3A, and then the calculated drawdown from pre-pumping conditions, in Figure 3B. And that shows that by about January 24th, water levels had nearly -- the pumping water level had nearly come into equilibrium. Then the pumping rate changed. The pumping rate was increased, and, again, the water levels began to come into equilibrium again after that change, about the end of January, when the test ended.

So I think that my view is that the differential pressure represented by the depth -- the pumping level in Well 45-7 and the wellhead pressure during injection in Well 55-7 nearly come into equilibrium by the end of the test, after no more than

ten days.

Q. So this is different than what was stated in AmeriCulture's prehearing statement, that the wells did not reach equilibrium; you actually see them coming into equilibrium?

A. I believe they will, yes.

Q. I also want to turn, Dr. Shomaker, to the report authored by Mr. Jim Witcher in 2001. And it describes a well test at the AmeriCulture State Well #1 and conclusions relating to that test. Are you familiar with that report?

A. Yes, I am.

Q. And I don't believe that's in evidence. It was given to us as part of an exhibit exchange, but I would -- it looks like the Executive Summary is item number six in our exhibits.

And, Dr. Shomaker, I want to ask you quite broadly: Do you agree with Mr. Witcher's data as it relates to AmeriCulture's Federal Well #1?

A. Well, I believe in the report itself. Not referring to the summary that's in the exhibit, I believe Mr. Witcher interprets a barrier boundary between the well that was pumped during the test he represents and an observation well to the west of it. I disagree that the pump test information leads us to

believe that there is a barrier boundary.

Q. And why do you disagree? Can you talk a little bit more about that?

A. I interpreted the data that Mr. Witcher presented in the appendices of that report, and I used the plots of drawdown data in three wells. There was a pumping well, AmeriCulture #1, an observation well called Burgett A, and an observation well called AmeriCulture Federal.

And the drawdown data for the observation well, Burgett A, when interpreted to calculate the transmissivity in the storage plume [sic] of the aquifer with the effective values for the aquifer between those two wells. I get a similar value for transmissivity as between the pumping well, in Burgett A, and I get a storage quotation that's very low, which I would expect in view of the fact that these two wells are completed in hard-fractured rocks, and the permeability is largely in form of their connected fractures.

The Burgett A well, which is more than 800 feet away from the pump well, responded very rapidly, and I think, in conventional interpretation of pumping tests, that means that the storage coefficient is very low, which is what one would expect in a case where the rocks themselves had rather low permeability but the

fractures offered a very fairly direct connection.

In the case of the other observation well, which is the AmeriCulture Federal, it's about 1,100 feet away, as I recall, to the west of the AmeriCulture State well that was pumped and on the opposite side of a fault or barrier boundary of some sort that's positive in the report.

I found, on interpreting the information from that test, that while it's true, as Mr. Witcher pointed out, that the effects in that well were much delayed -- about 550 minutes, as I recall, before the projected effects reached that AmeriCulture Federal Well -- a storage filtration can still be calculated, and it's still within the range that one would expect of a confined aquifer or in the case of a system in which most of the connection between the pumped well and the observation well consisted of interconnected fractures and otherwise fairly low-permeability rock.

And the AmeriCulture Federal observation well is in alluvium. It's not in fractured bedrock, but the effects reach that well by way of the fractured bedrock because that's what the pumping well is seated in.

Q. Given that Mr. Witcher's report is not in evidence, I did want to offer the opportunity if there

are any key portions of that report that you would like to read into evidence.

A. Well, I think the part that I specifically disagree with is the following, which, for reference, is at page 23. "Drawdown in the AmeriCulture Federal well does not occur until nine hours into the pump test. When the delayed drawdown did occur, the water levels fell much less than the Burgett A, and there is no doubt that a shallow impermeable boundary occurs between the AmeriCulture Federal well and the AmeriCulture production well." It is that last sentence that I disagree with.

Q. The sentence: "There is no doubt that there is a shallow impermeable boundary"? Is that the word?

A. Correct.

Q. And that boundary was between State Well 1 and the AmeriCulture Federal Well?

A. Yes.

Q. Do you happen to know where the AmeriCulture Federal Well is located on the visual behind you? And if you don't know, that's okay. I'm putting you on the spot.

A. It's not located on that map. And what I remember is that it's roughly 100 feet west of the AmeriCulture 1 State, which was the pumping well.

Q. Dr. Shomaker, I have just a couple more questions. One is with regard to the resource, the Lightning Dock Geothermal resource. Are you aware of studies, tests that may have been conducted on the resource that have not been made available to Mr. Witcher?

A. Yes, I am.

Q. And in your opinion, is injection into Well 55-7 likely to cause any significant drawdown or effects at AmeriCulture State Well #1?

A. I think the evidence that I would refer to is the set of the hydrographs that are in our July -- or March 2002 -- 2012 report. There were rises in water levels in some wells, declines in water levels in other wells, as expected because there was pumping from two wells and reinjection into two wells. So I would certainly expect, as Mr. De Rocher described this morning, a situation in which the water levels in most wells near the vicinity of the project would change, some up, some down, but that they would reach equilibrium condition.

Q. One more question, Dr. Shomaker. Based on your observations in the March 2012 report from the pump test last year, do you have any opinion on or any thoughts on what the magnitude of drawdown, if any, might be on

AmeriCulture State Well 1 at a pumping rate of about 1,500 gallons per minute, based on observations relating to the Rosette State Well 3 in the March report?

A. I would just turn, again, to our March report and look at the plot for the State Well 3, which I believe is at Figure 16.

The decline in water level in State Well 3 during this closed-loop pumping test, which was conducted at a rate -- total mass balance rate of around 1,500 gallons a minute, and that decline appears to have been around three feet. The last several days of measurements in that well appeared to be roughly the same. Apparently, in my view, an equilibrium had been reached relative to that view.

May I add to that answer, please?

In all of these plots, barometric pressure varies, variation at the scene, so there is a dynamic change of significance in each plot. Just looking at the -- either the peaks or the troughs, in comparing those from day to day, they appear to be essentially the same.

Q. Is there anything else in the March 2012 report that you would like to bring to the Commission's attention?

A. I don't think so. I think they summarized what

was known about water-level changes as a result of this pumping and their injection.

Q. Thank you.

MS. HENRIE: I'll pass the witness, Madam Chair.

CHAIRPERSON BAILEY: Questions?

MR. LAKINS: Yes, ma'am. Thank you.

CROSS-EXAMINATION

BY MR. LAKINS:

Q. Dr. Shomaker, I want to make sure I understand correctly. What was your role in designing the tracer test?

A. I had just a very little role in it. Mr. Barker of Raser, then Cyrq, actually designed the test and arranged for the data collection to be done by Tecton. And he asked us to provide some help taking hand measurements, which Mr. Coates, in our office, did, and I think Dr. Melis, in our office, also helped with that. Most of the data collection was by Tecton, and that data was all sent to us to be put into a summary report, which is what you have before you.

Q. Well, in your report, I see a lot of information about drawdown and pressures, et cetera, but could you point me to where you talk about the results of the tracer test?

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A. Well, I think, in my mind, the tracer test is part and parcel of this test that I'm talking about. It was a closed-loop test to determine the effects of pumping and reinjection on a large number of wells in the vicinity. And in the process of that, a tracer was injected into the State 7 well.

And I think probably we're concentrating on the word "tracer" when we should be concentrating on the word "test." I think to do a tracer test requires some movement of water, and, to me, that means that some pumping and some reinjection needs to be done. So I think it's all one thing. But I had no role in the choosing of the tracer or the decision to do a tracer as such. To me, the part that is of interest is the hydrogeology.

Q. I'm having a little bit of a problem, because Mr. Janney said you were the guy to talk to about tracers, and now I'm hearing you don't know anything about tracers. Do you see any conundrum?

A. I think my explanation to you is that the tracer test was a test of pumping an injection, which included the use of a tracer. And my part of the process was to help a little with the water-level data collecting and then to prepare the summary of water-level information.

Q. Let's move on to the pump test itself. Could you explain to me your role in designing the pump test?

A. My role was very small. Mr. Barker asked me what wells we should make measurements in and monitor during the pumping test, and I told him every well that he could find. And he was limited to some degree by accessibility and by the availability of water-level measuring transducers and reporting equipment. But other than that, he designed the test to include a large number of wells, as you see.

Q. And the test itself included not a single one of AmeriCulture's wells, did it?

A. I don't believe it did.

Q. So it doesn't give us any data whatsoever specific to AmeriCulture's wells, correct?

A. I think it gives us a good deal of information in the sense that State Well 3 was included, and that's in the very near vicinity of the AmeriCulture wells, so I think it has relevance.

Q. Sure. We can extrapolate, but it doesn't give us any specific data pertaining to AmeriCulture's wells. No specific data, right?

A. I don't believe any AmeriCulture well was measured.

Q. Why do you do a tracer test?

A. Well, in general, I think the tracer is designed to see where water goes when it's injected in one place, where it -- where it travels.

Q. Well, in the context of doing a tracer test in conjunction with this pump test, where would be the smart place to put the tracer?

A. Well, I think the tracer, in the first place, would be put into a well into which water was being injected, and in this case, it was the State 7 Well. And I think Mr. Barker must have had some reason to believe that he either would know where water went by where the tracer appeared or would know that he had not created a condition that would result in a thermal breakthrough by the fact that he didn't find it in other wells, apart from the AmeriCulture well.

Q. Now, in that State well -- or the 7 well that the tracer was injected into, that's kind of up close by the State 1 and 2 wells on that map behind you, right?

A. I believe it is, yes, sir.

Q. It's not anywhere near 55-7, is it?

A. No. I think it's at the opposite end of the wellbore [sic].

Q. It's at the opposite end of the way that the natural water flows, yes?

A. Well, sir, I'm not so sure about that. I think

the shallow groundwater does flow from, roughly, south to north. And I think if that's what we're thinking of by natural flow, direction, then that's correct. State 7 would be in the direction away from -- or down gradient in terms of the shallow groundwater flow.

On the other hand, we're creating a drawdown, creating a cone of depression, by pumping the wells that we pump. And what the gradient would be under those conditions is one of the reasons for doing the test. We're trying to learn from that. But --

Q. Sorry. Go ahead.

A. I must say, I have not been privy to Mr. Barker's plan for the test and the detail of why the dye was injected into Well 7. So I can't testify on his behalf.

Q. What would you have done to determine if injecting into 53-7 and 55-7 would result in water going back and being drawn out of 45-7? If you were using a tracer test, what would you have done?

A. I've never been asked that question, and it probably would be inappropriate for me to answer it on the spot. I think I would like to examine the situation, and having done so, I might come up with the same answer Mr. Barker did. I haven't tried to design a tracer test for this project.

Q. Well, you're the hydrogeologist here. You're the expert in geology and hydrogeology, the expert in groundwater hydrology, right?

A. (No answer.)

Q. And so based on your expertise, what would you do for designing a test -- give me kind of a rule of thumb, if you would -- for this project, because here's the scenario I see. We're pumping out of 45-7, and we're injecting into 53-7 and 55-7 over here (indicating). Wouldn't you want to know if they were connected? Wouldn't you inject into one of those wells to see if water's actually going back to 45-7?

A. Well, there are two things to remember. One is that the State 7 was also an injection well, so we were -- they were injecting into that well that they put the dye in. So as far as that water having been injected into the State 7 well would go would be a matter of interest.

In terms of the future project and what -- what one would do with the dye tracer, I'm not sure. I think -- in my practice, the information from heads, groundwater levels and flows, is the main source of information, and I probably wouldn't have done a tracer test at all. But then, on the other hand, I'm not an expert in geothermal energy development either. I'm a

groundwater hydrologist.

So I can understand why Mr. Barker did what he did, because he was injecting water into the State 7, and I can understand why one would do the tracer test, injecting into one of the proposed injection wells. And I think it would be of value in learning the timing of the arrival of water from the injection well back to the pumping well. But in another sense, I would find the same answer in another way by analyzing the flow packs and the aquifer properties -- properties derived from pumping tests.

Q. So as far as the tracer test went, are you familiar with the results of that test?

A. I don't think I've seen much data about it. I've heard that the Rhodamine appeared in the AmeriCulture production well, But I don't know what the concentrations were.

Q. Do you know if it appeared in any of the other wells that were being pumped?

A. I don't think it has, no.

Q. The only one it found its way to was the AmeriCulture's well, that you're aware of?

A. Yes. I think AmeriCulture's well was pumping at the time. I've been given to understand that, although I didn't observe it. And I understand that the

dye was injected into the State #7, which isn't very far away. So it seems quite clear to me that what happened was that the one well increased the head in the aquifer and the other decreased it, and there was flow between them.

Q. So we know there's flow between the 7 and AmeriCulture's well?

A. I believe that both those lines of evidence suggest that, yes, sir.

Q. Now, if I told you that AmeriCulture's well was just pumping at 100 gallons a minute, would that change your evaluation in any way?

A. Qualitatively, it would not. I don't think the fact that it was pumping at one rate or another would change the statement that I gave. I think that if you're pumping at a higher rate, more dye would have appeared in it, but a lower rate, probably less. But I don't have a qualitative answer.

Q. So let me make sure I understand what you're saying here. Essentially, the pumping rate wouldn't really have made any difference except as far as the level of Rhodamine that would have appeared in the well?

A. I think the pumping rate would have made a difference in the sense that it would have caused more water to be drawn into the well, and if that water

contained Rhodamine, there would be more Rhodamine brought into the well.

Q. What does it say to you that no tracer was found in any of the other wells in the area?

A. Well, I think the clear answer is that the -- the couple of wells that are involved vis-a-vis the tracer includes just those two, and there hasn't been enough other pumping to bring water into the other wells.

Q. Are you familiar with the proximity distance of some of the other wells that were tested?

A. Yes.

Q. And what's the farthest one away?

A. I'm just estimating around 4,000 feet.

Q. Would you expect dye to travel 4,000 feet in a month?

A. I can't answer that question without knowing a lot more about the hydraulic properties of the system and the pumping that was involved.

Q. Are you familiar with the hydraulic properties on the Lightning Dock system?

A. Only in a very general way. I think there's a great deal of uncertainty as to the local hydrologic -- or hydraulic properties in the system from one place to another.

Q. So you, sitting here today, cannot give any specific expert testimony regarding the hydrogeologic property of the Lightning Dock system. Is that fair to say?

A. I think what's fair to say is that I can describe the system in general terms as being largely one in which fairly low-hydraulic conductivity rocks are broken by fracturing and that the fracturing is interconnected, to a greater or lesser degree, from place to place and that the whole bedrock -- fractured bedrock system is overlain by alluvium, valley fill, which has somewhat higher permeability and certainly more nearly uniform hydraulic properties.

But as far as assigning hydraulic properties to the vicinity of an individual well, I don't think there's very much information about that. Mr. Witcher's test provides useful information, certainly, for the three wells that he dealt with.

The pumping test that we're looking at here would provide information as to hydraulic properties, but I've never been asked to develop the numbers for hydraulic conductivity or storage coefficient as related to the geothermal project.

Q. Okay. Well, as far as just the hydrogeology goes, not the geothermal aspect of it, can you with

certainty say that the water that is being proposed to be injected into Well 55-7 at the rate of three million gallons per day would definitively go back to the vicinity of Well 45-7?

A. I think the evidence from the 2012 pumping test, closed-loop test, shows that it would, yes, sir.

Q. And that the water that's proposed to be injected into 53-7 would definitively make it back to 45-7?

A. I think it would, yes. I think the test that was done supports that. I think to do a longer test with essentially the same configuration of wells as the proposed geothermal project would define that very well.

Q. Now, explain to me what equilibrium is.

A. Well, I think in the way I've been using the term, equilibrium is a condition in which the water levels in wells don't change very much if the conditions of pumping and reinjection don't change very much. So we would approach equilibrium by pumping and reinjecting for a period, and I think that period would be measured in weeks, probably. And during that time, water levels in most, if not all, of the wells in the immediate vicinity of the project would change. So some would go up, and some would go down. And after that period of readjustment, those water levels would not change very

much. To me, that's what I mean by equilibrium.

Q. I want to make sure I understand what you're saying here, because you say some would go up, and some would go down. And the amount they would go up and go down are unknown, yes?

A. Well, they would not be unknown after a full-scale test has been conducted. They would be rather well known.

Q. And then would equilibrium, as you're using it, mean that that well that went down, it would stay down, or would it then return to where it was before anything took place?

A. Does your question carry with it the assumption that the project has ended, or is the project continuing as --

Q. Well, in the context of how you're using equilibrium, is what I'm getting at. When you said equilibrium, you said some will go up, and some will go down. And what I'm trying to understand is what you mean by that. Does equilibrium mean they stay down, and they stay up? That's my question.

A. If, by your question, you are implying that the pumping and reinjection conditions stay the same, then I think equilibrium means that the water levels in the wells stay roughly the same as the levels that they had

reached.

Q. So in your report -- let's turn to that. And what I would like to turn to is your Figure 12. Okay? This is a drawdown in Well G-2-SE. Where is that?

A. The location of the wells that are described in the report, each of the wells, is found on Figure 1, if I'm not mistaken. G-2-SE would be, oh, roughly 4- or 500 feet to the northeast of Well 55-7.

Q. And 55-7, was that being used for injection or pumping?

A. It was used for injection.

Q. So G-2-SE is 4- to 500 feet northeast of the proposed injection well; is that right?

A. (Indicating.)

Q. Now, the variations of the left or right would make it a squiggle. Is that largely due to barometric?

A. Yes, sir, I believe it is.

Q. The general trend of that well was down; was it not?

A. Yes, sir. The general trend was downward until about January 28th, and after that, it appears to have been roughly stable.

Q. Because I'm looking at the beginning. It's at zero, at the very bottom, yes?

A. Yes, sir, at the end of the graph.

Q. And then it went down to just below five, maybe six around January 22nd. Yes? But at the very end, the far top of the graph, the end date is down at about, what, seven or so. So, to me, that graph seems to indicate that it's a general downward trend.

A. I think the plot indicates a general downward trend until about, oh, roughly, January 28th, and after that, I think the -- looking at either the troughs or the peaks suggests that the water levels are roughly stable.

Q. And then if you turn to Figure 14, which is Well A-131 -- now, that well is the one that is A-131 on your Figure 2? Would that be correct?

A. Yes, sir, it should be.

Q. And that would be about the same approximate distance from 55-7, or would that be a little farther away?

A. It would be a little farther.

Q. So, what, 5- to 600 feet, or what would you say?

A. I would say more than 600.

Q. And it appears to me, as well, that the general trend of that well was also downward?

A. Yes, sir.

Q. Then if we look at well -- at your Figure 16 of

State Well #3, which is way up there, you know, to the -- it's in Section 6, actually. About how far away is that?

A. I'm going to estimate around 4,000 feet.

Q. And then in this test, were you injecting into State 7?

A. Yes, sir, part of the time.

Q. And so it's within about 300 feet of the State 7?

A. Yes, sir, roughly.

Q. And the general trend of that well was down as well?

A. Yes, sir. The trend, again, was downward until about January 28th, after which I think it's roughly stable.

Q. Now, on your Exhibits 17 and 18, could you tell me what those big spikes are? What that represents?

A. I think they represent the problems with the water-level measuring device.

Q. So you had a problem with the water-measuring device?

A. Yes, sir. And perhaps I should say that I didn't.

Q. I stand corrected. I'm sorry.

There was a problem, apparently?

A. That would be my guess, yes, sir.

Q. And then when we get to your Figure 6, the injection pressure, tell me what it means to you when you started out with basically -- and you're going to have to school me a little bit on this, with your feet of water at 200 feet and the pressure. Essentially, tell me what it means when you started at 70, on January 16th, and by January 24th, you were down to zero. Explain that to me, please.

A. The vertical axis or the Y-axis scale is pressure, but it's in feet of water at 200 degrees out, from 200 degrees Fahrenheit. So that's making a density correction to compensate for the temperature of the water. And in this case, I'm just showing pressure in terms of the height of the column of water at that temperature. And the height of that water column would have been about 76 feet at the beginning of the injection, and it declined very rapidly until, let's say, January 18th, and then declined less rapidly, and then was essentially stable on January 23rd and 24th.

After that, the injection rate increased and water -- the pressure increased, again, January 28th. It was roughly stable through the 29th, and then it dropped and it varied with time, but it didn't -- I don't think there is a systematic change in pressure.

Q. All right. Because what I'm trying to figure out here from your diagrams -- you have drawdown data on some wells; basically starting water level in a well, so many feet below ground, and then changes, et cetera. And on your Figure 6 -- well, excuse me. In your report, you don't have any specific similar data for Well 55-7. Does your Figure 6 provide that information in some sort of different type of measurement, is what I'm trying to figure out?

A. Yes, it does.

Q. Do you understand what I'm trying to get at?

A. Yes, I do. It provides that type of information in the very same way. It's in feet of water, just as a drawdown would be.

Q. So tell me if I understand this figure correctly, then, that on January 16th, basically the water level was at 70, and by January 24th, the water level was at zero?

A. No, sir. On January 16th, the water level -- in terms of the injection pressure, the pressure at the wellhead, the pressure that it took to put water into the well, had reached the equivalent of the column 76 feet high. Not that there was such a column. That was just the pressure.

Q. Pressure. Gotcha.

A. And that pressure declined quite rapidly until about January 18th, at which time it reached a low of about 15 feet. And then because of variations in the pumping and injection rates, it went up again on January 18th and then declined relatively smoothly until about January 23rd. And then a little bit later -- there is missing data -- the pumping rate increased, and that injection pressure was higher on January 28th and later, until the pumping and injection ended.

Q. Does your report, in any place on any of these figures, tell me what the water level was in Well 55-7 before you started and throughout the injection process?

A. No, sir, I don't believe it does.

Q. How about with well -- same kind of question with Well 53-7. Do we know what the water level was? Do we know anything about drawdown on 53-7?

A. No, sir, I don't believe we do. We have a plot that shows the pumping rates, but I don't believe that the water levels were measured in 53-7.

Q. Because we got -- then at your Figure 3B is the drawdown in 45-7, and what I see is a substantial curve there starting about January 25th through January 31st, and then on February 1st, it goes back up. So does this still tell us, though, what the drawdown in 45-7 was?

A. Yes, sir.

Q. Why is there that steep curve? What does that define? What does that tell you?

A. Well, the reason the curve is there -- well, let me say this. There are really two curves. The data from the earliest injection -- I mean the earliest pumping -- I'm sorry -- aren't shown, because if you refer back to Figure 2, you'll see that the pumping began to occur on January 16th, and there is no water-level measurement until about midday on January 18th.

So it would have been a similar-looking curve starting at zero, and then tracing the part of that plot that ends at about the end of the day on January 24th. That plot would have looked like the next segment, which is the steep curve from January 25th through January 31st, but it didn't reach its greatest drawdown because there was a lower pumping rate, as indicated on Figure 2.

Then after January 26th, after a period of no pumping, as indicated on Figure 2, during which water levels in the well rose rapidly as indicated by the little upward spike in the middle of the graph on Figure 3D, pumping at a higher rate began and continued through January 31st, and it's pumping at that higher rate. And, I believe, it was very close to coming into an

equilibrium water level or creating an equilibrium drawdown at the end of the test, on January 31st.

Q. Well, if it was equilibrium, wouldn't we expect the water level in 45-7 to have basically stayed the same? I mean, if the water is injecting into 53 -- 57 and making its way back to 45-7, and it's a closed loop, wouldn't we expect the water level basically to stay the same?

A. Yes, sir. I believe it does. I think that's what that graph shows us.

Q. Because I see this drop down from 20 feet to 120 feet between January 26th and January 31st.

A. Yes, sir. I think earlier in my testimony I said that sometimes it's required -- sometimes it's necessary for these water levels in all these wells to reach equilibrium. And that's because, in the ground, the water doesn't flow absolutely unimpeded. There is a resistance to flow, so it takes some time for the effects to be fully developed and to establish themselves as an equilibrium. But I think the equilibrium was very close to occurring in the last day or two of January.

Q. Do you expect 100 percent of the injected water to return to the production --

A. Yes, sir, I do. I think there is certainly a

possibility that some percentage of the actual molecules of water that are injected may not return to the pumping well, but I think in a mass-balance sense, all of that water will return to the pumping well. And I think in all probability, that all of the injected water will return to the pumping well, because you will have created a sink.

Q. And even though the general flow of the groundwater -- shallow groundwater is south to north, you don't think that will affect whether or not any of the injected water would return to 45-7? For instance -- let me flesh that out a little better.

53-7 is north of 45-7. So is it your testimony that all the water that would be reinjected into 53-7 would run counter to the natural groundwater flow and make it to 45-7?

A. In the first place, at depth in the system, I'm not sure that the natural groundwater flow is to the north. I think we talked about that a little bit earlier. I think that shallow flow system certainly contains water that's on its way northward down the valley. But I think at depth, the head gradient is probably very nearly vertical, and you're probably seeing water rising in fractures in deep bedrock.

Q. Do you see any problem in injecting into 55-7

below 1,050 feet when there is no casing on the well, when the target zone is basically 500 feet deeper than that?

A. I think Mr. Janney, I believe it was, made the point that if the fracture into which the water would go is deeper than the bottom of the casing, then that's where the water would go.

Q. I'm asking you your opinion, not what Mr. Janney said.

A. I agree with Mr. Janney.

Q. So you don't see any problem that there is no casing, but your proposal injection interval is 500 feet deeper --

MS. HENRIE: Objection. I think the witness just answered this question.

MR. LAKINS: I was trying to rephrase it, but I'll move on.

Q. (BY MR. LAKINS) Do you agree with Mr. Janney's statement in his PowerPoint presentation that the geothermal production in the injection wells may be in hydraulic communication with AmeriCulture State Well #1?

A. I agree with that for this reason: I think that to a greater or lesser degree, and with huge variations, I think all of that groundwater system is in some communication.

Q. So then if you're injecting into 55-7 or 53-7 and the proposed injection level is pretty deep compared to AmeriCulture State Well #1, isn't it possible, then, that the State Well 1 will be affected?

A. We're creating the sink at the same time. We're not just injecting. The amount of water to be injected is to be matched, essentially, exactly by the amount of water to be withdrawn from the sink. And I think that's what will determine where the injected water goes.

Q. Just to clarify one thing, as far as the actual use of the geothermal source, the heat, you're not offering any opinion about that?

A. No, sir.

MR. LAKINS: Pass the witness, Madam Chair.

CHAIRPERSON BAILEY: Mr. Brooks, do you have any questions?

MR. BROOKS: Yes, I do.

CROSS-EXAMINATION

BY MR. BROOKS:

Q. I am having trouble seeing the board, but I have a copy of the map here in front of me, and it looks like the 45-7 well from which, for the moment, Los Lobos proposes to withdraw is farther south and considerably greater distance from AmeriCulture's property than the

53-7 into which they propose to inject; is that correct?

A. That's my understanding, yes, sir.

Q. And the 53-7 is north of the 45-7, and AmeriCulture is north of the 53-7; is that correct?

A. Yes, sir.

Q. Now, the 55-7 is in very close proximity to the 45-7, right?

A. Yes, it is.

Q. Now, to me, as a layperson who is not an expert in geology, it would look like I could draw -- particularly given that there is some suggestion, although you don't necessarily -- well, let me ask one question at a time here.

There was some suggestion that the predominant movement of the water was from south to north, correct?

A. I believe that's correct insofar as it applies to the shallow groundwater of the valley fill, but I don't think that's --

Q. But that shallow would not apply to the depth at which Los Lobos' wells are completed, correct?

A. No, sir. And I don't know what the groundwater potential metric contours would look like for the deep zone, but I think that the water is, generally speaking, coming up.

Q. So you don't really have an opinion as to what the predominant direction of the flow would be at the depth at which AmeriCulture proposes to inject?

A. AmeriCulture or --

Q. I'm sorry. Los Lobos proposes to inject.

A. Well, sir, I do have an opinion, because I believe that the flow pattern in that system will be strongly dominated by the location of the pumping well. I think the water will be moving from the injection wells to the pumping well, just because it will have created that sink.

Q. So it would be moving, in your opinion, north to south?

A. Yes, sir.

Q. Do you think that -- the fact it will be moving away from the injection wells toward the producing well, will that tend to adversely impact AmeriCulture's well?

A. I think that's the reverse. I think it would tend to isolate the Cyrq operations away from AmeriCulture's well.

Q. Even though the water is moving south, which would be away from AmeriCulture's well?

A. Well, it's moving south towards that sink.

Q. Right.

A. Then it's coming right back again to be

reinjected. So in the sense that the water is moving, it would be moving south. But the net effect -- I think once the establishment of what we call an equilibrium condition as among all the wells in the area, once that has been established, then I don't think water will be moving in the deep system anywhere except within that cell that includes the injection of the pumping well.

Q. Now, let me move up further to one other subject. You have analyzed Mr. Witcher's -- you have reviewed Mr. Witcher's analysis of the geology of this area?

A. I have reviewed it, yes, sir.

Q. What is your principal difference of opinion, if you have one, between your analysis and Mr. Witcher's analysis?

A. I haven't concentrated on the geology at all. I think Mr. Janney has been our geologist, and Mr. Peery, in our office, also has more familiarity with the geologic conditions than I do. My role has been to try to understand the groundwater flow.

And for me, the intricacies of the stratigraphy, the layers of sedimentary rocks and the volcanic rocks and volcanic clastic rocks is not so important as the distribution of hydraulic conductivity and hydraulic properties. So I don't dispute

Mr. Witcher's overall geologic interpretation. I have disputed, as I've said before, some of his hydrologic interpretation.

Q. Some of his what?

A. Hydrologic groundwater flows interpretation.

Q. Review for me -- I believe you answered Ms. Henrie's question on that, but review for me what you said.

A. Yes, sir. Mr. Witcher had concluded that there was a barrier to flow, that there was an impermeable boundary within the system that he interpreted from the tests that he did in 2001. I don't believe that the tests that he did leads to that conclusion.

Q. Now, let me move to one other subject, and then I'll be through. You do a lot of work with the State Engineer's Office; do you not?

A. Yes, sir.

Q. And you're accustomed to what kind of information they require in water-rights issue cases?

A. Yes, I am.

Q. Now, were you in any way involved in the adoption of the statutory amendment in 2012 that had to do with the State Engineer's jurisdiction and geothermal regulation that was House Bill 201 in the 2012 session?

A. Yes, I was.

Q. So do you have a general understanding of what that statute requires?

A. Yes, I do.

Q. Okay. Now, it requires, does it not, that information be submitted to the State Engineer about a geothermal reservoir and that the State Engineer be given an opportunity to give an opinion on whether the geothermal operation will result in an impairment of any water rights. Is that a reasonable summary?

A. Yes, sir, I believe it is, but I must confess, I haven't read that statute in a great long time.

Q. If Ms. Henrie would get permission to approach, perhaps she can give you a copy of it.

MS. HENRIE: May I approach, Madam Chair?

CHAIRPERSON BAILEY: Yes.

Q. (BY MR. BROOKS) I have a copy of it, also, in front of me, so I'll give you a few moments to review it, particularly paragraph B2.

A. Yes, sir. I've given this a rapid review.

Q. Okay. Based on your work with the State Engineer, would you feel that you would be able to understand what kind of information the State Engineer would be looking for, you know, if they were requested to give such an opinion?

A. Yes, sir.

Q. And has AmeriCulture, or does it -- I'm sorry. I keep calling you Americulture.

Has Los Lobos done or does it now propose to do the tests that would gather the information that you would expect the State Engineer to want for purposes of that requirement?

A. I believe the test information, coupled with geologic information, coupled with the fact that the proposed project would have almost zero net depletion and that any incidental depletions would be met from other water supply sources is essentially sufficient for the Engineer to make the determination required in this statute.

Q. Do you believe that Los Lobos already has that information, or do you need to do additional testing to obtain that?

A. I think the information that has been developed from the -- partly through the work of Mr. Witcher and partly through the closed-loop test that's been referred to and from my report of March 2012, it probably contains enough information with which the Engineer could reach his decision. If the Engineer felt that he needed more information, I think it would be amply available in the proposed test.

Q. The proposed test being one that you propose to

conduct?

A. You're using the word "you." I assume --

Q. I mean Los Lobos --

A. Yes.

Q. -- proposes to conduct, which is the focus of the immediate focus of this injection permit application?

A. Yes, sir.

Q. Thank you.

CHAIRPERSON BAILEY: Commissioner Warnell?

COMMISSIONER WARNELL: Thank you.

CROSS-EXAMINATION

BY COMMISSIONER WARNELL:

Q. I'm going to ask a question first kind of going back to the last witness. Several times we've heard about the depth discrepancy of where the pipe -- the tail of the pipe is. It's 540 feet above the zone that you're proposing to inject into?

A. Yes, sir.

Q. And you are probably not the person to ask this question, so forgive me, but I'll ask it anyway. Would it be possible for Los Lobos to go in and set 550 feet of pipe and cement it in place?

A. Madam Chair and Commissioners, I haven't looked at the construction diagram of that well, and I wouldn't

be able to answer that question specifically. It's not ordinarily difficult to do that, to set a liner.

Q. Okay. Thank you. I appreciate that.

Now, back to your testimony. What is the permeability of the bedrock that we're talking about here?

A. I don't think that there is an answer to be given at this hearing. I think the groundwater modeling enterprise could be undertaken, which would develop an understanding of those -- of the distribution of the hydraulic properties in the system. But precisely because this is intended to be a closed loop in which injection is matched by pumping, that sort of information isn't really very useful. It would be of great academic value, and I would enjoy doing it a great deal. But the fact that the water that's going in is pumped immediately nearby, it means that knowing the distribution of hydraulic properties throughout the system is not of great importance.

Q. So would it be fair for me to assume that it's very tight permeability? I mean, we're just dealing here with fractures?

A. Well, Madam Chair and Commissioners, I think I would say it's not very tight. The rock itself is very tight, but the fractures are capable of yielding 1,500

gallons a minute, which is a very substantial water well.

Q. So we're going to throw permeability out the window, and we're just looking at fractures as the conduit?

A. Well, we're looking at permeability in a bulk sense, that over a large area or in a large volume of the aquifer, there would be an equivalent permeability, but that would largely be in the form of fracture openings.

Q. On some of your graphs that we looked at -- and I don't really want to call out any particular one because I didn't write anything down. But the drawdown is very sinusoidal; looks like an SP [sic] and an old ES log.

A. Yes, sir.

Q. What's causing that? Why do we see that?

A. I think that's the diurnal or barometric pressure effect being seen in the pressure of the well.

Q. It has nothing to do with pump frequency or anything like that?

A. No, sir, I don't think so.

Q. And one other question, if you'll bear with me here. There's been a lot of talk about and we've kind of danced around this tracer test today, and maybe you

could help clarify it for me. Who or why was the decision made to run the tracer test?

A. I think -- when we speak of the tracer test, I think we're talking about the pumping test that was involved here, which was a closed-loop test designed to determine what would change and if water were pumped out of two wells and if water were injected into two others. To me, the tracer aspect of that was almost incidental to the test, although, in conversation, it was called a closed-loop test, and that's the title I've given it in my report. It's been called a tracer test in this hearing because a tracer was used in a part of that activity.

Q. Well, I'm not sure if it's incidental. It seems to be that it's muddied the water quite a bit. Excuse the pun.

That's all the questions I've got. Thank you.

CHAIRPERSON BAILEY: Commissioner Balch?

CROSS-EXAMINATION

BY CHAIRPERSON BALCH:

Q. Good afternoon, Dr. Shomaker. Thanks for your testimony.

So the closed-loop test that you're talking about, really you're pumping water from 45-7 and 53-7 at

the same time, and all that water is going into -- is it 55-7, or is it going into 63-7 or 55-7 at the same time?

A. Are we speaking of what's being proposed?

Q. No. What's been done.

A. What's been done in 2012? Let me just make sure, because I have a tendency to be a little dyslexic about these well names.

45-7 and 53-7 were pumped, and 55-7 and State #7 were injection wells during that test.

Q. Was the water from 53-7 injected into State 7?

A. No. The water that was actually injected into State 7 came from off site. It was intended to balance the losses that would occur because some water escaped to steam.

Q. Evaporation?

A. So to keep the mass balance intact.

Q. So the actual water that resulted from 53-7 and 45-7 were injected into 55-7?

A. Yes, sir.

Q. I saw that you had about 100, maybe 120 feet of drawdown for equilibrium in 45-7 at about 1,500 gallons per minute.

A. That's as I recall, but I can certainly look here.

Q. And it didn't have a direct head measurement in

the 55-7, but when you increase your pressure, it would imply to me that there would have been increase at the head of that wells -- in that well?

A. Yes, sir. Yes, sir.

Q. I'm a physicist, so I draw vectors on things. The A-131, you had a dip in the head, and G-2-SE, you had a dip in the head. And those were to the east of the hypothesized fault. So it appears that there is communication across that pretty well?

A. Yes, I believe so.

Q. If you hadn't been injecting -- I'm going to ask you to make a conjecture. If you hadn't been injecting into 55-7, do you think the magnitude of the decrease in the G-2-SE and the A-131 would be greater?

A. If there had been only pumping and no injection?

Q. Right.

A. Yes, I do.

Q. So the impact of injecting in 55-7 is, you're supporting, kind of, the head in the area. It seems to me that's the way it's supposed to work, right?

A. Yes, sir.

Q. Doing what it's supposed to do?

A. I believe it is.

Q. The maximum injection rate for the two

injection wells with a new test is three million barrels per day, each well, and corresponds, roughly, to 4,500 gallons per minute of production and primarily from the 45-7. Assuming they can actually sustain that rate, do you feel comfortable extrapolating the result of this test to that scenario?

A. Yes, sir, I do.

Q. What do you think the results would be?

A. I think the results would be similar to the results of the 2012 test. I think there will be an equilibrium reached again, with some wells rising, some falling, and probably a little longer time than it took for the onset of near equilibrium in the 2012 test, something close to 1,500 gallons a minute.

Q. Thank you. Those are my questions.

CROSS-EXAMINATION

BY CHAIRPERSON BAILEY:

Q. I asked Mr. Janney about trigger points for making adjustments on establishing equilibrium to smooth out the pertubation in reaching that equilibrium. I'm a regulator. I look for trigger points, numbers on which we can say: This is the criteria by which you need to make an adjustment. Can you give me those? He deferred the answer to you.

A. Madam Chair, for that, I shall be eternally

grateful.

(Laughter.)

A. I think in the State Engineer's jurisdiction, which is where I primarily am, the impairment of a water right occurs when the owner of the right is no longer able to exercise it. And so the ultimate trigger point, I think, would be the point at which any other water right would no longer be capable of being exercised.

Q. But no warning symbol -- no warning measurement in anticipation or before?

A. Yes, I do, Madam Chair. I think there certainly will be ample warning in the sense that a record of water levels and water quality in all the wells involved -- monitor wells, operating wells, wells of Cyrq and wells of AmeriCulture -- will tell us when things are not -- if things are not proceeding as expected.

Q. Which just points out the need for the monitoring wells and constant monitoring of other wells in the area?

A. Yes. I think that constant -- that may not be quite the word I would have used. I think after a period of some length, some months, years, it may be found unnecessary to measure as frequently or to sample as frequently. But I think monitoring and sampling

would continue through the life of the project.

Q. And the sampling frequency is to be determined dependent on the impacts that we see?

A. As far as I'm aware. I don't think that a sampling program has been put forward, but I may be mistaken about that.

Q. Do you have recommendations for a sampling program?

A. I have not been asked to do that. I think that would probably fall in Mr. Janney's bailiwick.

Q. Those are all the questions I have.

CHAIRPERSON BAILEY: Do you have any redirect?

MS. HENRIE: I have one question, Madam Chair.

REDIRECT EXAMINATION

BY MS. HENRIE:

Q. Dr. Shomaker, the table -- the chart labeled "Figure 6" in the March 2012 report that shows the pressure -- the injection pressure at the wellhead for Well 55-7, I think the chart has been kind of confusing, and I appreciate you spending some time to explain it to people.

I think the question I want to ask is: Is it even possible to measure the depth to water in a well

that we're simultaneously injecting into?

A. Yes, it is.

Q. And how would you do that?

A. If the injection creates a pressure at the surface, then it's just a matter of measuring it with a pressure gauge. If the injection is all by gravity and the water doesn't need to be pumped into the well, then the conventional -- what's called a pumper tube or various other ways, electronic pressure, transducer could be used to do that very thing.

Q. I believe the standard is to --

A. Yes.

Q. And this chart reflects the same?

A. Yes.

Q. Thank you.

MS. HENRIE: No more questions, Madam Chair.

And I don't think I have any exhibits to move with this witness, so I'm ready to call my next witness.

CHAIRPERSON BAILEY: Well, it is 4:30 in the afternoon. Let's do some housekeeping before we bring on another witness.

You may be excused, Dr. Shomaker.

THE WITNESS: Okay.

CHAIRPERSON BAILEY: How many more witnesses do you have?

MS. HENRIE: I have one or two. I was just going to huddle with my team to see whether both are necessary.

CHAIRPERSON BAILEY: Okay. Clearly, we're not going to be able to wrap up your testimony today. Tomorrow, we cannot meet in this room. This room is no longer available for the rest of the week. We can only meet tomorrow morning in the Land Office, Morgan Hall. But time constraints mean that we can only meet between 8:00 and 10:00 in the morning, which creates its own set of problems for everybody. Otherwise, we would have to continue this case after today into the following week.

How many witnesses do you have.

MR. LAKINS: Two, Madam Chair.

CHAIRPERSON BAILEY: Two. And the length of time that you expect?

MR. LAKINS: More than two hours.

CHAIRPERSON BAILEY: More than two hours. So we may decide whether we want to meet to continue this for two hours tomorrow morning at the State Land Office auditorium or if we should reschedule another date next week. So what is the availability of the parties next week?

MS. HENRIE: Madam Chair, if I could just report on the discussion I had with my client. Our team is here. We would like to continue tomorrow, even though we realize it's only two hours, and then try to give AmeriCulture its opportunity next week. I will need to check with everybody on availability.

CHAIRPERSON BAILEY: Are you available tomorrow morning between 8:00 and 10:00?

MR. LAKINS: Yes, Madam Chair.

CHAIRPERSON BAILEY: The State Land Office does not have parking.

COMMISSIONER WARNELL: Does not have parking? Is that what --

(Discussion off the record; break taken, 4:33 p.m. to 4:37 p.m.)

CHAIRPERSON BAILEY: Can we go back on the record?

If you would like to call your next witness.

MS. HENRIE: Madam Chair --

MR. LAKINS: Before we do that, Madam Chair, one real quick housekeeping matter. Exhibit 18, which is technically mine, Mr. Shomaker's report, we still need to admit.

MS. HENRIE: No objection.

CHAIRPERSON BAILEY: All right. Then it is admitted, Exhibit 18, for AmeriCulture.

MR. LAKINS: Otherwise, I'll forget it.

CHAIRPERSON BAILEY: Best to do it now.

(AmeriCulture Exhibit Number 18 was offered and admitted into evidence.)

MS. HENRIE: I'd like to call Chuck Smiley as my next witness.

CHARLES P. SMILEY,

after having been first duly sworn under oath, was questioned and testified as follows:

DIRECT EXAMINATION

BY MS. HENRIE:

Q. For the record, Mr. Smiley, please state your full name.

A. Charles P. Smiley.

Q. Where are you employed and in what capacity?

A. I'm employed by Cyrq Energy. Did you ask where? In what capacity?

Q. In what capacity.

A. I'm the site manager for Cyrq Energy based in Animas, New Mexico.

Q. And please summarize your education and employment background.

A. I graduated from the United States Air Force

Academy with a Bachelor of Science degree in Civil Engineering. I spent the next 28 years as an active-duty engineering officer. My principal duties were in facility management, facility upkeep, construction; deployed around the world doing humanitarian response, disaster relief and construction projects.

When I retired from the Air Force -- and during that time, I got a Master's of Science degree in Engineering Management from the Air Force Institute of Technology. I got a master's degree from the Air Force's War College, and I also attended a professional school called Air Command Staff College.

Following my retirement, about five-and-a-half years ago, I've served in a number of capacities. I was the construction manager for the construction of a diesel power plant, $220 million plant in Alaska. I served as vice president of operations for two small companies and have been employed by Cyrq Energy since August -- correction -- since August of 2012, I was hired to lead the construction effort.

MS. HENRIE: If I may approach, I'd like to give the witness some exhibits.

CHAIRPERSON BAILEY: Yes.

MS. HENRIE: I've handed him Exhibits 5, 8

and 9.

Q. (BY MS. HENRIE) And, Mr. Smiley, if you could, please describe Exhibit 5 for the Commission.

A. Well, Exhibit 5 is a -- is a Bureau of Land Management form that leases -- there are two, actually. One is for 2500.96 acres to Lightning Dock Geothermal HI-01, and, secondarily, a similar lease agreement from the BLM for 640 acres. So those are the two pertinent documents as far as my company is concerned. And also within this package is a State of New Mexico State Land Office lease to AmeriCulture for ten acres of state land. That's Exhibit 5.

Exhibit 8 is an affidavit --

Q. Whoa, whoa, whoa.

A. I'm sorry. Excuse me.

Q. Mr. Smiley, the name on the BLM lease is "Lightning Dock Geothermal HI-01, LLC"; is that correct?

A. That's correct. Yes.

Q. Please explain the relationship between that company and the Applicant, Los Lobos Renewable Power, LLC?

A. Well, even to pull it back further, as I said, I'm employed by Cyrq Energy. Cyrq Energy, in turn, owns a company called Raser Power Systems, LLC, who, in turn, owns Los Lobos, which is the holder of our company's

permits in this regard, for this particular project. And then finally, Los Lobos owns the Lightning Dock Geothermal HI-01, which owns the assets for the company. So that's the relationship.

Q. When this project was started, it was started in the name of Raser Technologies, I believe.

A. It was.

Q. What is the relationship between Raser Technologies and Cyrq Energy, Inc?

A. Raser Technologies became Cyrq, Inc. They changed the name of the company.

Q. Thank you.

If we could now turn to Exhibit 8. Could you please describe that?

A. Yes. Exhibit 8 is an affidavit signed by the chief executive officer of Cyrq Energy, Nicholas Goodman. Do you want me to read it or just to describe what --

Q. Please describe what it says.

A. In essence, what it says is -- an affidavit that says that we, at this point in time, do not plan to install a water-cooled cooling system as part of this -- the project that we're planning to undertake, nor do we plan to do it in the foreseeable -- in the future at all. It's not part of our plans at this time. As a

matter of fact, if I may add, we have been actively in the process of trying to sell the water-cooled cooling tower assets that we currently have had on site for some time.

Q. Mr. Smiley, some of the earlier witnesses described the power plant as being a binary technology system.

A. Yes.

Q. Can you confirm if that is, in fact, what the company plans to --

A. Yes. Yes, Madam Secretary [sic], Commissioners, that is, in fact, what we plan to build, the binary system.

Q. Mr. Smiley, does this project have a signed power purchase agreement?

A. It does. We have a PPA that's signed. It went into effect the 30th of April of 2012 with PNM. And it was accepted and approved by the New Mexico PRC on the 11th of December 2012.

Q. Does the project own any water rights at this point in time?

A. No, we do not own water rights.

Q. How does the project use water lawfully on the site right now?

A. We have an annual lease. The most recent one

took effect the 1st of January of this year. We are leasing 150 acres from a nearby family, the Rudiger family, who, in turn, have agreed not to use that same amount of water for agriculture or other purposes.

Q. How did the company know how much water to lease?

A. Well, we had had water leases in the past. As a matter of fact, previously, in 2012, we had one with the same -- with the same family. We decided that it was -- for what we were renting, it was well in excess of our needs even under the most extreme circumstances, if we were drilling wells, et cetera. So we decided to scale it back. We still are leasing more, frankly, than we -- well beyond what we anticipate needing, but that's what we negotiated with the party.

Q. Mr. Smiley, are you familiar with the discharge permit that is, I believe, Exhibit 6 of AmeriCulture's exhibits?

A. Yes, I am familiar with it.

Q. Does that exhibit include a monitoring program?

A. It does. As a matter of fact, the appendix to it contains five tables, all of which describe various components, wells, different assets, a recurring and a regulated monitoring program which we will certainly have.

Q. But it's not set up yet?

A. It's being set up as we speak, but it's not currently set up.

Q. Also, within the discharge permit -- you may have heard the Chair ask Mr. Janney and Dr. Shomaker about triggers. And can you reference anything in the discharge permit that might be such a trigger?

A. I think what we're talking about -- if the Commissioners could refer to -- I think it's AmeriCulture Exhibit 6, which is the discharge permit itself. On page 8, right in the center of the page, it's number iii. And it talks in general terms about what the groundwater monitoring program does, what it consists of, refers to the tables I talked about a moment ago. And there are, in fact, certain triggers that I think are -- I think addressed the point you're making, Madam Chair.

Q. Mr. Smiley, you recently testified about the lease rights of Los Lobos, or Lightning Dock Geothermal HI-01 vis-a-vis AmeriCulture, and you mentioned that AmeriCulture has a ten-acre state mineral lease.

A. Yes.

Q. Does AmeriCulture, to your knowledge, have any other rights to use the geothermal reservoir?

A. Yes. In the joint facility operating

agreement, there are 15 acres additionally. I'm looking at our Exhibit 9, I guess. But it's 15 acres that's also leased to AmeriCulture via the JOFA.

Q. And that's shared between Los Lobos and AmeriCulture?

A. Yes, that's correct.

Q. And is that ground physically located where AmeriCulture's plant is?

A. Yes.

Q. Also within the JOFA, the document you're looking at, Exhibit 9, is there a provision in there that relates to heat?

A. Yes. Well, let me find it real quickly. Yes. Within that particular document, the Joint Facility Operating Agreement, on page 6, paragraph bravo three, it requires us -- we've accepted the idea that if there is a depletion of heat to the AmeriCulture operation, that we would -- I'll just read it. It says: "Lightning Dock shall provide AmeriCulture with effluent heat in the amount equivalent to that by which AmeriCulture's resource is depleted."

Q. Has this agreement been assigned to Lightning Dock Geothermal HI-01, LLC?

A. It has, ys.

Q. Mr. Smiley, if project construction started on

April 1st, 2013, could this project be built by the end of the year, meeting the requirements of the federal --

A. It's possible. You know, I've been doing construction for a long time. I would say that at this date, we would have to pretty much catch every break we could get logistically, materialwise. This test, of course, which would necessarily precede it, would have to come out in a favorable manner. But, I mean, it is physically possible to do that, yes. I'm optimistic.

Q. And do you have any knowledge about the level of investment that your employer has put into this project?

A. Well, you know, the truth of matter is, I'm down in Animas. I'm not at the corporate headquarters. I'm not in a position with senior executive responsibility of this company.

Just in collateral conversation, I know that we have already spent literally tens of millions of dollars, and we have tens of millions of dollars to go. So there is a pretty high price. But as far as actual numbers, I do not know.

Q. Fair enough.

MS. HENRIE: I have no more questions. I pass the witness.

CHAIRPERSON BAILEY: Would you care to

defer your questions until tomorrow morning at 8:00?

MR. LAKINS: Yes, Madam Chair, I would.

CHAIRPERSON BAILEY: Why don't we continue this hearing until 8:00 tomorrow morning in the State Land Office Building, Morgan Hall.

(The proceedings recessed, 4:53 p.m.)

STATE OF NEW MEXICO

COUNTY OF BERNALILLO

CERTIFICATE OF COURT REPORTER

I, MARY C. HANKINS, New Mexico Certified Court Reporter No. 20, and Registered Professional Reporter, do hereby certify that I reported the foregoing proceedings in stenographic shorthand and that the foregoing pages are a true and correct transcript of those proceedings that were reduced to printed form by me to the best of my ability.

I FURTHER CERTIFY that the Reporter's Record of the proceedings truly and accurately reflects the exhibits, if any, offered by the respective parties.

I FURTHER CERTIFY that I am neither employed by nor related to any of the parties or attorneys in this case and that I have no interest in the final disposition of this case.

Mary C. Hankins

MARY C. HANKINS, CCR, RPR
Paul Baca Court Reporters
New Mexico CCR No. 20
Date of CCR Expiration: 12/31/2013