BEFORE THE DEPARTMENT OF WATER RESOURCES

OF THE STATE OF IDAHO

IN THE MATTER OF APPLICATION)
FOR PERMIT NO. 63-32573 IN)
THE NAME OF M3 EAGLE LLC)
_____) VOLUME VI

(Pages 1206 through 1469)

BEFORE

HEARING OFFICER: GARY SPACKMAN

Date: May 4, 2009 - 8:52 a.m.

Location: Idaho Department of Water Resources
322 East Front Street
Boise, Idaho

REPORTED BY:

JEFF LaMAR, C.S.R. No. 640

Notary Public

APPEARANCES:

For M3 Eagle LLC:
GIVENS PURSLEY LLP
BY MR. JEFFREY C. FEREDAY
MR. MICHAEL P. LAWRENCE
601 West Bannock Street
P.O. Box 2720
Boise, Idaho 83701-2720
For North Ada County Groundwater Users Association:
BY MR. JOHN THORNTON
5264 North Sky High Lane
Eagle, Idaho 83616
For Eagle Pines Water Users Association and Individually:
BY MR. ALAN SMITH
3135 Osprey Road
Eagle, Idaho 83616
Appearing Individually:
BY MR. NORMAN L. EDWARDS
884 West Beacon Light Road
Eagle, Idaho 83616
///
///

APPEARANCES (Continued):

Also Present:
Jerry Peterson
Jason Smith
Dennis Owsley
Cherie Padilla

I N D E X

W I T N E S S E S

E X H I B I T S

THE HEARING OFFICER: Let's go on the record. We're recording again. Today is May 4th, and it's approximately 8:45 in the morning. This is a continuation of the hearing for application to appropriate water No. 63-32573. And we're in the middle of the testimony of Mr. Ed Squires.

And I think, Mr. Thornton, you were cross-examining Mr. Squires.

MR. THORNTON: Right. Yes, I was.

THE HEARING OFFICER: All right. You may continue.

ED SQUIRES,
having been called as a witness by M3 Eagle LLC and previously sworn, testified as follows:

CROSS-EXAMINATION (Continued)

BY MR. THORNTON:

Q. Okay. Well, Mr. Squires, I bet you enjoyed your week off like I did.

In the testimony the previous week, I want to thank you for pointing out the Pierce Gulch sand and how it could be viewed in a large exposure in terms of the north -- the location of the north Boise foothills. And I think you even

brought in a sample -- I don't know if that was here today -- of the material for illustrative purposes of that.

And this weekend we went up to look at that area of Pierce Gulch sand. And I was wondering if you ever observed all of the birds that are building their little tunnels about halfway up in that exposed face?

A. Yeah.

Q. Okay. And thinking of the sample of the Pierce Gulch sand over here that you brought up previously in your expert opinion and with your intimate knowledge of the Pierce Gulch sand, could you estimate what angle of repose that sand might be right now where those birds are building into that face?

A. It's pretty steep. It's a fairly sheer face.

Q. Okay. And then in your expert opinion as a registered professional geologist, why do the facies of that exposure in Pierce Gulch appear to be largely stable and near vertical?

A. I think that we've said throughout our research and all of our reports that one of our major findings is that the Pierce Gulch sand was

quite cemented, actually. And that comes through in all of our aquifer testing. We've had to correct for the fact that it's cemented.

It's a combination of cementation in the subsurface, but also there's some things that happen in the outcrop that cause it to stand like that as well. And it has to do with water evaporating out of there and precipitating near the surface. It gives it a harder surface in the outer few feet. But it doesn't necessarily mean if you dig back in there where the birds are going back in that it isn't a lot less cemented in the outcrop.

Q. Okay.

A. In the subsurface it appears to be quite cemented.

Q. And then in your testimony or in your display of the Pierce Gulch sand, are you stating that the Pierce Gulch sand being 200, 300, 400 feet, whatever the thickness is, that it is all like that?

A. No, I'm not stating that.

Q. Okay. And so what would you look at based on your resistivity logs where we can see it's not necessarily a straight line over I think

to the left, but it varies, there's quite a bit of variation? What does that tell you about that medium of the Pierce Gulch sand, then?

A. Well, it tells us that there are interbeds between the sands. And it's not a constant, thick, homogeneous unit.

Q. Okay.

A. It has fine sands, coarse sands, gravels, et cetera, that all affect the geophysical response. But we have -- you know, we've mapped 270 feet of Pierce Gulch sand capping the foothills, you know, in the Boise area. And that seems to correlate pretty well what we see on the geophysical logs.

Q. So are you saying that it is all some medium of sand or is it interbedded, as Dr. Spence Wood testified, where it's a layering of sand, some coarse, some fine, some clays, some finer materials in there?

A. There's certainly finer materials in there. The lower part of the Pierce Gulch sand has very little clay in it. We know that from the geochemistry; we know that from our cuttings. And just because you see oscillations in the geophysical logs, you don't see those oscillations

come back to the clay line. They're far from it. So it's mostly sand.

Q. Okay. But a difference in the transmissivity between those different --

A. Well, it depends. If you look at it on a micro scale, sure. But as Dr. Wood explained, you've got these switching deltas and these lows that build on top of each other. But everything that we've seen, the hydraulic data suggests that it's pretty connected.

Q. Okay. All right?

A. Certainly there's going to be changes in transmissivity in any natural deposit based on any number of causes.

Q. Okay. All right. So in your earlier testimony the week before last you discussed at some length the quality of residential wells in general and your opinion of the quality of residential wells in north Ada County; is that correct?

A. I have testified to that, yes.

Q. Okay. And did you indicate in that discussion that many of the well reports you reviewed from the area -- from that area, in the Eagle area north of Boise River, that most wells

had been completed by some five or six well drilling companies?
A. I didn't say that.
Q. Okay. And then could you tell me what your -- so in --
Yeah, I just wondered if we could just relisten to the testimony, but that's what we had down what he said, that he said that generally five or six well drilling companies --
A. I don't recall that, but I'd be glad to --
THE HEARING OFFICER: I don't recall that either, Mr. Thornton. And I don't know how to find it. I mean if it's not there, I don't know how to find it.
MR. THORNTON: Okay. We'll continue on --
THE HEARING OFFICER: Okay.
MR. THORNTON: -- in interest of time here.
THE WITNESS: I wouldn't dispute that that's probably true.
Q. (BY MR. THORNTON): Okay. And then did you also indicate that for the -- a lot of the well drillers in that area, are you familiar with those companies from your many years of experience in the Treasure Valley?

A. Generally, yes.
Q. Okay. And can you tell us which of those companies that you are familiar with?
A. I'm familiar -- I could go on and on. Of course, I'm familiar with them not only from personal experience but also from reviewing these logs over the years. There's not too many that I'm not familiar with.
Q. Okay. I believe you testified that a large number of those well drilling companies are not drilling appropriately in terms of what you had stated in terms of poorly constructed wells; is that true?
A. I believe that domestic wells are poorly constructed in this valley, yes.
Q. Okay. And what -- are those companies licensed to drill wells?
A. Yes, they are.
Q. And what agency issues those licenses?
A. The Department of Water Resources.
Q. And is there some type of requirement that a well driller must possess to obtain a license?
A. Sure.
Q. So is there some level of quality, you

know, the state of the art of practice that the licensed well driller usually carries out?
A. Yes.
Q. So in your experienced opinion, was the intent of the well drillers licensing law to afford some level of protection to the lay public when hiring well drillers?
A. Absolutely.
Q. Again, do you recall indicating in your earlier testimony that wells in the north Ada County area was the highest density of wells that you've seen in many years of your experience?
A. I would say that, yes.
Q. Okay. Now, what was the approximate number of wells you're referring to in your testimony?
A. I believe, depending on the area, I think we've got something around 2250, 2,250 wells that we have in our north Ada County database. I think we've reviewed up to perhaps 3,000.
Q. Okay. And so would all of those 2,000, 2,500 wells generally have water rights senior to whatever water right that might be issued to M3?
A. Well, I would say that any -- any

existing well is going to be -- have a water right that's senior to a new well.
Q. Right. And in terms of the wells that are poorly constructed, do you have the names of those companies that poorly construct wells? Could you provide us those?
A. I think what I am referring to is I think that all air-rotary wells drilled under the current rules in the Treasure Valley and around the state are poorly constructed, in my opinion.
Q. Okay. And are those wells, the majority of those, wells in your expert opinion following the State regulations for well construction?
A. Yes, they are.
Q. Okay. All right.
A. The current standards.
Q. The current standards.
A. They will change now in July after three years of trying to improve them.
Q. Okay. And what was the substantive change just recently?
A. Well, there were a number of changes.
Q. And do you have what those were?
A. Well, one is an increase in the

surface seal to 38 feet from 18 feet. A lot of the rules were clarified. And those are the two main substantive changes.

Q. Okay. Thank you.

And then what about the cable-tool wells? I think you talked a little bit about that. In your opinion, cable-tool wells, how are they in terms of providing for better construction?

A. I think I'm referring to all drill-and-drive methods.

Q. Okay.

A. That includes cable tool and air rotary. The problem with those types of wells is they can't be sealed effectively, so they comingle everything that they drill through.

Q. Okay.

A. Doesn't mean that a homeowner can't get his water. I think they're very effective at -- obviously, you've got a lot of people depending on water that are getting their water from those wells.

Q. Okay.

A. But in terms of protection of the resource, they're grossly inadequate.

Q. Okay. And, Mr. Squires, if you could refer to Exhibit 45, please.

A. Got it.

Q. Do we all have that out?

And then I believe previously you testified that you're the primary author of this document with your professional geologist stamp on it?

A. That's correct.

Q. Okay. And if you could go back to the appendix containing the letter from Scanlan Engineering. And that is probably two-thirds of the way back. And the top of the page has "Scanlan Engineering."

MR. FEREDAY: Attachment A.

MR. THORNTON: Attachment A.

THE WITNESS: Appendix A?

Q. (BY MR. THORNTON): Yeah, Attachment A.

A. Okay. It says Appendix A right here.

Q. Oh, okay.

MR. FEREDAY: Let me show you.

THE WITNESS: Okay. Got it.

Q. (BY MR. THORNTON): And then on -- okay. And then on page 2 -- and I believe you

testified earlier regarding this letter about an earlier water right application in the general area of M3 project; is that correct?

A. You know, I'm not -- I can't recall that I did speak to this letter. Perhaps I did, but I can't recall that I did.

Q. Okay. If I didn't write it down, I don't know if I could remember either.

So please refer to page 2, and specifically to the third paragraph on that page. And could you read that -- and it's stated "Groundwater flow direction." And if you could read that paragraph underneath "Groundwater flow direction."

A. The sentence starting with "However"?

Q. No. It starts, "The proposed points." So we're maybe not close on this --

A. "Groundwater flow direction" heading?

Q. Yeah. That starts, "The proposed points of diversion."

MR. FEREDAY: Objection. Mr. Hearing Officer, this should speak for itself. If there's some specific purpose for having the witness recite this, maybe it's justified. But we would object that it speaks for itself. And it wasn't

Mr. Squires -- and I believe it is beyond the scope of direct because we did not inquire about this letter in this way.

MR. THORNTON: He did -- Mr. Hearing Officer, he did testify on this particular exhibit. And we have been -- what I want to try to bring out is the discussion on the groundwater flow tributary to the Payette River.

THE HEARING OFFICER: Okay. With respect to the objection regarding the reference to the letter, I'll overrule that objection. We've referred extensively to Exhibit No. 45. This is an attachment to it, and it apparently was attached thereto for purposes of either illustrating some point, perhaps this particular point as well as others.

But with respect to the objection about the text, is there a specific portion of this, Mr. Thornton, that you want to --

MR. THORNTON: Yeah, I could go with my next question on that paragraph, if you'd like me to.

THE HEARING OFFICER: What I want to do is just avoid Mr. Squires reading the whole thing.

MR. THORNTON: Right.

THE HEARING OFFICER: However, we're taking enough time that we just as well have.
MR. THORNTON: Right.
THE HEARING OFFICER: Is there a particular portion of this, I guess?
MR. THORNTON: Yeah, there is.
THE HEARING OFFICER: Okay.
MR. THORNTON: And could I rephrase my question to assist in that?
THE HEARING OFFICER: Sure.
Q. (BY MR. THORNTON): So in that second paragraph, essentially the last sentence in that paragraph.
So, Mr. Squires, was the logic expressed by Mr. Scanlan in the last sentence of that paragraph regarding the Boise River Basin groundwater moratorium part of the logic that your team of experts used in postulating that the PGSA has a primary outlet to the Payette Valley?
MR. FEREDAY: Objection to the extent it asks this witness to testify to another person's logical thought processes.
THE HEARING OFFICER: I'll sustain the objection. But it has more to do with the phrasing, Mr. Thornton. I'm not sure that -- and

I think you called it a major outlet to the Payette River Valley. I guess I don't recall that reference. So let's rephrase the question.
MR. THORNTON: Okay.
Q. So was the logic expressed by Mr. Scanlan in the last sentence of the paragraph regarding the Boise River groundwater moratorium part of the logic that your team of experts used in postulating that the PGSA has some discharge of ground water to the Payette Valley?
A. I would say no.
Q. Okay.
A. I would go on to say that I think that Mr. Scanlan correctly inferred that this area, which is not the Pierce Gulch Sand Aquifer, does flow toward the Payette. We concur with that. We looked at that. We see no reason or evidence why it would not flow to the Payette.
And similarly, in the stratigraphic section, as we understand it, we would see no reason also why the Pierce Gulch Sand Aquifer would not flow to the Payette.
Q. Okay. Thank you.
And then still in Exhibit 45, on page 14 of the third paragraph. Page 14. And the

first sentence in that paragraph states that, quote, "Said differently, even if the exact direction of groundwater flow and/or the precise locations of discharge far to the west of the M3 site have not been defined definitively, et cetera."
Are you saying you really don't know where it goes?
A. I'm not saying that at all.
Q. So do you know where the discharge goes?
A. I have a pretty good idea, yeah.
Q. And what is the direction of the discharge?
A. And the discharge of what, sir?
Q. Of the Pierce Gulch Sand Aquifer.
A. Well, we've shown that the Pierce Gulch Sand Aquifer is a regionally extensive aquifer. We have said in our reports and in our testimony that it discharges to the Boise River, it discharges to the Snake River, it discharges to the Payette River Valley.
And I think it's pretty evident that it's extensive over a huge, vast area that includes several river valleys. I believe it

discharges as all -- as all groundwater basins do, in the lower parts of those valleys in those basins.
Q. Okay. Thanks.
And then in that same sentence you use the -- a term "insufficient groundwater" where it says this -- "Said differently, even if the exact direction of groundwater flow and/or precise locations of discharge far to the west of M3 site have not been defined as definitively, this does not mean there is insufficient groundwater in the PGSA for the development of 6500 acre-feet of groundwater annually at M3."
And how do you define "insufficient"?
A. That there is insufficient water for the use.
Q. And do you -- and so insufficient for a person that's concerned about their water table declining? What is "insufficient"?
A. I think that what I meant when I wrote that is that -- and I think what it says is that we've shown that the Pierce Gulch Sand Aquifer, as it underlies the M3 site, is well connected to the Valley, the Boise Valley. We believe it's -- we're almost certain that it is also connected to

the Payette River Basin and to the Snake Basin, and even across and beyond the Snake Basin.

So not only have the protestants in this case, your experts and the DWR staff seem to have just focused on this idea of whether it actually flows to the Payette River. What I'm saying is it really doesn't matter to me as a scientist whether it flows to the Payette River. It clearly flows from the Boise Basin, under the M3 site, and beyond.

And so to me, it doesn't matter where the water goes after it leaves 5 miles beyond the M3 site in terms of water sufficiency for this project.

Q. Okay. So if you could refer to Exhibit No. 12. And that's the -- I think we've talked about it as the M3 model. And on --

MR. LAWRENCE: Exhibit 12 is the 16 aquifer test report?

MR. THORNTON: Well, it's the --

MR. LAWRENCE: Exhibit 16 is the M3 --

MR. THORNTON: It's the five models history updates. Exhibit 16. I wrote it down wrong. Exhibit 16. I'm sorry.

THE WITNESS: I'm there.

Q. (BY MR. THORNTON): And then if you would go to -- if you would go to I believe the first page of the executive summary. And on the second paragraph it states that "The new model, the M3 model, supersedes the four earlier groundwater flow models." It goes on to the second sentence to say, "The previous four models were unable to simulate and predict impacts to wells near the M3 property because these models were" -- and the third bullet in there is stated -- "set up with boundary conditions that did not allow groundwater flow in the Pierce Gulch Sand Aquifer, or for that matter any modeled aquifer, to move to the Payette Valley as measured in the field."

And so I believe I just heard you testify that it doesn't matter which way it flows, if it goes there or not, but yet this is one of the main points you identify for the benefits of the model and previous insufficiencies of the past.

So how do you explain that third bullet sentence?

A. I believe what I said was for the purposes of the sufficiency of water to be granted

for this water right, the M3 application, I believe it's moot whether it flows to the Payette or not.

Q. Okay.

A. This paragraph and bullet that you are referring to simply states that the previous models did not allow for any flow to the Payette whatsoever, because there's a no-flow boundary between the two basins.

Q. And so are you saying that it does matter? I'm confused. Does it matter if it goes -- your model matter if it goes to the Payette River, or does not if it --

A. It depends in which context you mean, if you mean for purposes of appropriating this water right. I don't believe that it does matter, no.

Q. What about in terms of potential drawdown curves if you had a no-flow boundary to the Payette River, would that make a difference on your drawdown curves?

A. Well, I believe that -- I believe that we do have no-flow boundaries on the M3 site. It's obvious. We've reported on them, we've drawn them, we've described it. There's two of them, at

least.

Q. But to the Payette River? What if you had a no-flow boundary to the Payette River, would it make a difference in your estimates of drawdown?

A. Not especially, no.

Q. Some?

A. Hardly at all. We modeled that. Made essentially zero difference.

Q. Zero difference?

A. Yeah, zero.

Q. Okay.

A. To my knowledge. You know, I'm not the modeler on this project. But I know that we modeled that, and there was not a significant difference to cause us to change our conclusions in any way.

Q. Okay. Okay. If you could in the same -- well, Exhibit 45, going back to that. On page 39 and 40, the bottom of 39 and 40.

A. Yes.

Q. On the staff memorandum it states that "The staff asserts that the pumping in the PGSA at M3 would cause a reduction in groundwater discharge to the river of indeterminate magnitude

in unknown locations." And then in a partial response to that in your report at the very bottom of the page, the start of the last paragraph, it goes on to state that "There has been no study of the potential effect on the Boise River flows that could occur by pumping that 6500 feet annually from the PGSA for the M3 Eagle project. However, because PGSA groundwater in the M3 vicinity is tributary in part to the Payette River, we do not anticipate measurable impacts to the Boise River in reaches downgradient from the M3 site."

Do you agree with those statements?

A. Yes.

Q. Okay. So in this case here you're stating, in large part, the PGSA in large part is going to the Payette River.

How do you know that?

A. Well, I think we've shown, number one, that the flow gradients show clearly that there is a potential between the Boise River Valley and the Payette Valley. We've also shown that there is a physical drop between the two valleys, and we've shown that there are permeable, traceable geologic units between the two valleys.

So every line of evidence that we have

indicates that there would be flow to the Payette Valley. And no line of evidence that we have seen, discovered, or considered would suggest that there's not.

Q. Enough line of reasoning for you to say that in large part Pierce Gulch Sand Aquifer is going to the Payette River?

A. I'm fine with that statement.

Q. Okay. Could you not find a well somewhere out which is -- and I'll get to the Treasure Valley Hydrologic Report, well pressure heads and whether it's in the Marsing area or Notus area that shows a flow gradient from Boise River down there as well? Isn't it just connecting dots?

A. From the Boise River to?

Q. From upper Boise River from the piezometric heads and looking at data down in Notus and Parma, could you draw a line that direction?

A. You know, I can't answer that. I'd have to look.

Q. Have you stated that water likely does flow from the Boise River down to the Snake River?

A. You mean in the river itself?

Q. Yeah.

A. I believe that to be true.

Q. So isn't it a matter of just connecting dots from one place to another over large distances where your data is gathered?

A. No, sir, it's not.

Q. So how do you really know that the majority of the flow, as you state in your report, in large part the water from the M3 Eagle vicinity in the Pierce Gulch Sand Aquifer in large part is going to the Payette River?

A. Well, I think what we're saying is it's going to the Payette Basin, for starters. Number two, I think it's based on several lines of evidence. And I'll repeat those to you again.

Q. Okay.

A. As we measure wells in the area, there's higher head in the Boise area and lower head in the Payette area. This is true for virtually all wells in the Payette Valley as compared to the Boise Valley.

But we have shown both through geophysical evidence and flow gradients that there are permeable layers that exist between the two valleys. And we've drawn them very graphically in

cross-sectional diagrams. Dr. Wood has testified to those.

So we have a conduit; we have a gradient. There's no reason for us to believe that it flows in another direction.

And as far as connecting the dots goes, if you have a high head in the Boise Valley in the vicinity of M3 and you have a low head in the Payette Valley to the north and to the northwest, groundwater -- there still exists a gradient that goes in that direction.

Q. A gradient 100 percent for sure, or an assumed gradient?

A. Well, there's a gradient 100 percent for sure. There's no doubt about that.

Q. And is there also a gradient between the M3 property and if you were to be down at Notus?

A. Sure. We're in the upper valley and that's in the lower valley, and groundwater flows that direction.

Q. Downhill. Okay.

A. But I would clarify that we're not saying that all the water that flows through the Eagle/Star area flows to the Payette.

Q. Okay.
A. And I don't think the groundwater contour maps show that either. I think they show that there's flow in more than one direction.
Q. Okay. Okay. If we could go again on Exhibit 45, page 14.
A. Yes, sir.
Q. Let's see here. So is the quote on page 45 of 15, which is -- excuse me, page 14 in conflict with a quote from pages 39 and 40, question 3? I'll go back to 39 and 40.
MR. FEREDAY: I have an objection here in that he has not identified which statement on page 14 he's referring to.
THE HEARING OFFICER: Yeah, at least right now I need to know, Mr. Squires needs to know what statement on page 14 you're referring to, Mr. Thornton.
MR. THORNTON: Okay. All right. I'll get that.
Q. So on page 14, the third paragraph, where it says "Said differently, even if the exact direction of groundwater flow and/or the precise locations of discharge far to the west of M3 site have not been defined definitively, this does not

mean there is insufficient groundwater in the PGSA for the development of the 6500 feet." And then so that statement and looking -- turning to page 39 and 40.
A. Yes.
Q. And then on that page it says, "There has been no study of the potential effect on the Boise River flows that could occur by pumping some 6500 feet annually from the PGSA." And then, "However, because the PGSA groundwater in the M3 Eagle vicinity is tributary in large part to the Payette River, we do not anticipate measurable impacts to the Boise River."
So the question is how do you know there's not going to be an impact to the Boise River?
A. Well, to the extent that we are saying -- and perhaps the staff is saying, because we have made the same statement ourselves -- that there would be -- could be an impact to the Boise River is because in the area of Eagle and Star, there's an upward flow gradient. That means that water is moving from the ground upward and into the Boise River. That is documented by the fact that the river is a gaining stream in that reach.

Okay?
So therefore, if we through our pumping or anyone else through their pumping was -- were to lower the heads in the Pierce Gulch Sand Aquifer by some X number of feet, then the gradient between the Pierce Gulch Sand Aquifer and the overlying aquifers and the gravel aquifer and ultimately to the river would then be somewhat reduced.
So therefore there would be less of a gradient, so there would be less flow across the geologic section in general, and not just to the Boise River. Think of it as a sheet underneath the Boise River where the groundwater is coming up everywhere. And it's ultimately feeding the river gravel aquifer, and those are flowing to the Boise River and moving off down as surface water.
Well, the amount that would get changed in that gradient, the amount of pressure change that would happen in that gradient caused by the pumping at M3 would be immeasurable, in my opinion, to the Boise River. You would not be able to measure that impact. It would be beyond the ability of us to measure it. That's what I said.

And furthermore, I think that the impact would be very, very small. And I believe that is why in the Department's, quote, or so-called "200-foot rule" that wells that are completed below 200 feet are exempt from conjunctive management in the Boise River Valley.
And added to that, I think where this goes, is that the cone of depression, the collective cone of depression that will occur around the future well field of the M3 project will not only be lowering the gradient under the Boise River to some small extent, but it will also be lowering the gradient to the northwest and under water that is already beyond the reach of the Boise River and is flowing to another basin. So it will be somewhat attenuated in that regard as well.
Q. Okay. Thank you.
Mr. Squires, referring to your testimony in this hearing on Friday afternoon of April 24th, did you say "I don't believe it is M3's responsibility to try and determine where the recharge and discharge of this regional aquifer is"?
A. I believe that's true.

Q. Okay. And then, Mr. Squires, would a model that does not reflect the location of the discharge and the recharge not have an unreasonable level of uncertainty?

A. No, it does not.

Q. And would the --

A. And I'd be glad to speak to that if you'd like.

Q. Sorry. Yes. Go ahead.

A. The -- because there's a lot of misconceptions here with respect to the M3 model and areas of recharge and the areas of discharge.

As I said before, we've identified the areas of discharge as being the Payette Basin, downstream of Leatha for the most part, perhaps, and the Snake River and the Boise River. That's where the water that runs under M3 ultimately discharges to.

Q. To those three areas?

A. Yes.

And as to the recharge area, our model does not encompass the entire recharge area. The recharge area has been well-known for many, many years to be, in large part, above Capitol Bridge in Boise. That is where we have decreasing

potential with depth where water from the Boise River and all surface waters indeed is downward. That means water flows from the surface downward.

This is well documented in wells, in experiments, in modeling, and in piezometer nests. There's no question that that happens.

During the summer months the decreasing potential with depth area increases further due to pumping where gradients are reversed in the Boise Valley.

But the area where the -- where the Boise is a losing reach above Capitol Bridge, the Pierce Gulch Sand Aquifer doesn't exist up there. It's entering into the Terteling sand facies of the Terteling Springs formation at that location.

Our model, the headgates, if you will, where the water enters our model, that is in the Pierce Gulch Sand Aquifer. And if you extended Cole Road north, which it doesn't go north, but if you extended the line of Cole Road to the north and all the way out to the north through the M3 property, where that line would cross the Boise River, that is where the -- where the edge of our model is.

But we know that the Pierce Gulch Sand

Aquifer extends quite a ways upgradient from there in terms of miles.

So the statement that our model does -- you know, has some kind of inconsistency between areas of supposed recharge and areas of supposed discharge just isn't true, but we have modeled that point. And my colleague, Mark Utting, will speak to this more succinctly today because he's the project manager on that project.

But I know that we modeled the fact that none of the effects of M3 pumping make it back to the edge of our model boundary. So I think I have a fairly good handle on where recharge is happening. I just said I don't think it's M3's responsibility to obtain what I consider to be, you know, a modest water right application to work out all the recharge mechanisms that are in the Boise Valley 15 to 20 miles from their site. It's never been done before.

And so the water entered through the Terteling Springs formation. It has to go through its own path through the Terteling Springs formation before it even enters the Pierce Gulch Sand Aquifer. So it's not a direct recharge -- it's not a direct path all the way to the recharge

area. But from the area of our model, it is a direct path.

So I hope that answers your question. I think we have a pretty good idea on where the recharge occurs. We've mentioned five or -- four or five things in our reports of where we think it occurs.

Q. And do you know how much water is actually going through that reach? Dr. Spence gave testimony last week that identified no one really seems to know for sure where that water is going in. So you seem -- this week you seem to know where it goes for sure.

Can you tell me the amount of water that's going in there? What information do you have that shows the amount of water going in there?

THE HEARING OFFICER: One question at a time.

MR. THORNTON: I'm sorry.

THE WITNESS: If you're referring to how much water is moving underneath the M3 site, which we have evaluated on at least two occasions, and in our very first report we speculated that there was 30 -- I think 30 -- 20 to 30 mgd flowing

beneath a 5-mile swath of the Pierce Gulch Sand Aquifer that underlies the M3 site.

Since that time, we have refined our understanding of the boundary conditions, and we believe that the swath of the aquifer that runs under M3 to be smaller than 5 miles, somewhat just less than 4 miles.

In our recalculations using the gradients, which have also been refined through our well measurements and our modeling efforts, we now find that -- we now calculate that there's somewhere on the order of 34 cfs flowing through that smaller -- or 34 mgd flowing through that swath that underlies M3.

Q. And --

A. If you're asking how much water is being recharged totally by the Boise River at all locations, I don't know that. I haven't studied that.

Q. And do you know -- in your expert opinion, what are the mechanisms for recharge for the Pierce Gulch Sand Aquifer? You gave testimony to that last week, but just bring it back up again.

A. Well, I think that there's no question

that the recharge to the aquifers -- to the aquifer, the alluvial aquifer, if you want to call it that in the Boise Valley and to the Pierce Gulch Sand Aquifer and to the Terteling Springs Aquifer, the water comes from the Boise River drainage. There's no other magic water that's coming into this basin. It all originates with the Boise River and its tributaries.

Q. Okay.

A. In the upper part of the basin that is dominantly sand and there's a downward gradient, the water flows into the aquifer in those locations.

Q. And then if we could have you refer to Exhibit 16, I believe it is, which is part of the Treasure -- excuse me, which is -- yeah, 16 that we were just on. Let me grab this here again. And page 2 --

A. Exhibit 16?

Q. Page 2, Exhibit 16. It may have been called 16A. It's your model --

A. Oh, okay.

Q. -- the M3 model. Yeah, page 2, paragraph 2.

A. That's a big paragraph.

Q. It is. And beginning with towards about two-thirds of the way down, the far right-hand side.

THE HEARING OFFICER: Mr. Thornton, I'm referring apparently to the wrong page.

MR. THORNTON: Okay. Page 2.

THE HEARING OFFICER: Of what?

MR. THORNTON: Of document 16A. It's the M3 model.

MR. FEREDAY: Excuse me. It's not 16A. It's Exhibit 16.

MR. THORNTON: Exhibit 16. Excuse me.

MR. LAWRENCE: And you're not referring to the executive summary, are you? You're referring to the main report?

MR. THORNTON: Yes, the No. 2.

THE HEARING OFFICER: Okay. I am on the correct page then. I think you were referring to paragraph 2?

MR. THORNTON: Yes. The second full paragraph.

THE HEARING OFFICER: Okay. All right.

Q. (BY MR. THORNTON): And then two-thirds of the way down to the far right, it states that "The construction of the Treasure

Valley Hydrologic Project model prohibited the simulation of groundwater flow toward the Payette River Valley through designation of the region between the Boise Valley and the Payette River Valley as a no-flow boundary. Because of its regional focus, boundary conditions that force groundwater to flow towards the southwest and the nonincorporation of the Pierce Gulch Sand Aquifer, it was not, and cannot now, be used to assess groundwater development from beneath the north Ada County foothills area."

So can you -- okay. So that seems to imply that a model that does not allow flow to the Payette River Valley is not correct for the M3 project; is that correct?

A. I would say that's correct.

Q. Okay. Can you explain how the paragraph relates to your recent testimony that seems to imply that location of recharge and discharge are not important to the model?

A. What I am saying is that -- let me see if I can explain this to you.

Q. Okay.

A. Consider -- assume for a moment that we have a calibrated model of the entire Boise

Basin that goes from Barber Dam to the Snake River, and assume that it is a calibrated model that works and everybody trusts. And let's assume that in the upper valley there is groundwater moving through the Terteling Springs sands, as I've suggested, large deltaic sand in the upper part of the valley. Think of it in terms of the Table Rock area where those sands are present very close to the river.

And it flows into the aquifer system there, and along some flow path, and ultimately discharges to the Snake River and the Payette River, for the sake of this assumption. And everything works out and the heads are predictable and they're represented by this model.

And then if you move downstream by 6 miles, say, or 7 miles, and you now chop off the upper part of the model but you keep the flux across the model the same at that location, well, that's not going to change the model, because you have the same flux across this area of the model.

So we draw -- let's say we draw a line where I previously indicated where our model is at the extension of North Cole Road, well, as long as you keep the flux the same from the recharge area

to the discharge area, you can eliminate that part of the model, and it's not going to change anything downstream in the model.

And what I'm saying is that our model, the M3 model, has its headgate, if you will -- that's probably not the best term you could use, but it has its input or recharge in the Pierce Gulch Sand Aquifer at that location. It doesn't mean that things aren't happening differently above there.

The same is true on the lower. If you have the model that discharges wherever it discharges, to the Boise, to the Snake, to the Payette River, but you draw your model boundary 5 miles upstream and you keep the flux the same, it doesn't matter where it goes.

Q. Okay. And so how do you know what the flux is? Where is your data for the flux?

A. Well, I know what the flux is underneath the M3 site because we've measured it. We've measured. We've exhaustively measured all the transmissivities from all available tests that are available. We've conducted tests of ourselves to understand the transmissivity of the aquifer itself.

We've gone out and measured water levels ourselves. We've created monitoring wells to measure water levels over time. We've surveyed in the well sites to do the best job we can of determining the groundwater flow gradient underneath this area.

And now we've taken a width of the aquifer, which is the last remaining part we need to calculate what the flux is. And those are the numbers that we come up with.

And I submit that the flux that we've calculated, even under nonpumping conditions, is so much greater than the water that M3 is seeking to appropriate that the error bars there are -- there's so much water available that I think it goes without saying that there's sufficient water for this project.

Q. So you just mentioned error bars.

Can you point to me in your M3 model, Exhibit 16, where you have identified some sensitivity analysis or some error bands on your estimates?

A. Yeah, I will defer to my colleague, Mark Utting, who will be testifying this afternoon, who is far more familiar with this

model than I am.

Q. Okay.

A. And I can say that I know we have done extensive sensitivity analysis.

Q. Okay.

A. And he will explain those to you.

Q. Okay. That's great. Thanks.

Back to Exhibit 45 on figure 2, about maybe halfway through the document. It's titled "Subsurface Seismic Reflection Profiles" from Wood.

A. Yes.

Q. And could you refresh -- just because it's been more than a week, can you refresh our memories regarding the information presented here?

A. Well, I'll try to. It's not -- I think Dr. Wood probably explained it better than I could.

Q. Okay.

A. His interpretation of the deep-seated faults located by the seismic reflection profiles are that the -- that noticeable faults at depth do not apparently extend upwards and break the shallower sedimentary section.

And I think when I was listening to

that testimony, one thing that I would also add, just to help you understand this conceptual model or the way that this happened, is that there seems to be a misunderstanding that we had a geologic section, and all of a sudden it got faulted down X number of feet all at once.

Well, that did not happen. That can't happen. Our world would fall apart if that happened. Okay?

What happened was small offsets over a very, very long time period, like the -- for instance, the Borah earthquake, 10 feet here, 10 feet there, earthquakes over time, gradually this plain we call the Snake River Plain subsided.

Well, as that happened over a very, very long period, obviously the most displacement has to be in the deepest section, because the other section didn't even exist at the time that it was being faulted and displaced.

Now, there's no question in my mind that -- because we know, and I've observed them myself, that you can find small offsets on the order of a foot or less, even in the modern and ancestral floodplain terraces of the Boise River Valley that might be 100,000 years old, 200,000

years old. There's question that there can be some measured amount of faulting that has come up through the entire section.

But the idea that these deep-seated offsets on these faults propagate up along a single line and offset the upper section as much as they offset the lower section is not true. There's a lot more offset on the deeper section, in the upper sedimentary section, there's a lot more evidence of faulting in the older Terteling Springs formation, and very little evidence of faulting in the Pierce Gulch, that I've seen.

Q. Thanks.

And for this seismic profile testing, when was that conducted?

A. I can't remember the date.

Q. A number of years ago?

A. Oh, a number of decades ago.

Q. 30, 40 years? Okay.

A. I honestly don't know.

Q. Okay.

A. It's probably described in...

Q. All right. And then -- so this was taken by an oil company exploration?

A. Yes.

Q. Do you suppose the oil company that made the profile was much interested in the unconsolidated sediments above the main rock?

A. Well, as I recall, this is data that was acquired from the oil companies. They were probably not interested. But this is data, as I recall Dr. Wood testifying, that was purchased by the Department of Water Resources for reanalysis by him, and that's what he did. These -- this is the result of that analysis, not the oil field analysis.

And the purpose of this was not an oil field when it was reprocessed and acquired by IDWR. And if you want a landmark, I think it was somewhere in the '80s.

Q. Okay. And then for this couple-decade-old seismic information aimed at finding oil or gas in deep rock strata, is it really suitable for interpretation of the shallower sediments? Are you an expert in this field?

A. No.

Q. In your opinion, is it appropriate to use for the shallower sediments?

A. Apparently Dr. Wood and others have

thought so, and they've presented the data in that light.

Q. Okay. So if we can have you go on to Exhibit 45 to figure 3, titled "Deep Well Locations and Transect Lines for Hydrogeologic Cross-sections."

A. Yes.

Q. Are the locations of those two seismic lines shown on this -- are the locations of those two seismic lines shown on this figure the ones that we refer to in figure 2?

A. To my -- to my understanding, no. I believe that this is a section out by Middleton, but I -- I'm not sure.

Q. So they're not the Chevron seismic lines shown in -- just where it says "Chevron line 1B-25"?

A. I can't answer that question. I don't know.

Q. Okay.

A. I don't think so.

Q. Okay. I believe Dr. Wood testified that these two lines were about 8 miles west of the M3 property, the ones that are at least showing here on the Chevron lines; is that true?

A. If that's what he said.
Q. Okay. Looking at the map, would you say that they're about 8 miles on figure 3?
A. It looks pretty close.
Q. Okay. And can you tell me about how far those two lines extend north of, say, Highway 44?
A. Well, I'm not positive I can see Highway 44 here. But if it is where I think it is, and if you're referring to the Chevron line IB-25 --
Q. Right.
A. -- it looks like it could extend 3 1/2 miles north of Highway 44 --
Q. Okay.
A. -- as I interpret Highway 44 to be on this map.
Q. Okay. And my eyesight isn't so good either.
So to me, that appears to leave maybe another 10 to 12 miles of unexplored subsurface between these two lines and the rim of the Payette Valley; would you agree with that? So going north of -- I'm trying to clarify the question.
Going north of the furthest extent of

that Chevron seismic line, is that still another 10 or 12 miles just to the rim of the Payette Valley that's been unexplored?
A. Unexplored by deep petroleum seismic exploration, yes, that's true.
Q. Do we have any seismic data for that area?
A. Not that I'm aware of.
Q. Okay. So still referring to this figure 3, do you see the locations of the Oroco O&G well and the El Paso Natural Gas well No. 1?
A. Yes.
Q. And I believe that Dr. Woods (sic) testified that these two wells were about 18 miles apart.
Do you agree with that?
A. It looks close to me.
Q. And Dr. Woods also testified that the El Paso Natural Gas well No. 1 was about 12 miles from the M3 property.
Do you agree with that?
A. It looks close.
Q. Okay. Going to figure 4 in Exhibit -- the same exhibit. Will you please identify what information is presented on this figure. Refresh

our minds. I believe you talked to it quite a bit, maybe in a general sense just so everybody can be brought back up to speed, what is being displayed in this figure 4.
A. Figure 4 of --
Q. Of Exhibit 45.
A. Well, figure 4 is a cross-sectional representation of the subsurface that is drawn by correlations between geophysical logs, borehole geophysical logs, at the location shown on figure 3, the previous page, the map.
Q. Okay. And then can you identify the horizontal scale for the resistivity information on the Oroco Oil and Gas well and the El Paso Natural Gas well? What is the scale? What is that distance?
A. I'm afraid I don't understand your question. You're referring to the scale of the cross-section. It says right there, "Horizontal distance not to the scale."
Q. Okay. And then do you know -- and thank you.
Do you know the distance between those two wells?
A. Well, I think you just stated, it

was -- wasn't it -- you said 17 or 18 miles. I can't remember.
Q. Okay. All right. And then can you explain why the resistivity signatures for the Pierce Gulch Sand Aquifer and those two wells do not seem to compare very well?
A. Well, I disagree. I think they compare quite well.
Q. So would you say that the signature of the resistivity in the El Paso Natural Gas well, that that section that delineates the top of the Pierce Gulch Sand Aquifer and the bottom of it is similar to how that is extrapolated to the Oroco well? You're saying that those two resistivity sections are similar?
A. In my opinion, they are. I think there's good correlation between those units.
Q. So from looking at it ocularly, you're saying those two look similar?
A. In my opinion as a professional well log analyst, yes. I've looked at a lot of geophysical logs. And you may look at the darker lines or the more oscillatory expression that you see in the El Paso Natural Gas, but you must remember that these things are taken by different

instruments and they're processed differently.
But overall, what Dr. Wood is trying to show here is that you have the characteristic signature of the pro delta slope, the bottom of the Pierce Gulch Sand Aquifer, which is pretty distinguishable in not only these wells, but in numerous other wells across the basin and into other basins.
And then when you also put this lower signature of the -- what we're calling the Terteling Springs Aquifer, it's a thin unit, down beneath the Pierce Gulch Sand Aquifer and under a thick mudstone unit, it's a good correlation.
Q. Okay. And then do you believe that the -- what do you believe is the origin of the Pierce Gulch sands at the Oroco O&G well? And maybe I can clarify that question.
Is the Pierce Gulch sand at the Oroco O&G well at that location from the Boise River or likely from the Payette River?
A. Well, it's not really from a river. It's from a very large lake that occupied this area. And these sands were deposited in a big delta along the shores of the lake. And then numerous streams, rivers worked it after the lake

drained, began to work it out in a sheet across the valley. But everywhere that the lake was, as the lake drained, these sediments were getting worked across the now exposed lakebed.
Q. And is not two of the major tributaries to Lake Idaho in the Emmett area at the Oroco well, the Payette River and the Boise River? Are those two of the major ones?
A. I don't know what rivers were present and occupying at the time that this happened.
Q. So do you know the age of the Idaho Batholith from which the Payette River and the Boise River largely flow from? Being a geologist in the area, what's the age of the Idaho Batholith?
A. It's cretaceous.
Q. And in years for the layman, that is how many millions?
A. It varies. There's many lobes of the Idaho Batholith. But we can just say that it's extremely old.
Q. And the Atlanta lobe portion of that is somewhere probably in the 40 to 60 million year range, would you say?
A. No.

Q. What would you say?
A. I don't have a comment on it at this time.
Q. Okay. Would you say that the Idaho Batholith from where these two rivers flow from greatly precedes the filling of the lake with sediments?
A. I would say that's definitely true.
Q. Okay. So would you say that there's a large likelihood that the Pierce Gulch sands that are downstream in the Emmett area or downstream are from the Payette River?
A. I can't understand your logic. If you mean they're from the Idaho Batholith, yes.
Q. Are they worth -- because the deltas were formed by rivers; correct?
A. Correct.
Q. Did the Payette River likely flow through the Emmett Valley as the lake was filling up?
A. I -- I don't -- I can't answer that. I don't know that.
Q. Okay.
THE HEARING OFFICER: Mr. Thornton, why don't we take a break right now. Our morning

break. 15 minutes.
MR. THORNTON: Okay. Yeah, that's fine. Thanks.
THE HEARING OFFICER: Be back at 10:15.
(Recess.)
THE HEARING OFFICER: We're recording again.
Mr. Thornton, questions?
MR. THORNTON: Okay.
Q. Mr. Squires, again on Exhibit 45.
A. Yes.
Q. I'm going to ask you some questions in terms of the scales that are on -- represented by figures 3 and 4 to help me understand what appears to be some discrepancies.
And on figure 3 we talked earlier that the location between the Oroco well and the El Paso Natural Gas well was about 18 miles apart. I think you agreed with that on figure 3.
A. If you say so, and you want to get me a scale. It's looks okay.
Q. We can give you a ruler, if you'd like.
Can you get him that ruler?
If you'd like to use this or not.

A. It's somewhere between 18 and 20, it looks like.
Q. Okay. And then on figure 4 -- and you'll see that figure 4 has a horizontal distance scale on the upper plot in figure 4 there.
And then on that one, what is the scale between the Oroco well and the El Paso Natural Gas well?
A. Well, it looks like it's about -- it looks like it's about right.
Q. About 23 miles, is what we got. Is that correct, or not? Not to try to shoot out too many questions, on figure 3 we scaled it as about 18 miles, and on figure 4 we scaled it as about 23 miles.
THE HEARING OFFICER: I'm not sure he scaled that yet. Do you want to give him an opportunity?
MR. THORNTON: Okay.
THE WITNESS: It looks to me like it's somewhere -- going by these township/range registry marks on this map, it looks like it's 6, 12 -- 17 miles on the figure 3. And I would say that it's a little over 2 inches, so 2- -- I'm in agreement with the 23 and 17, 18.

Q. (BY MR. THORNTON): Okay. I think would you agree that that -- that that is, as depicted on figure 4, while you have the resistivity cross-sections for those wells, while in appearance on that figure they may look close, are they in fact many miles apart, between the Oroco well and the El Paso Natural Gas Company well?
A. Well, if you're referring to the lower figure where it says "Horizontal distance not to scale," the idea there was to try to shorten it up so that you could fit it on one page.
Q. Correct, yeah. Would you agree that there -- those two wells are somewhere between 18 and -- 17 and 20-some miles apart?
A. I would -- I would say that's true.
Q. Okay.
A. I would probably go -- you know, I'm just not sure how accurately these are plotted on the map.
Q. Okay.
A. Because they were taken from a larger map.
Q. Okay.
A. But it's somewhere in that range.

Q. Okay. So, Mr. Squires, is it standard practice in the science of hydrogeology to extrapolate subsurface data over such large distances with any degree of certainty?
A. Well, sure it is, if you can.
Q. Can you in this case?
A. Yes.
Q. And what data do you have between those two points to help connect the dots, between those 17 to 20 miles?
A. Well, we don't -- we have our understanding of how stratigraphy works and how depositional systems work, and we see the aerial extensive signature over a much larger scale. In other words, there's no reason to think that something's different.
Q. And so as a licensed professional geologist in the state of Idaho, are you comfortable, then, with the assumption that the Pierce Gulch Sand Aquifer extends with no discontinuities over some 17 to 20-some miles of unconfirmed, unknown subsurface information to the Payette River Basin?
MR. FEREDAY: Objection. I don't think that that fairly represents the facts in evidence.

THE HEARING OFFICER: Sustained. Mr. Thornton, the characterization as unconfirmed, and I think there's one other term in there, I think that does mischaracterize what Mr. Squires has said.
MR. THORNTON: Okay.
Q. So in your professional opinion, do you have an opinion on what is between those large distances, 17 to 20-some miles, but no real data; is that correct?
A. That's correct.
Q. Okay. And then if you could refer to Exhibit No. 68. And that is a paper by Dr. Woods titled "Hydrogeologic Framework in the Boise Valley of Southwest Idaho."
MR. FEREDAY: Excuse me, Mr. Hearing Officer. Just for the record, it's Dr. Wood.
MR. THORNTON: Dr. Wood. Thank you.
MR. FEREDAY: With no "s."
MR. THORNTON: Thank you for that. I appreciate that.
MR. ALAN SMITH: Exhibit 68.
MR. THORNTON: Exhibit -- Exhibit 68 is one of the documents that was provided by IDWR staff.
Q. And if you go to page 7 when you have

a chance to get to that.
A. You know, I don't seem to have an Exhibit 68. I go from 65 to 101, unless it's --
MR. LAWRENCE: I believe it's loose from the witness exhibits, not contained in a binder.
THE HEARING OFFICER: Perhaps it's still here. It's right here.
I've given Mr. Squires what's been marked, I think received into evidence as that, Exhibit No. 68.
THE WITNESS: Do you have one, Mr. Hearing Officer?
THE HEARING OFFICER: I don't.
THE WITNESS: Because if you don't, I'm very familiar with this document, now that I see what it is. You're welcome to use this one.
THE HEARING OFFICER: I do not have a copy. But if you want him to refer specifically, that's fine.
THE WITNESS: I know the document, unless it's necessary.
Q. (BY MR. THORNTON): Okay. I'll just read one --
THE HEARING OFFICER: I'll look over your shoulder.

THE WITNESS: Okay.
Q. (BY MR. THORNTON): So we've got that 68. And then on page 7, in the top left-hand side, Dr. Woods -- I'm sorry --
MR. FEREDAY: Dr. Wood.
MR. THORNTON: Dr. Wood.
THE WITNESS: I'm there.
Q. (BY MR. THORNTON): In that upper left-hand side, Dr. Wood identifies and states, "One should view with distrust cross-sections attempting to correlate over distances of several miles unless the section is along a strike -- or is along strike and a sedimentary facies is identified."
How do you interpret what Dr. Woods is stating?
A. Well, I can't speak to what Dr. Wood is thinking. But I can tell you that this document -- I'm familiar with this document. I know what it was prepared for. It was originally prepared for a short course that I put on here in the valley. And I believe I can interpret what that means.
Q. And your interpretation is what?
A. Well, what Dr. Wood is trying to say

is that if you don't know what the physical facies or the physical depositional environment of a unit is, you must be very careful about correlating it over long distances. And the reason he refers to along strike is because we know that when we're correlating these deep sections where the dip of the strata can be 640 feet a mile, we don't drill very many things that deep.
We're mainly concerned with the upper thousand feet for water supply, because we reach warm temperatures below a thousand feet. So if you have two wells that are along strike and the dip is, say, 600 feet a mile, you can never reach the same strata down the dip of the aquifer because it's below it, because we're not drilling 1200-foot deep wells.
But in the case here of M3, which I believe is what you're asking about, we know what the facies is. That's the whole purpose in this exercise, that we've identified this delta in this Pierce Gulch Sand Aquifer. That's the facies of which we're talking about. We know what that facies is. That's what we're correlating in these well logs.
And we have -- we're very, very

fortunate in this basin to have the benefit of oil well drilling, petroleum industry drilling that went to great depths to where we can see this signature over very long distances.
So in my opinion, what Dr. Wood was referring to was when you don't know what the facies is and you're going down dip where the wells can't follow. But both those requirements are met in the data that he presented as part of our report.
We know what the facies is. We can correlate it along strike. We know what the depositional system is. And we have these rather deep wells. Some of them are 14,000 feet deep where we can trace the aquifer in the characteristic geophysical signature across great distances.
Q. So I'm confused because I thought I heard you say just a little while ago that you had no real data between those two wells, and you're extrapolating your opinion, but no data. Now I think I hear you saying you have data.
What?
A. I haven't said that there's any more data. I'm just saying that we do have data. We

have data that exists in the wells. If you're saying is there a deep well between the two petroleum wells over that 18-mile distance, no, we don't have any wells out there.

Q. Okay. And the --

A. But I suggest if you did drill a well out there you'd find the same signature and the same characteristic geophysical representation of the Pierce Gulch Sand Aquifer and the underlying Terteling Springs formation.

Q. In the Payette River system above Emmett, I believe you stated that the Pierce Gulch Sand Aquifer was partially formed where the deltas formed by the Payette River; is that correct?

A. I never said that the Pierce Gulch Sand Aquifer or anything about it being above Emmett. I think I heard Dr. Wood say in his geologic mapping he mapped some in the foothills at the VanDusen Ranch, which is north of Emmett. But I don't have any knowledge myself of the Pierce Gulch sand extending in the Emmett area. And I have not postulated that there's any flow through the Pierce Gulch Sand Aquifer to Emmett, ever.

Q. Okay. Is there Pierce Gulch sand in

Emmett?

A. Not to my knowledge.

Q. Is there a Pierce Gulch Sand Aquifer going to Emmett?

A. Not to my knowledge.

Q. To the Payette River?

A. To the Payette Basin.

Q. Downriver from Emmett, perhaps?

A. Downriver from Emmett.

Q. And how far downriver?

A. Well, it -- I don't know exactly. Some distance above Leatha.

Q. And is Leatha about 8 miles downgradient from Emmett, approximately?

A. Approximately.

Q. Is it, in your opinion, that the Payette River formed a delta similar to the Boise River in terms of protruding into Lake Idaho?

MR. FEREDAY: Objection. Asked and answered.

THE HEARING OFFICER: Sustained. I think, Mr. Thornton, we've spent a lot of time questioning Mr. Squires about what river systems may have formed the deltas and deposited the sands.

MR. THORNTON: Okay.

THE HEARING OFFICER: And I think Mr. Squires has consistently said he doesn't know what river systems were in existence at the time.

MR. THORNTON: Okay.

THE HEARING OFFICER: I think we've covered that particular subject.

MR. THORNTON: Okay.

MS. PADILLA: Gary, I'm getting beeping.

THE HEARING OFFICER: Okay. Let's change tapes.

We're recording again. Sorry for the interruption.

Q. (BY MR. THORNTON): And if we could refer to -- we had it listed as Exhibit 209, and it's the Treasure Valley Hydrologic Project.

And perhaps you have a --

MR. FEREDAY: Exhibit 33.

MR. THORNTON: Exhibit 33.

Q. It's a very large document. And I'm not sure how they're tabbed. I'd like to refer to one section that is titled "The Geochemistry and Isotope Study." And it is a good probably halfway through that document.

MR. FEREDAY: I believe that's Exhibit 33G.

MR. THORNTON: 33G? Thanks.

And, Mr. Hearing Officer, I want to make sure that -- I believe, but I could be incorrect, that this is an exhibit that's already been introduced and accepted.

MR. FEREDAY: Yeah.

MR. THORNTON: I see Mr. Fereday saying yes. Thanks.

THE HEARING OFFICER: Yes.

MR. THORNTON: Did you have a chance, everybody, to get to the geochemistry and isotope study?

THE HEARING OFFICER: I'm there, Mr. Thornton.

MR. THORNTON: Okay.

Q. And then on -- more in the executive summary on small Roman numeral iv, the second paragraph, if you will, first bullet on that page, and the two sentences state, "Contemporary seepage from rivers and/or irrigation diversions is not the primary source of recharge for most deep -- for most deeper, regional aquifers. Paleo-river channels, fractured granite aquifers in the Idaho Batholith and tributary sedimentary aquifers are the most likely sources to recharge to the

regional flow system."
The question I have is, how does this statement here reconcile with your identification of the source of recharge for the Pierce Gulch?
A. It's the second-to-the-last bullet that you're referring to?
Q. Yeah, it's on small Roman numeral page iv, starts with "Contemporary seepage from rivers and/or irrigation diversions."
A. Okay. Well, Mr. Thornton, I would point out that we have an expert today that's going to talk about geochemistry. But I'll answer your question in a general sense.
Q. Okay.
A. I think it compares very well with our conceptual model. I -- it says, "Contemporary seepage from rivers and/or irrigation diversion is not the primary source of recharge." And I'm interpreting that to say when we draw water out of the well at M3 or down-valley, we know, as I've stated before, that the water is all coming from the Boise River. Okay?
So right now, as we speak, there's water leaking out of the Boise River into the aquifer system. Present day, modern, contemporary

seepage is seeping into the aquifer today.
When we draw that out 15 miles or whatever downgradient, we're drawing out water that's been in the system a lot longer. Okay? And I think -- what I'm interpreting this to say is that -- as we have said, is -- it comes back to this idea that the water that we're drawing out in the M3 and in the other wells that were tested as part of the Treasure Valley Hydrologic Project is ancestral water. It's water that was recharged before development, before there was an irrigation component.
And I think that's what this is saying. It's not -- it's not the irrigation diversions. Now, are irrigation diversions providing recharge today to the upper part of the system? Sure. But the water that we're drawing out down at the bottom of the system or somewhere in the flow path has no indications of irrigation or flow through soils or applied water. It has no indication of that whatsoever. It only shows that it's derived from the Boise River. But it's had a residence time in the aquifer.
So what we're drawing out shows no indication that it's modern-day water. It's kind

of like if you -- if you are -- if your wife is irrigating the peas at the bottom of the garden you got a 100-foot hose and she wants you to turn on the water and you turn on the water, well, there's fresh water at the spigot where you are, but the water down where she is has been in the hose awhile. So it's going to take awhile for that modern water to get through.
Q. And you identified that it is ancestral water.
And do you have -- we went through this a couple weeks ago. But do you have a relative time period in terms of tens, hundreds, thousands, tens of thousands of years?
A. Well, I can -- I can leave that for our -- we have a very qualified geochemist here that will --
Q. Okay.
A. -- that will attest to that. I think that's better. I think he'll do a better job than I will at describing that.
Q. Okay.
A. But I will say that I think we have a pretty good handle on it.
MR. THORNTON: Okay. All right. I think

we're getting close to finishing.
THE HEARING OFFICER: Okay.
MR. THORNTON: If I can have about 30 seconds here.
THE WITNESS: And I believe Mr. Glanzman is up right after me so you'll get that question answered.
MR. THORNTON: Good. He's prepping for it right now.
Q. Okay. So, Mr. Squires, in your testimony today, it seems to indicate that whether or not the PGSA discharged flows to the Payette River is not important to your model, is that true, it's not necessarily important? I believe I heard you say that.
A. It's not important to the numerical model that we've created with respect to the water right application for M3 Eagle.
Q. Okay. And then why then have your documents, M3's documents, Hydro Logic documents, spent so much effort to show that some of the flow does go to the Payette River?
A. Well, I wouldn't say that we've made a concerted effort in any way to say that it flows to the Payette. Our investigations and our

research tell us that it does. And that's kind of a new finding. So we're -- we're putting that out there.

But you must realize that there seems to be an understanding here that all of the work that we've done has to do -- I mean we're characterizing the aquifer system. That's what we're doing. We're putting out research on the aquifer system and how it behaves.

But as I've said before, I don't think the fact that the water -- and as you've heard staff testify, Mr. Vincent's testimony, I don't think it really has a bearing on this case whether the water gets past M3 and it's past M3 by several miles, and then ends up flowing to the Payette River.

I think it does have implications to our overall understanding of the flow systems, the recharge and the amount of recharge in the aquifer. Because if there is a significant amount of discharge that's moving off to the Payette River Valley, which I believe there is, just as there's a very significant amount of discharge that's moving off to the Snake River Valley south of the New York Canal, then we need to account for

that, because I think the recharge estimates that we've been working off are too low. I think there's a lot more recharge than we've previously thought, because that water has been unaccounted for in all of the previous models with the -- well, at least in the TVHP model. The Douglas U of I model showed flow to the Payette.

Q. All right. I think the last question that I will have for you, Mr. Squires, for now is again going to Exhibit 68, the one by Dr. Wood.

A. Okay. Yes.

Q. And then on figure 1, which is on page 2 of the document.

A. Yes.

Q. And then can you see the representation of where the Boise River comes across the ancient Lake Idaho as well as the Payette River cutting across the ancient Lake Idaho? Can you see the line for the river?

A. I can see the lines of the two rivers.

Q. Of the present-day river?

A. Yes.

Q. Okay. Would you agree that the average basin size of the Payette River at Black Canyon compared to Barber Dam are approximately

both around 2700 square miles?

A. Do I? I don't know.

Q. Could you describe on this figure what your conceptual idea would be of the formation of these delta deposits on the Boise River we've talked about a lot, but where did the delta formations from the Payette River, especially as the lake was full and then it started slowly going down, where did they merge?

MR. FEREDAY: Objection. Asked and answered.

THE HEARING OFFICER: I'll overrule the objection. This is a different question than I've heard. Let's see if Mr. Squires knows.

THE WITNESS: Sure. Well, we know, to the best of our current knowledge, that the high-stand of Lake Idaho is marked by a series of oolites, that's a near-shore facies, a rock type that's caused by sand grains and other things rolling around in the water and picking up concretions. And it's a very diagnostic and very recognizable rock type or facies.

And it is apparent, as Dr. Wood testified in layman's terms, as a bathtub ring around the high-stand of the lake. And we

generally see that at elevations 3600 to 3800 feet around the valley. And of course, the lake levels, even though we have different basins and different base levels for the modern-day rivers, the lake, of course, is a constant elevation.

So we see oolite deposits that mark the top of the lake in the Boise Basin, and we see oolite deposits that mark the top of the lake in the Payette Basin. And they're very visible over there at the top of the sand facies of the Terteling Springs formation.

And the reason that they're there, if I can refer back to the bathtub ring analogy where the lake is full, it's at its high-stand, and these oolites are forming, and as all the rivers and all the tributaries and drainages go into the lake, they can no longer carry their sand that's being eroded from the Idaho Batholith because they now don't have any motion. They're flowing into the lake so the stuff drops out. That's what forms the delta deposits and the thick sand deposits all the way around the edge.

But we've also shown that in Lake Idaho the transition to fine-grained sediments can be pretty abrupt in some cases, to where you get

into clays and mudstone rather quickly.
So if you can imagine the shore of ancient Lake Idaho as going through the Boise Valley and over into what's now the Payette Valley, you have the same type of depositional system all the way across the foothills from Boise -- maybe you can think about it as though, you know, it's another arm of the lake over there.
As the lake drained, there were large river systems. There was a large river out in the area of Highland Valley Summit that's kind of the tip of the -- of what we call the Boise Fan Aquifer. And there were undoubtedly other rivers coming in all along the north part of the plain -- of the lake.
Same on the south side, there were rivers entering from the south side of the lake, all around the lake, whatever the drainage areas were, there were rivers. Whether it was called -- you know, obviously, it wasn't called the Payette River. Or what its course was at that time, I don't know. But there were a number of rivers entering into the lake.
And the conceptual model is that as the lake now drained, you have drainages, small

and large, that are now coursing down and cutting down through this delta, this thick deposit of deltaic sediment that's along the shore. And it's now able to move it farther out into the basin.
And so you start out with this already worked delta deposit that's worked by fluvial currents and waves, et cetera, that's already been cleaned up. And the fine materials have been moved out farther out into the lake. That's what deposited into the mud that's out in the deep part of the lake. Okay?
But now you've got these fluvial streams that are pushing this and they're flooding and they're pushing the sand out over the now dry lakebed as the lake declines.
Then, as I said, at first you've got sand that's already worked. And this characterizes the Pierce Gulch sand up in the vicinity of M3 because it's near to the mountain front, it's near to the basin margin. So now it's getting worked again by these rivers. So it's a very, very permeable sand.
And then as the lake continues to drain and the rivers are now in size through these deposits, the delta deposit, it's already laid

down, the really clean, doubly reworked sand, now you have more sediment coming in eroding off the Idaho Batholith. And now that sediment was getting broadcast across.
And as Spence Wood indicated, you have these delta lobes that are forming that are switching. It's like a -- you've got a river that's coming down through the sediments, and you have a flood event and it spills over, and now it's depositing a lobe over here. And it's just switching back and forth. But they're still all connected hydraulically.
And that is the concept that I have of how these things came about.
Q. (BY MR. THORNTON): So if you will refer to figure 1 on 45, Exhibit 45. It's a regional map on the wells.
A. Yes.
Q. Also, would you agree that it gives a relatively accurate spatial location of the Payette River as well as the Boise River as they come out of the Idaho -- well, at least the Boise River -- coming out of the Idaho Batholith, and then they have some basalt flows at the mouth or the throats of those canyons? Would you agree

that's relatively --
A. I would say that's not shown here at all.
Q. Okay. Can you see Black Canyon Reservoir on the Payette River?
A. Yes.
Q. Okay. And I believe you can't quite see Barber Dam on the Boise River there, it looks like.
The question I have is --
A. Barber Dam is miles upstream.
Q. Okay.
A. 15 or more miles upstream.
Q. Okay. Good. Good point. What I'm trying to understand, and I believe I heard you say, that this -- these deltas into the lake, they were reworked with fluvial processes as the lakes receded; correct?
A. Yes.
Q. Do you have knowledge as to the contemporary thoughts of how quickly Lake Idaho receded?
A. No.
Q. Maybe we can refer to document No. 68, again from Dr. Wood. And on page 7, Dr. Wood

cites the work of Schumm and Etheridge, 1994, in terms of lowering of the lake, the bottom left-hand side of 7. And it states that "The average lowering of the lake was likely 15 centimeters every thousand years seems reasonable," according to Dr. --

A. I don't think that's what that says. I think what that says is that the research by Schumm and Etheridge for a lot of major rivers, not this river, not this valley, that their research of valley incision into bedrock and major rivers is what you stated.

Q. Okay. Based on Dr. Wood's paper where he's talking about the lowering of the lake level when it is theorized to go over into Hells Canyon, was that geologic time period; would you agree with that?

A. Yes.

Q. Okay. So with that in mind, if we can go back to figure 1 on Exhibit 45.

A. Yes.

Q. Where do you theorize the main delta from the Boise River and the main delta from the Payette River, did they meet, did they not meet, where did they meet between them -- being 20,

30 miles apart?

MR. FEREDAY: Objection. Asked and answered.

THE HEARING OFFICER: Sustained.

MR. THORNTON: All right.

Q. Where would you theorize the two major deltas met --

MR. FEREDAY: Objection.

Q. (BY MR. THORNTON): -- on this --

THE HEARING OFFICER: Sustained.

MR. THORNTON: I don't understand.

THE HEARING OFFICER: Well, the reason I'm sustaining is because, again, my understanding of Mr. Squires' testimony and other testimonies, we don't have any idea what river systems existed in the time, whether there were two deltas or multiple deltas existing.

And so the reference is -- asks a question that I think has been asked and answered. And I don't think Mr. Squires has further testimony, or I don't want to elicit it from him at this point.

MR. THORNTON: Okay.

Q. You have talked about the delta lobes coming into Lake Idaho; correct?

A. I commented on Dr. Wood's comments.

Q. Do you have any certainty -- how do you then have certainty that the Pierce Gulch sand from the Boise River is connected at the Leatha area?

MR. FEREDAY: Objection. Asked and answered.

THE HEARING OFFICER: Well, I'll let that one stand. Overruled.

THE WITNESS: Well, it is because, as I stated in the beginning, I've worked on hundreds of wells in this area, and I've run my own geophysical logs in those hundreds of wells, and I've been fortunate enough to have as mentors people like Dr. Wood and Will Burnham, who studied this for decades before I came along.

And what I see in my research is that we've been able to take the sands that we see in the outcrops of the Boise foothills and foothills around them, and we've been able to develop a signature for that in geophysical logs, and we've been able to follow that geologic stratification in that stratigraphic section into the subsurface where obviously you can't see it. You can't observe it, only through drill cuttings, which are

not real representative. I mean they're not like looking at the sand cliff that you looked at the other day. But we've correlated that several of these major litho-stratigraphic units have a characteristic signature on geophysical logs that we have then been able to trace as they dip down below surface and go into the subsurface basin beneath us.

And everywhere that I've worked, I can -- well, not everywhere. But everywhere where I would expect to find that characteristic signature and where I've been able to work and where I've been able to obtain geophysical logs, I find that signature. It doesn't mean I've worked everywhere. But everywhere I've looked, I can find -- find it -- where I expect to find it.

And the deep petroleum exploration wells that were drilled out we're going to say around the 1980s, we obtained those records, and those show the same characteristic signature. And they show that that same unmistakable characteristic signature is not only present in the wells that -- the shallow wells, relatively shallow along the lake margin, but it also shows that you can trace that same signature across the

Payette Valley. You can trace it down to the south to around Lake Lowell. You can trace it to the Snake River, and even beyond the Snake River over into the -- beyond Ontario, Oregon. And that's what the cross-sections drawn and submitted by Dr. Wood show, that it does indeed extend over there.

Q. And do you know with certainty that -- in the lake environment, Lake Idaho as it was receding, that you could tell with certainty the difference between Pierce Gulch sand that came from the Boise River system versus the Payette River system?

MR. FEREDAY: Objection.

THE HEARING OFFICER: Sustained.

MR. THORNTON: All right. I would say I'm done questioning. I don't know how to re-ask that question, so...

THE HEARING OFFICER: Okay. Should we just take ten minutes again and get up and walk around, five or ten minutes just to stretch?

THE WITNESS: That sounds great.

THE HEARING OFFICER: Yes, I think that's helpful to keep our focus.

(Recess.)

THE HEARING OFFICER: We are recording. Mr. Smith, your turn to examine.

MR. ALAN SMITH: Thank you, sir.

CROSS-EXAMINATION

BY MR. ALAN SMITH:

Q. I guess you'd rather be sworn in again than sworn at.

THE HEARING OFFICER: I trust you won't, Mr. Smith.

Q. (BY MR. ALAN SMITH): Mr. Squires, I think we've covered a lot of this on the well drillers and construction methods. I'll try to sum up what I believe your opinions were, if Mr. Fereday will allow me that latitude. And if I say anything you don't agree with, why, you correct me.

As I understand it, you recognize there are qualified well drillers, you just don't agree with some of their construction methods?

A. That's true.

Q. You do recognize that they're doing it according to Water Resource standards and Idaho State law?

A. Yes. It is the rules and regulations

that I disagree with.

Q. Okay. You don't think the 18 foot of seal is adequate?

A. No.

Q. What, in your opinion, would be proper sealing methods?

A. Well, I believe that a well should be sealed to full depth, from the land surface to the top of the aquifer. That is the best, most prudent, most productive way to go. But an 18-foot surface seal, and even the new 38 proposed surface seal that should take effect in July, in a valley like we have where you have a 60-foot thick river gravel, it really doesn't do anything.

THE HEARING OFFICER: Okay. Mr. Smith, I want to be assertive right now. And I guess my question is -- and I know there's been some testimony about the wells -- the domestic wells that have been affected. But I guess my question is, why is the method of construction, at least with respect to the sealing, why is that important, or whether the well drillers have properly constructed those wells or not? Is that important to us? I'm just asking the question.

MR. ALAN SMITH: It seems to be important

to Mr. Squires, but...

THE HEARING OFFICER: Well, my understanding of the testimony was there were questions about whether wells that had difficulty producing water, whether those wells had gone dry or had not gone dry. And I think with respect to the question of construction, I think that is a legitimate question.

But I think the question of seals and whether the wells are contaminated or not contaminated, whether there's -- there may be a question about cross-connection. But I want to be careful that this doesn't become a forum for impeachment of well drillers or --

MR. ALAN SMITH: All right.

THE HEARING OFFICER: -- to try to discredit the rules, either as they have been or will be in the future.

MR. ALAN SMITH: No, I don't plan to go there.

THE HEARING OFFICER: Okay. All right. Thank you. Go ahead.

Q. (BY MR. ALAN SMITH): But I think you said in your opinion the 18 foot of seal would not adequately protect the well from contamination?

A. It would not protect the groundwater from contamination, the resource itself.
Q. So contamination can move --
A. Through the well --
Q. -- from one aquifer to another?
A. Yes, it can.
Q. And is that by seepage or water or what?
A. It's basically caused by the hole that's drilled being bigger than the casing. So it leaves an unsealed annular space outside the casing. And it is relevant to not only contamination, but I think to the testimony in this case, that I believe that measuring water levels in such wells is inaccurate, because of the commingling and the average -- averaging of the heads that occurs in those wells.
Q. Okay. Let's go to the M3 project.
How long have you worked on that M3 project?
A. Well, I think -- I think I got started in March of 2006, if my memory serves me.
Q. And HLI, is Hydro Logic, Inc., a corporation?
A. That's correct.

Q. And I think you said you were president?
A. Yes.
Q. Is Mark Utting an officer or director of the corporation?
A. No. He's a project manager, hydrogeologist.
Q. How much has HLI been paid to date for its work on the M3 project?
A. I think in response to your discovery request, that our bills are somewhere in the neighborhood of 1.3 million.
Q. What were you paid by M3 on the -- or what was HLI paid by M3 on the Arizona project?
MR. FEREDAY: Objection. Relevance.
THE HEARING OFFICER: Sustained.
Q. (BY MR. ALAN SMITH): Do you have any financial interest in M3 or M3 Eagle or any affiliate thereof?
A. Not one bit.
Q. Do you own any stock in those companies or corporations?
A. No, sir, I do not.
Q. Are you to share in any way in any profits?

A. No, sir.
Q. Are there any bonuses or contracts or agreements, verbal or written --
A. No, sir.
Q. -- about that?
Is the location of any of the proposed M3 wells known at this time?
A. Yes, sir.
Q. And where would they be?
A. Well, we have already made submittals to the Department of Environmental Quality for an approved public drinking water well site that is at the location of our test well No. 4. We have a second site near Spring Valley 7. And we've identified many other points of diversion, but they will pick and choose amongst those points of diversion based on how the wells that we drill first, how they perform, and the drawdowns that we see from those wells.
We're thinking that the water project could be served from as few as four wells, including a backup well. But depending on how the distribution system is finally configured, we may have more smaller wells rather than four large wells.

Q. Didn't you say on direct that five or six wells is what was contemplated?
A. Well, again, it's going to depend on the final engineering design for the water system, simply by virtue of the fact this is a site that has a lot of elevation difference on it. So water has to be pumped from the various elevations to different elevations.
So as the phasing is settled upon and as the engineering water system is -- comes into view, there could range from four wells to eleven wells. I can't say for sure. But the total volume of withdrawal in the instantaneous diversion rates for this project will not change under any configuration.
Q. In your second amended application, what I think you said, if you wrote that, or HLI, some of your staff did, "15 additional wells are contemplated beside the 12 existing wells"?
A. Well, I didn't write that document, but I was intimately involved with the development of that document. And the 15 wells that I believe you're referring to are wells that already exist on the property. There's a number of domestic wells that were associated with the property.

There's test wells on the property.
And if my memory serves me, at least most of that 15 have to do with preexisting wells that are already there, so we named them as points of diversion for the water right.
Q. Well, I believe it said 15 additional wells to the 12 existing wells for a total of 27 --
A. Well, there's 12 existing, and we provided for up to 15 additional wells, if that is what is needed.
THE HEARING OFFICER: Okay. Mr. Smith and Mr. Squires, if you would please wait so that once the question is asked; and, Mr. Squires, if you'll answer and then wait for Mr. Smith. If I don't speak up, the court reporter will.
MR. ALAN SMITH: I'll try to slow down.
Q. Are there going to be wells drilled on both sides of what we called the panhandle fault, if you know, Mr. Squires?
A. There certainly could be. We have points of diversions on both sides of the inferred fault and the deep volcanics, yes.
Q. And the length of that fault is not known, is it?

A. You mean in terms of lineal distance?
Q. Correct.
A. No. We know that it extends between two magnetometer lines that we did.
Q. If Hutchings and Petrich are right, would not the length of that fault be important to know since it might affect the water flow in that area?
A. There's no indications at all that it affects water flow in that area. And there's no reason to believe that it does. Our conclusion is that it doesn't.
Q. All right. Is it your opinion that groundwater originates from the Boise River and from leakage from irrigation canals southeast of Eagle?
A. Yes. And from other sources.
Q. Is that to the shallower or deeper aquifers, or both?
A. To both.
Q. Okay. Would you agree that urban sprawl over what was irrigated agricultural land which was flood irrigated will gradually decrease the recharge to the aquifer?
A. In my mind, that is not conclusive at

this point. I think there's a lot of complicating factors. Intuitively, you would think so.
Q. Don't many of the subdivision developers tile and line irrigation canals that pass through the subdivisions, further reducing the aquifer recharge?
A. Depends on the location of the canals, because some -- some areas of the valley, the flow is upward and the flow would actually be into the canals. So it would actually be the opposite.
Q. And don't these subdivision developers almost always convert to sprinklers rather than flooding, further reducing the aquifer recharge?
A. Generally speaking, they convert to pressurized irrigation.
Q. Doesn't that transformation from agricultural flooding to sprinklers cause a further decline in the aquifer recharge, in your opinion?
A. Depends on the location. In many areas of the valley, the applied irrigation water does not recharge the aquifer.
Q. Okay. If wells go dry after a high capacity -- or high-volume well nearby begins pumping, doesn't that indicate to you that water

level has dropped?
A. If that were to happen, if a large production well were to -- to begin pumping and pump continuously and the water was actually drawn down in the domestic well I think you're referring to, to a nearby domestic well such that the water level was below the reach of that well, it would indicate to me that the water level at that well was drawn down. I haven't seen that myself.
Q. Are you aware that both the Steiner and Lawton domestic wells had to be replaced within a few weeks after the Brookwood well came online?
A. I've heard you mention that. It's very difficult for me to believe that, based on my understanding of the system and the production from the Brookwood well and the locations of those two wells and the testimony of Roger Dittus.
Q. Well, if the static level in the wall is dropped to 2 or 3 feet below the pump, would you say that that well is probably not functioning?
A. Oh, I can't speak to that, because I don't know where the pump is set and I don't know the depth of the well.

Q. Well --
A. I can't speak to that.
Q. Excuse me. Go ahead.
A. I can't speak to that. I don't know the particulars of where the pump is set.
I can say that I have designed and completed wells myself where -- that would be fine to have that much submergence. The well would work fine with 2 feet above where the pump is set.
Q. Would you say the well driller has two choices, either lower the pump if he can, or if not, deepen the well?
A. I think that depends on -- I'm not trying to evade your question. But I think it depends on a lot of factors. I think it depends on how the well is constructed, what condition it's in, what the water level is, and how deep the pump setting is.
Q. Are you aware of all of the wells that have had to be replaced or gone dry in the Homer Road and Ballantyne Road areas?
A. I'm aware of the Eagle area, Eagle/Star area in general, and in fact across the Treasure Valley that a lot of wells get replaced all the time. I'm not aware myself of any wells

that have gone dry, and I've never measured any that have gone dry, except one well out in the Micron area 20 years ago.
And I think I've talked about this idea of wells going dry. And I haven't seen any information in any measurements I've taken or others -- presented by others that tells me that wells have actually gone dry.
Q. If multiple wells go dry or have to be replaced that are near one another within a few days or weeks of one another, would that not indicate to you that the water level has dropped?
A. No, not necessarily.
MR. FEREDAY: Objection. This is a compound question. He's already testified that he hasn't seen evidence of wells going dry, with one exception. Your question was in the disjunctive, and I'm not sure which part of it you're asking him to answer. So that's the basis for my objection.
MR. ALAN SMITH: Let me rephrase it.
Q. If multiple wells have to be replaced within a few weeks of one another where they're nearby each other, does that suggest to you that the water level has declined?

A. Not necessarily, no, sir. But I think that could be determined rather easily, and I think this question of wells going dry could be determined quite easily as well, if the people whose wells were allegedly going dry would allow their wells to be measured. But apparently that has not happened.
Q. Don't you or HLI state at page 241 of your reanalysis of the 16 aquifer tests the development of additional municipal groundwater supplies --
THE HEARING OFFICER: Just a moment, Mr. Smith.
Q. (BY MR. ALAN SMITH): -- and associated water table --
THE HEARING OFFICER: Mr. Smith.
MR. ALAN SMITH: Pardon?
THE HEARING OFFICER: I think we need to refer to a specific portion of that report for Mr. Squires.
MR. ALAN SMITH: All right.
Q. Would you go to page 241.
THE HEARING OFFICER: And this is Exhibit 12?
MR. ALAN SMITH: I believe it's Exhibit 12,

the 16 aquifer tests.
THE WITNESS: What page, sir?
MR. ALAN SMITH: 241, I believe. Top paragraph.
THE WITNESS: At the top of that page it starts out "Then 1600 wells"? Is that what you're referring to?
Q. (BY MR. ALAN SMITH): I have it as "Development of additional municipal groundwater supplies" --
A. Okay.
Q. -- "and associated water table drawdowns may require some existing wells to be deepened and/or replaced."
Is that your opinion?
A. I think you're referring to the second half of the point No. 19 at the top of the page?
Q. I believe it's paragraph 19, yes.
A. Okay.
Q. Does it not state that there?
A. If you read that -- if you read that point 19 correctly, I agree with that.
Q. Did you write -- did you write this on the 16 aquifer tests, or cause it to be written?
A. Both.

Q. Won't the effects of pumping, especially of multiple high-capacity wells, eventually be transmitted throughout the Pierce Gulch Sand Aquifer? And I'm referring to a statement on page 7 of the 16-day aquifer test, third paragraph.

THE HEARING OFFICER: Page 7?

MR. ALAN SMITH: Page 7, yes.

THE WITNESS: Just give me a moment. I'll read that.

(Reviews.)

That paragraph refers to pumping within the Pierce Gulch Sand Aquifer. It does not refer to aquifers underlying or overlying the Pierce Gulch Sand Aquifer.

Q. (BY MR. ALAN SMITH): Okay. Let's go to paragraph 20.

THE HEARING OFFICER: Okay. Mr. Smith, would you please speak up.

MR. ALAN SMITH: Page 241, paragraph 20.

Q. I believe it states there "Pumping at deeper zone will ultimately affect the shallower portions of the aquifer. Likewise, pumping a shallower zone ultimately affects the deeper zones."

MR. LAWRENCE: Objection. That's not what I -- what paragraph No. 20 states.

THE HEARING OFFICER: Okay. I'm on page 241, Mr. Smith.

MR. ALAN SMITH: All right. No, it's page 7. I'm sorry. Page 7.

MR. JASON SMITH: Third paragraph, kind of towards the bottom again. It's the last sentence, I believe he's looking at.

THE WITNESS: Yes, sir.

Q. (BY MR. ALAN SMITH): Starts with "Eventually," I believe.

A. Yes. As I previously stated, this paragraph is about the Pierce Gulch Sand Aquifer, and not overlying or underlying aquifers. So when it says "In other words, pumping a deeper zone of the Pierce Gulch Sand Aquifer ultimately affects the shallower portions of the aquifer. Similarly, pumping a shallower zone, ultimately affects the deeper zones," I'm referring there to the Pierce Gulch Sand Aquifer itself, not the overlying or underlying zones.

Q. So --

A. And I believe that statement to be true.

Q. All right. Didn't you tell us in your earlier testimony, I believe on Friday, that pumping from a deeper aquifer would not affect the shallower aquifer or cause any drawdown to the shallower aquifer? I believe you said that was a layman's misconception.

A. I don't believe I said what you just said. I think --

Q. Okay.

A. I think what I said and what I understand is that the Pierce Gulch Sand Aquifer is a dipping aquifer. In some places it's -- on the east side of Eagle, it's closer to the surface. And in some places on the west side of Eagle and Star area, it's deep and it's more confined.

And I believe our reports clearly show and state that pumping from the Pierce Gulch Sand Aquifer does have an attenuated effect in some locations above in the overlying as yet unnamed and undifferentiated aquifers that many of the domestic wells of this area are completed into.

Q. So it does have some effect on it?

A. Sure.

Q. Okay. Let's go to your inspection of

the nearby wells. I believe you stated in your earlier testimony that you inspected over 160 nearby wells, did you not?

A. I think I stated that we inspected 2,250 to 3,000 wells, if you're referring to drilling records. If you're referring to the water-level measurements that we took, which is not inspecting a well, there were 160 measurements, approximately 167, I think, in our first round of measurements in 2006.

Q. And that was of the nearby well owners?

A. Well, it wasn't just the nearby well owners. It was just about every well that we could gain access to in the general area within a relatively short period of time. And that was in wells on both sides of the M3 property.

Q. And that would be to the south down toward the feed lot?

A. That would be to the south, to the north, to the west, to the east.

Q. Okay. The west would be over towards the Hillsdale Estates?

A. Yes, sir.

Q. And did you personally do that, or did

your staff do that?
A. My staff and interns, graduate student interns from the University of Idaho accomplished that.
Q. And I believe you said you knocked on doors and talked to many of the well owners?
A. Yes. And also some of the wells were measured by faculty from the University of Idaho.
Q. Did you assure any of the well owners that the M3 wells would not affect them?
A. No.
Q. So you wouldn't have told them that to avoid potential protests?
A. No. I just wouldn't say that, period, under any circumstances.
Q. Let's go back to page 241 of the 16-day aquifer -- or 16 aquifer test analysis.
A. 241?
MR. JASON SMITH: 241?
MR. ALAN SMITH: Yes.
THE WITNESS: Yes, sir.
Q. (BY MR. ALAN SMITH): I think I may have already asked you this, but I believe it says "Development of additional municipal groundwater supplies and associated water table drawdowns may

require some existing wells to be deepened or replaced." I believe that's paragraph 19.
MR. JASON SMITH: Yeah, we talked about that.
Q. (BY MR. ALAN SMITH): Did you tell any of the well owners that, what that statement said?
A. No, sir. This report was done long after we measured those water levels.
Q. Did you tell them what's stated in paragraph 20 on page 241, that diminishing artesian flows may require them to have to put in pumps to produce water in the future? I believe it's paragraph 20 on page 241.
A. If you mean did I go on the site and go up to a house and measure a water level and tell them that, no, I did not, sir.
Q. You or your staff?
A. No, sir.
Q. Okay. Let's go to page 240, paragraph 19.
Did you tell any of those well owners that high-capacity wells in the Eagle/Star/M3 project area will cause drawdowns that will affect their wells --
A. No, sir.

Q. -- or other wells in the area?
A. No, sir.
Q. Did you tell them, as you state in your Squires and Woods (sic) at page 2001 -- or report of 2001, page 14 --
THE HEARING OFFICER: Okay. Mr. Smith, would you identify a document by number so that Mr. Squires can --
MR. ALAN SMITH: I don't think I have the number. It's the Squires and Woods report of 2001. Now, I don't know if I have the exhibit number of it.
THE HEARING OFFICER: Okay. Let's go off the record for a minute. Let's find the document.
(Recess.)
THE HEARING OFFICER: We are recording again.
Now, Mr. Smith, if you'll refer to the document that we've identified for the record, or refer Mr. Squires to the particular portion you want him to look at, and then ask him a question.
MR. ALAN SMITH: All right.
Q. It's Exhibit 19E, page 14, I just wanted to ask you if you told these well owners that you or your staff talked to what that last

sentence says, "It may take months to decades for larger drawdowns" --
THE HEARING OFFICER: Where on page 14?
MR. ALAN SMITH: The last sentence of the paragraph.
Q. "It may take months to decades for large drawdowns to propagate through the seemingly continuous section of interbedded sand and thin mud."
A. I did not tell any domestic well owner that sentence.
Q. And if you'd go to Exhibit 50, page 24.
A. Yes, sir.
Q. I don't believe that's a quote from you, but I wanted to see if you disagreed with it, that "Pumping in the PGSA is likely to eventually impact the majority of area well owners."
Do you agree or disagree with that?
A. I disagree with that statement.
Q. Okay. All right. Let's go to the second -- second amended application at page 7.
THE HEARING OFFICER: Okay. What exhibit number?
MR. ALAN SMITH: I believe that's --

MR. JASON SMITH: 42.
MR. ALAN SMITH: -- 42, Exhibit 42, page 7. That's the tab 4, page 7.
THE HEARING OFFICER: 42, and then I assume it's --
MR. ALAN SMITH: Tab 4.
THE HEARING OFFICER: -- subpart A --
MR. JASON SMITH: Yeah.
THE HEARING OFFICER: -- and then subpart 4 under tab A.
MR. JASON SMITH: Yeah.
Q. (BY MR. ALAN SMITH): Have you got that page, Mr. Squires?
A. Yes, sir, I do.
Q. Okay. Would you look at the third paragraph, about two-thirds --
THE HEARING OFFICER: Page number again, Mr. Smith? I'm sorry.
MR. JASON SMITH: 7.
MR. ALAN SMITH: Page 7.
THE HEARING OFFICER: I'm trying to burrow down. Okay. Thank you.
Q. (BY MR. ALAN SMITH): Third paragraph, about two-thirds of the way down states, "The largest potential for interference effects to

existing wells is on the west side of the M3 Eagle lands near State and Highway 16."
Did you tell any of those well owners that?
A. No, sir, I didn't tell any well owners that.
Q. Did anybody on your staff do so --
A. No, sir.
Q. -- if you know?
Okay. Let's go to this recharge issue.
Does anyone, hydrologists, geologists, whatever, know the source of recharge to the PGSA or where it is?
A. Yes.
Q. Does all of the evidence indicate that the recharge occurred a very long time ago?
A. It's hard to know what you mean by "a very long time ago." If you mean more than 140 years ago, I would agree with that.
Q. It's ancestral?
A. Yes.
Q. Geologically ancestral?
A. I'm not sure how you want to define that term. We don't know if the water is 45 years

old or thousands of years old.
Q. Okay. Would you look at page 13 on that second amended application.
A. In the same part 4?
Q. Yes.
A. Yes.
Q. Down toward the bottom of the page, subdivision 2(b), "Groundwater originates as a direct infiltration from the Boise River in the east-central Boise area and through leakage from irrigation canals southeast of Eagle."
A. Yes, sir.
Q. Is that still your opinion?
A. I believe that that is a true statement.
Q. Is that seepage the primary source of recharge to the Boise River -- or to the PGSA?
MR. FEREDAY: Objection. There isn't the word "seepage" appearing in that sentence, but...
THE HEARING OFFICER: Overruled.
Q. (BY MR. ALAN SMITH): Is it from seepage or leakage --
THE HEARING OFFICER: Just a minute, Mr. Smith. There's a question pending.
MR. ALAN SMITH: All right.

THE HEARING OFFICER: So I don't know whether Mr. Squires is reading to respond.
THE WITNESS: I was reading, but I am confused about the question. If we could repeat the question, that would be helpful.
Q. (BY MR. ALAN SMITH): Well, my question to you is, is it seepage or leakage from the Boise River from the irrigation canals that's the primary source of recharge to the PGSA?
A. Yes.
Q. Are you aware that Hutchings and Petrich concluded that contemporary seepage from the rivers and irrigation diversions is not the primary source of recharge for the most deeper regional aquifers?
MR. FEREDAY: Objection. This question has already been asked and answered, perhaps not by this party, but I believe it has been asked and answered.
THE HEARING OFFICER: Okay. Mr. Smith, if you want to argue, then I'll rule.
MR. ALAN SMITH: No, I'm just asking if he's aware of it.
THE HEARING OFFICER: Okay. Well, if you have an argument in response to Mr. Fereday's,

I'll allow you to make it. If not, I'll rule.
MR. ALAN SMITH: That's my only argument.
THE HEARING OFFICER: Sustained.
MR. ALAN SMITH: I'm asking if he's aware of --
THE HEARING OFFICER: Sustained. We've covered this language previously in Mr. Squires' testimony.
MR. ALAN SMITH: Okay.
Q. Doesn't Petrich also find that recharge occurring in the shallower aquifer zones does not reach the deeper -- the deeper zones and thereby limits the recharge of the deeper regional aquifers?
A. I believe that I recall that that was one of his conclusions, yes.
Q. And isn't the bottom line there that, just as you stated on page 7 of the second amended application, tab 4, of your 2007 May report, I believe you state "The actual extent of any future impact cannot be truly known until actual pumping wells are in place."
A. I believe that's true, yes.
Q. Is that not a little bit late?
A. No, sir. I believe that that's the

way that we find out. That's the actual real data.
But we have been monitoring on the M3 site for over three years now, so we have a fairly good idea of what the baseline water levels are. And I submit that any changes caused by the M3 pumping will become apparent.
Q. So your later studies would modify that statement, then, or you would change it?
A. And the statement again is?
Q. Well, that the actual extent of the impacts on other wells will not be truly known until actual pumping wells are in place on the M3 property.
MR. FEREDAY: Objection. This mischaracterizes the statement, which referred to future impacts.
THE HEARING OFFICER: Overruled.
THE WITNESS: I believe that the best way to measure impacts are real measurements. And I believe that the way that we determine how a resource is to be exploited is through exploiting that resource. That's the only way that we know.
I further submit that there seems to be a general understanding that we're going to

wake up one day and all of a sudden we're going to be past some point of no return and the aquifer is going to be in a state of decline. And I submit that is not going to happen, and that the effects, even minor effects of pumping, will show up in the monitoring data, if we have a quality monitoring network.
Q. (BY MR. ALAN SMITH): You realize, however, that's exactly what has happened in the Twin Falls area?
A. I'm not convinced that that's happened in the Twin Falls area.
Q. Okay. Let's go to -- see if we can figure out why these protestant rascals have made such an issue out of the Payette Basin flow. I believe it's been called a red herring issue.
THE HEARING OFFICER: Okay. Before we launch, it is just shortly after noon, this is a new subject, Mr. Smith. And I just want to ask the question whether we want to break at this point or whether you are near the end of your cross-examination. What do you think?
MR. ALAN SMITH: I'm getting near the end. But probably five minutes. It may be ten.
THE HEARING OFFICER: If you have five more

minutes, let's go ahead and finish. I think that's the right thing.
MR. ALAN SMITH: Maybe ten.
THE HEARING OFFICER: If you have ten minutes, let's finish.
THE WITNESS: Even if it's a half hour.
THE HEARING OFFICER: If you think you have a half hour or 45 minutes, let's break.
MR. ALAN SMITH: No, no.
THE HEARING OFFICER: Okay.
Q. (BY MR. ALAN SMITH): Let's go to the second amended application filed in support of the M3 water right request. The May 4th, 2007, tab 4, which I believe is now a public record since it's been filed in support of this application.
THE HEARING OFFICER: Okay. This is Exhibit what?
MR. FEREDAY: 42A4.
THE HEARING OFFICER: Okay.
MR. ALAN SMITH: Exhibit 42.
THE HEARING OFFICER: A4. What page?
MR. ALAN SMITH: Tab 4, page 1.
THE WITNESS: Yes.
Q. (BY MR. ALAN SMITH): Did you author this or participate in writing it?

A. Yes.
Q. Okay. Would you look at the very first page. And I believe it says -- it's about a third of the way down that first paragraph. It says, "Because the Payette Valley near Leatha is almost 300 feet lower than the Boise Valley near Eagle, groundwater flows out of the Boise River Basin and into the Payette River Basin through the sands of this aquifer."
So that issue appears to have been raised by M3 and --
MR. FEREDAY: Objection. Is this testimony or is this a question? Maybe there is a question coming, but I haven't heard one.
THE HEARING OFFICER: Well, let's see.
Q. (BY MR. ALAN SMITH): Has that issue been by raised by M3 and HLI on the very first page of tab 4?
A. Sure. I'll do my best to answer what I think -- what I infer your question is.
Q. Well, I think you can answer it yes or no.
Who raised the issue first? This was in 2007.
A. I think that we have recognized in our

research that there is a connection between the two basins, and it makes sense on a number of lines of evidence that water does flow from the Boise Basin to the Payette Basin.
Q. All right. Let's go a little further down in that same paragraph on page 1. "The groundwater proposed to be withdrawn by M3 Eagle or its development would be from subsurface flow that has already departed the Boise Basin" -- have you found that? -- "on its way to the Payette Basin so that impacts to existing area water users in the lowlands near Eagle are predicted to be small."
A. I'm still trying to find that, sir. Just a moment.
Q. Okay. It's about two-thirds of the way down. The sentence starts, "The groundwater proposed."
A. Yes, I read that sentence.
Q. Okay. Would you take a minute and read that.
A. I just read it.
Q. All right. Are those not two of the assurances that you're making there to Idaho Water Resources and the public that the M3 pumping is

going to have no effect because the water flows to the Payette anyway?
A. Oh, I didn't say that at all. I said that impacts to existing area water users in the lowlands near Eagle are predicted to be small.
Q. And what do you mean by "small"?
A. Well, if they're measurable, which it may be tough to measure the impacts. But whatever they are, I believe we will be able to monitor the effect on the pumping within the Pierce Gulch Sand Aquifer.
Q. Would you agree that you're making assurances to Water Resources and the public and the north Eagle well owners that the impact is not going to be significant at all?
A. No, I didn't say that, sir.
Q. I have just a couple more questions concerning the aquifer recharge. And I believe this is from the Idaho Water Resources memo, page 18.
MR. FEREDAY: Would that be Exhibit 50?
MR. JASON SMITH: Yes.
MR. ALAN SMITH: 50. Right.
THE WITNESS: And page, sir?
Q. (BY MR. ALAN SMITH): Page 18. Down

toward the bottom they're quoting from Petrich's 2004 at page 19. And he's talking about "The age of water in the regional aquifers range from thousands to tens of thousands of years." And he also states that "The youngest waters entered the subsurface a few thousand years ago and are found along the northwestern boundary of the basin -- northeastern boundary."
A. Yes, sir. I mean I'm not answering -- I'm asking what your question is.
Q. Okay. Do you agree with that statement?
A. Oh, I definitely do not. I think it's based on a misconception. I think it incorrectly represents anything about the age of the water in the aquifer, and I think it's quite incorrect.
Q. Didn't you and Glanzman state in your geochemical report that both the Pierce Gulch Aquifer and the Terteling Springs formation groundwaters originated from geologically ancestral Boise River water? And I think I --
A. Yes, sir, that's true.
MR. ALAN SMITH: That's all I have.
THE HEARING OFFICER: Okay. Thank you, Mr. Smith.

Mr. Edwards, questions?
MR. EDWARDS: No questions.
THE HEARING OFFICER: Okay. That's a good place to stop. Let's come back about a quarter after 1:00. And we'll go back to redirect with Mr. Squires. Thank you.
(Lunch recess.)
THE HEARING OFFICER: We're recording. So everyone's here ready to go after the noon recess.
Mr. Fereday, redirect testimony.

REDIRECT EXAMINATION
BY MR. FEREDAY:
Q. Mr. Squires, with regard to your measurements in this SVR-7 nine-day aquifer test, I believe I heard you say that you measured to within 2/100ths of a foot in one of the monitoring wells, monitoring well SVR-9 to be specific.
Is that a correct number?
A. No, sir, it's not. When I read the transcripts of my testimony, I realized that I said 2/100ths of an inch, rather than 2/10ths of an inch that we measured in the Spring Valley 7. So it was a mistake on my part.
Q. So the correct number is measurement

within 2/10ths of an inch in that case; is that right?
A. Of a foot.
Q. I'm sorry. 2/10ths of a foot; is that right?
A. Typically, we try to measure -- and all hydrogeologists strive to measure to hundredths of a foot. But the measured drawdown in the Spring Valley 7 -- in the Spring Valley 9 during the Spring Valley 7 aquifer test was 2/10ths of a foot drawdown.
Q. Thank you.
I believe you also mentioned an underlying unsaturated zone in part of your testimony.
Do you recall that?
A. You know, I don't recall that, but I can say that I don't know about any part of the aquifer that is unsaturated below the saturated section. In other words, where it's saturated, I believe it's saturated to depth.
You may have been referring to I think when I discussed test well No. 1, M3 test well No. 1, there were five zones, five piezometer zones in that well. And the four lower zones were

completed within the Pierce Gulch Sand Aquifer, and then the other zone was in an overlying aquifer.
And it -- I think I said that I felt that that aquifer was perched. I used that term, which is maybe not the most descriptive term. But I believe that that overlying aquifer does sit on top of a clay -- a clay unit. But I think that the clay beneath it is saturated.
Q. So there wouldn't be such a thing as -- with regard to the PGSA in the vicinity of M3 Eagle an underlying unsaturated zone; is that your testimony?
A. No, there would not be.
Q. Okay. Do you recall responding to Mr. Thornton this morning about the amount of water that flows through a swath of territory right underneath the M3 property?
A. Yes, I do.
Q. And you, I believe, mentioned some amounts in terms of million gallons per day.
Have you had a chance in the break to review the numbers that you gave, and if so, could you tell us what the actual numbers might be if you've made a mistake?

A. Well, I think that in our original first year characterization report, we estimated that under a 5-mile swath of the Pierce Gulch Sand Aquifer that underlie the M3 property that there was 20 to 30 mgd.
Q. Is that million gallons per day?
A. Million gallons per day traveling through the aquifer under the gradient we knew at that time under a 5-mile wide swath of the aquifer.
Q. Have you refined those numbers since then?
A. Yes. We have refined those numbers because, as you will recall, we recalculated through our second set of well measurements and survey points that we recharacterized and refined the gradient somewhat, and we have also refined the boundary conditions on the site so that we think that just under 4 miles is a better representation of the part of the Pierce Gulch Sand Aquifer that underlies the M3 site.
And our most recent calculation is that 24 -- that 24 mgd, I believe, is the refined number. And that equates to about 34 cfs, if that makes sense. So if I misstated that, I apologize.

But I believe those numbers are correct.
Q. Okay.
A. And you can pursue those with my colleague, Mark Utting. He's probably more familiar with those numbers since he did those calculations.
Q. With regard to Mr. Thornton's questions about one of Dr. Wood's reports involving his comment about geologic features along strike and that are represented by facies formations, do you recall that interchange?
A. I recall, yes. We've talked about strike on a number of occasions.
Q. Could you describe for the Hearing Officer what "along strike" means.
A. Well, strike is a geologic term, and it refers to where a dipping plain or a dipping stratum would break ground surface, projected to ground surface. So it is a line.
And we've talked about this idea of the dipping aquifer, that it's a plain in space that's dipping down Big Gulch and down underneath Star. And I think we've indicated on a number of occasions that the aquifer is, you know, fairly shallow over on the east side of Eagle, a couple

hundred feet, I think we referred to in last week's testimony, or week before last testimony. And it's much deeper -- several hundreds of feet deep beneath Star, perhaps 400 feet or deeper.
Well, if you project that plain in space up where it breaks the surface, that is the line of strike. And that is the representation of our green line, the so-called green line on our maps.
Well, that is the direction of strike. And what makes that significant, in my mind, in this whole idea about flow to the Payette or flow -- you know, is that generally speaking as these facies move down valley or downgradient, as the lake drained, I've characterized that the sediments grow finer to basinward.
And that's generally what we see, as you move down away from the front you see more and more of the influence of clays and you see, you know, more interbeds. And when you get down in the Marsing area, there's just a thick sea of mud down there.
Well, the idea of this concept of strike has to do with the permeability, too, of the sediments, the near-shore sediments, because

I've indicated that first -- as the lake drained, the reworking of the already clean sediments is near to the shore, perhaps in this 4-mile swath that underlies M3, because we're seeing very, very large transmissivity values in that swath. I mean really, really large.
And that makes sense to me. And that is also along strike. So if you have a lower -- if you have a lower base level in the Payette Valley and you have a sand layer that comes up dip along strike, and it's a very permeable area and it's getting backed up down valley, it makes sense that the water wants to flow that way along strike into a more permeable part of the aquifer.
Does that answer your question?
Q. Yes. And is that the kind of formation that you understand Dr. Wood to have been referring to in that paper that was discussed?
A. Oh, yes, it was. Because what he was referring to is that along strike -- and this is a good -- this is a good question.
If I can use this as an example. Here's the dipping plain that is the Pierce Gulch Sand Aquifer (indicating).

Q. Now, you're holding up an 8 1/2 by 11 group of papers that you're slanting in one direction?
A. Correct, as a representation of the dipping Pierce Gulch Sand Aquifer. And if -- and where a horizontal plain meets this, that is the line of strike.
And what Dr. Wood was saying is if you have two wells that are along strike, you see the aquifer would be at the same level on any wells that are drilled along this line. They're all the same depth. Okay?
Same here (indicating), if you drilled the wells over here.
Q. Further down the slope?
A. Further down the plain, further down the slope of the aquifer. If they were drilled perfectly along strike, you would encounter the aquifer at the same depth everywhere.
But if you drilled a well up here at the top of the -- at the upslope part of the aquifer, and you drilled a well down here at the lower part of the aquifer (indicating), you would encounter the aquifer at greatly different depth.
And I think what Spen was referring

f56bd4a1-b97c-4f3b-9405-765efbe2f920

to, that some of these aquifers, you know, they dip several hundred feet a mile, in some cases. So you don't have to get very far separated down dip opposite to strike to where you can't follow the traces.

And so he was saying -- he was inferring that, look, you can do a lot better job of correlating along strike because they're pretty much at the same depth, and over long distances down-dip, it becomes more difficult.

Q. But over long distances along strike is geologically feasible?

A. Yeah. And down-dip as well, if you have deep enough wells to penetrate the aquifer.

But he also indicated that one must also know the type of depositional environment. And we know the depositional environment.

Q. Thank you.

I'd like you to refer now to Exhibit 50, which is the staff's March 2nd memorandum. Page 18, at the bottom going to the top of 19. Here we have a paragraph that says, at least in substantial part, "The staff's preliminary calculations of travel time suggest that water entering the regional aquifer from the

southeast corner of the model domain that M3 used" --

THE HEARING OFFICER: Okay. I'm looking.

MR. FEREDAY: Bottom of page 18, top of page 19, Exhibit 50.

THE HEARING OFFICER: Which paragraph?

MR. FEREDAY: The very bottom.

THE WITNESS: Very last.

THE HEARING OFFICER: Starts "However, our"?

MR. FEREDAY: Starts "However, are preliminary."

THE HEARING OFFICER: Okay.

Q. (BY MR. FEREDAY): This statement -- and I'll paraphrase it, I think, accurately here. But this statement says that the staff's preliminary calculations of travel time suggest that water entering the regional aquifer from the southeast corner of the M3 model domain would reach the M3 property in a relatively short amount of time. And they say that that amount of time is an order of magnitude less than the estimated age of the water in the regional aquifer system. And they cite the Petrich report, 2004.

Do you recall being asked questions

about this by Mr. Thornton this morning?

A. Yes, I do.

Q. What is your response to this, and does it have -- what is your response to this statement in connection with your description, Mr. Squires, of the model boundary that I think you referred to as a headgate?

A. Well, I agree with the Department staff, that if you use the transmissivity and gradient that we have programmed into the M3 model, that I subject it is, you do calculate a rather quick flow time between the edge of our model and the M3 area.

Q. And the edge of the model is on that Cole Road line that you discussed earlier; is that right?

A. The extension of the Cole Road line that's actually the dividing line between townships.

Q. What's the significance of that model domain edge with respect to what the staff is saying here?

A. Well, I think that the M3 -- I thought that I referred to this in my previous testimony, but the M3 model domain, the headgate, if you

will, the input to the model, is within the Pierce Gulch Sand Aquifer. I mean those inputs -- the Pierce Gulch Sand Aquifer stratifies that -- or straddles that model boundary. There is additional miles of Pierce Gulch Sand Aquifer above the model boundary, because even the Swift wells that we've talked about are to the east of the model boundary. They're clearly in the Pierce Gulch Sand Aquifer, and several miles above there are still within the Pierce Gulch Sand Aquifer, in my concept of how it lays in.

Q. So are you saying, then, that there is some travel time that's not accounted for in your modeling that occurs upgradient from the model boundary?

A. That is what I'm saying. And not only within the Pierce Gulch Sand Aquifer, but within other sand deposits, like the Terteling Springs sand, sand facies of the Terteling Springs in the upper basin where we know there is a reach, a losing reach of the Boise River, the so-called above Capitol Bridge reach.

But it also relates to the fact that when we talk about an order of magnitude less than the estimated age of the water in the regional

aquifer system, I think there's a misunderstanding generally about the ages calculated in the Treasure Valley Hydrologic Project. And I think that because I'm soon to go off here and our expert Mr. Glanzman is more versed in the age dating of water than I am, I submit that it would be better to have him comment.

The physical nature of the system is that the path from a molecule of water entering the system to the M3 is more tortious than is being calculated by the edge of the model and the direct path goes.

MR. FEREDAY: Thank you very much. No further questions.

THE HEARING OFFICER: Okay. Mr. Thornton, recross examination?

May I remind the parties, too, that the recross needs to be within the scope of the questions that were asked by Mr. Fereday.

MR. THORNTON: The ones that were just asked by Mr. Fereday; correct?

THE HEARING OFFICER: Yes. I need to limit it, or we could be here a lot longer.

MR. THORNTON: I'm just formulating.

THE HEARING OFFICER: Okay. Shall we go

off the record, Mr. Thornton?

MR. THORNTON: I'm ready. I'm sorry.

THE HEARING OFFICER: Okay. We're ready, Mr. Squires.

THE WITNESS: Oh, I'm sorry.

RECROSS EXAMINATION

BY MR. THORNTON:

Q. Mr. Squires, you just testified that correlating data between wells along the strike of the sand layer is acceptable; is that correct?

A. Well, if you can make a correlation, that's true.

Q. Along the strike of the sand layer. Excuse me.

A. If there's a correlation there, it's certainly acceptable.

Q. And is that -- would you agree that that's appropriate over long distances?

A. Certainly can be.

Q. Okay. And then referring to your illustration, the finding a dip in strike when you have your white, 8 1/2 by 11 piece of paper, is it not a common practice -- is it a common practice to have three data points to define dip in strike?

A. That would be anyone as a three-point problem, and that -- that's true, if that's all you have. Of course, we have a lot more data points than that.

Q. And then how many data points do you have?

A. Well, I think in our reports, that would be in the amended -- second amended application or the hydrogeologic framework first year characterization report.

MR. LAWRENCE: That's Exhibit 42, tab A4.

MR. THORNTON: Page number?

THE WITNESS: I'm coming.

This is in Exhibit 42, tab A, tab 4, M3 Eagle Regional Hydrogeologic Characterization North Ada County and Gem County, Idaho, Year One Progress Report, dated May 4th, 2007. And if you go to the figures and go to figure 2 and figure 3 -- they're on opposing pages -- figure 2 shows one, two, three, four, five -- seven geophysical logs that we used to do what you're suggesting, to project and define the base of the Pierce Gulch Sand Aquifer.

And then if you go to figure 3, you'll see the locations of many of those wells and other

wells represented by the triangular portions of the -- on the map.

Q. (BY MR. THORNTON): And that is -- is that on --

A. That's figure 3. It's the next opposite page to figure 2.

Q. All right.

A. And in that particular map --

Q. Excuse me. The map you're referring to is figure 3; correct?

A. Yeah.

Q. Okay.

A. It appears that we have about 13 data points -- 13 or perhaps even 14 data points in that map that we based the dip of the bottom of the base of the Pierce Gulch Aquifer.

Q. And so where are the -- on this figure 3, where are the data points for the Payette River area?

A. Well, they're not on here. Those are in a later document that we've already talked about using the deep exploration wells showing the same geophysical character that's shown in figure 2.

Q. How many deep exploration wells were

there?
A. Well, overall, there were quite a number. We presented, I think -- I better go to the exhibit. That's the submittal by S.H. Wood --
MR. LAWRENCE: That's Exhibit --
THE WITNESS: -- submitted on November 26th.
MR. LAWRENCE: -- 19.
THE WITNESS: If memory serves me, there were at least eight data points.
Q. (BY MR. THORNTON): And you're thinking eight data points in the Payette Valley?
A. No. In the Payette -- directly in the Payette River Valley, I know that we have two that we presented: And that was the Ted Daws well and the Oroco -- I can't remember right now. I'd have to look at that.
MR. FEREDAY: Mr. Hearing Officer, it might help to refer to Exhibit 19A and 19C, which are Dr. Wood's reports that I believe Mr. Thornton is referring to.
Q. (BY MR. THORNTON): And if I could ask, Mr. Squires, are those known as the El Paso Natural Gas/Virgil Johnson, and in addition the Oroco O&G/Ted Daws?

A. Those are some of the wells, yes. There's eight geophysical logs that got submitted with that document, with that information.
Q. And are those the two that are in the Payette Valley, the Ted Daws and the Virgil Johnson wells?
A. I know it's Ted Daws, but I want to just look at the information to see if it's the Virgil Johnson.
Q. Okay.
A. And I want to look at --
Q. I just wondered if I could suggest -- it may or may not be what you're after. On figure -- on Exhibit 45, figure 3.
A. Yes.
Q. Perhaps that will...
A. Yeah, the El Paso Natural Gas/Virgil Johnson and the Oroco Oil and Gas/Ted Daws wells, those two wells are in the Payette River Valley.
Q. And in a prior discussion, those, again, were 18, 23 miles apart, between your El Paso No. 1 versus your El Paso No. 1 and 2 on figure 3; correct?
A. I think we said that they're somewhere between 17 and 23 miles between the Webber State

well drilled by El Paso Natural Gas and the Oroco Oil and Gas/Ted Daws well.
Q. All right. Okay. And the dashed line that is on figure 3 that is between the El Paso Natural Gas No. 1 well just to the -- I guess it would be to the north of -- well, I think you can see that on the map, and then there's a dashed line that goes to the El Paso Natural Gas No. 2, that dashed line --
A. Yes, that's what we refer to as the line of section.
Q. Yeah.
-- does that define the strike?
A. No.
Q. Okay. What defines the strike?
A. Well, the strike --
MR. FEREDAY: Objection. It's been asked and answered.
THE HEARING OFFICER: Overruled.
Q. (BY MR. THORNTON): Okay.
THE HEARING OFFICER: I think some clarification would still be helpful.
THE WITNESS: Yeah, the line of strike is the -- it's the direction that -- where a dipping layer would break a horizontal plain.

Q. (BY MR. THORNTON): Right.
A. And it's a good question because these lines that are shown on the map here are more what we call apparent dip. They don't go along the line of strike, nor do they go down-dip --
Q. Okay.
A. -- per se, you know, exactly. And so I don't know what else I can say to that.
Q. Okay.
A. But the line between El Paso Natural Gas No. 1 well and the El Paso Natural Gas/Virgil Johnson well is not along strike.
Q. Okay. Could you refer in this figure 3 the approximate location of the strike that you were talking about, where it is on this map, in general?
A. Well, I can tell you where it is on the M3 Eagle property.
Q. Okay.
A. And it's the green line that we've referred to.
Q. Okay. So I believe you just said that between El Paso Natural Gas No. 1 well and El Paso Natural Gas No. 2 was not on strike; correct?
A. That is correct.

Q. Okay. I'll refer back to document No. 68, which is Dr. Wood's paper on hydrologic framework in the Boise Valley.
A. Yes.
Q. Page 7, the top left where Dr. Wood states "One should view with distrust cross-sections attempting to correlate over distances of several miles, unless the section is along the strike and the sedimentary facies is identified."
I believe, did you not just say that those two points/cross-sections were not on strike?
A. I did say that, yes.
Q. And how would you reconcile Dr. Wood's statement that we should view with distrust this cross-section over several miles that's not on strike?
A. Well, I think I pointed out earlier that first of all, we know what the facies is. And not only do we know what the facies is, but we have also a representative characteristic signature within the geophysical logs that we can identify with that facies.
And so it's very clear in my mind that

the geophysical log signature that we see in all of these wells represents the same stratigraphic depositional system.
And so you'd have to ask Dr. Wood what he actually meant precisely when he made that statement, but I think what he is saying is that if you -- in the lack of good information -- he's not talking about geophysical logs here, he's just saying based on the information that we typically have and because of the dip of the aquifer, you must be -- you must question correlations that are down-dip, because over long distances, as I described, if you have even a 2-degree or 3-degree dip, you're still talking about 320 feet difference per mile.
And since the average depth of wells in the Boise Valley is somewhere -- I'm going to suggest in the neighborhood of, you know, 350 feet, once you get more than a mile away, correlation between those wells cannot be done because the aquifer's already 350 feet deep below where your other well is if you're down strike.
But in this particular case, not only does Dr. Wood know the facies, not only does he have a very distinctive and questionably

distinctive geophysical log character, but he also has very deep wells to work with. So I believe his correlations are correct.
I believe that it very clearly shows that there is a continuance of the sand from the Boise Basin to the Payette Basin. I don't think there's any question about that.
And furthermore, I think it is the basic underlying understanding of the depositional environment, just like this morning when we talked about the Terteling Springs Aquifer and the locally-named Willow Creek Aquifer that that flows from the Boise Basin to the Payette Basin.
Well, this is just another strata in that same depositional environment. There's no reason to think that the overlying aquifer doesn't behave the same in the Pierce Gulch Sand Aquifer as it does in the underlying and older Terteling Springs -- sand facies of the Terteling Springs.
Q. So do you know for certain that the -- what you are identifying as Pierce Gulch sand over down-dip or downgradient from Emmett, down the valley, that identified in the El Paso Natural Gas No. 2, do you know for certain that that isn't part of the depositional feature brought in by the

Payette River, not the Boise River?
A. Well, I don't know that for certain. I don't know what rivers existed at the time that was being deposited. But the basic depositional environment, which is a lake, starts out with the lakeshore, that basic depositional environment I believe is similar all around Lake Idaho. I have -- I've recognized these same geophysical characters on the south side of the plain where they now go up to the Owyhee Mountains.
Q. Can you describe why the Pierce Gulch sands in the Emmett Valley downgradient to, say, the Leatha area or in this area for Natural Gas No. 2, you're saying that's 300 feet lower, is that correct, approximately, than the M3 property?
A. I think that Spence Wood made those comments, that he predicted even back in 1994, before he even had as much data as we have now, that it might be on the order of 300 feet.
Q. Okay. So the depositional process, when that was occurring when the Lake Idaho was there, the question is, would not the elevation of the depositional feature in the Emmett area be the same elevation as a depositional feature in the Boise Valley?

A. No. What we -- I think I indicated earlier that as far as the high stand of the lake that we see all around the northern margin of the plain, we see the characteristic oolite deposits that represent the high stand of the lake between elevation 3600 and 3800.

Now, the present-day valleys, obviously those rivers run into the Snake in different areas. The Payette Basin runs into the Snake at a much lower elevation than does the Boise River. So it has a lower base level. So it's operating against a lower base level. And just by the natural physics of depositional systems, that river is at a lower -- a lower elevation than the Boise Valley.

And any river that runs into the Snake as you move down valley will be at a lower elevation.

Q. Were those delta deposits out of the Payette River and the Boise River at different elevations during the lake when the lake was at a constant level surface?

MR. FEREDAY: Objection. This has been discussed at length. And I believe it's beyond the scope of redirect.

THE HEARING OFFICER: Sustained.

MR. THORNTON: No more questions.

THE HEARING OFFICER: Okay. Mr. Smith?

MR. ALAN SMITH: Thank you, sir.

RECROSS EXAMINATION

BY MR. ALAN SMITH:

Q. Mr. Squires, let's go back to this strike. If you have a series of wells that are drilled up closer to the strike, then the series of wells down-dip, I think as you called it, aren't those eventually going to draw water away from the shallower wells, shallower aquifer?

THE HEARING OFFICER: Okay. Mr. Smith, I will need you to speak up.

MR. ALAN SMITH: Okay.

THE HEARING OFFICER: It's almost not audible for the rest of us that are here.

MR. ALAN SMITH: Okay.

THE HEARING OFFICER: You'll need to really try hard to speak up as you continue.

MR. ALAN SMITH: I will.

THE HEARING OFFICER: Thank you.

Q. (BY MR. ALAN SMITH): Going back to this strike. If you've got a series of wells that

are drilled up closer to the strike and a series of wells that are drilled down-dip, aren't those lower wells going to eventually draw water away from the shallower aquifer or the wells that are closer to the strike?

A. Well, I -- I think that that's -- that's a difficult question to answer, and the reason being that we have a pressure in the aquifer. And the way that the groundwater's moving in the aquifer is to a gradient in the aquifer.

And I think that if you have -- if you have pumping wells -- let's use the example of if you have pumping wells in Star, which is down-dip in the aquifer compared to wells that are in east Eagle, say Lexington Hills, and those are separated by a number of miles, they're completed into the same aquifer, and they have different head levels, slightly different head levels, well, there is a flow gradient most likely between the Lexington Hills well and the Star well that indicates that there's some flow in that direction, because flow is, generally speaking, to the west and the northwest, depending where you are in the flow.

But you could just as easily -- I mean you could have wells in the up-dip section. And if you had a well field in the up-dip section, then you could lower water levels up there. I mean you have to lower water levels in the system to cause water to flow to a well. This is an unmistakable thing. It's -- it has to happen. It's how you get water to flow to a well.

It's not unlike your bathtub. You could envision it as your bathtub. If you had a bathtub filled with water and you also filled it with sand -- okay? -- so you have a saturated sand, and when you pull the plug on your bathtub, just as a normal course, forget the sand for a minute, and you see that cone that forms around the drain, that's like a cone of depression from the well.

That creates the low pressure over there that makes the water in the bathtub flow to the drain. That's why it flows out of the bathtub.

And a well is very much like that, it creates a low-pressure area in some part of the aquifer, and water flows toward that well from all directions. But you cannot get water to flow to a

well, any well, your well, a domestic well, supply well, irrigation well, any well, you cannot get water to flow toward that well without lowering the pressure in the vicinity of that well. That's how wells work.

Does that answer your question?

Q. I think so. Is it possible that the wells up near the strike will have to be deepened or redrilled?

A. Well, again, I'm trying to lead you away from this idea that it doesn't really relate to strike. Strike is a geometrical thing of how the aquifer is. But I think I can be able to maybe answer your question, if you'll permit me.

We just made this concept that you have to lower water level to make water flow to a well. And I think you have seen in our previous testimony and in our previous graphs that show that water levels -- when you pump a well, water levels draw down around it. And we've seen water levels in monitoring wells draw down, you know, several feet. I think we talked about 7 feet in the State and Linder monitoring well due to the new Eagle field well or whatever.

Well, some wells, many wells,

especially domestic wells, have relied on and have enjoyed very shallow groundwater levels in this area, because water is not very far below ground in most of this area. So wells don't have to be drilled that deep.

And I think out of the 3,000 wells that we investigated, 60 percent of them are shallower than 150 feet. Those are -- you know, that's -- so as a community, we're enjoying very high water levels.

Some of those wells -- I mean but those wells range from 30 feet to 400 feet. And some of those wells are not completed deep enough into the water table, as you had suggested a situation where maybe there was 2 feet of water in the well. Some of those wells are not completed deep enough to allow additional well fields to be developed without the water level being lowered, because as you get wells all around the valley and the cones of depression begin to coalesce, you will see predictably a decline in the overall aquifer pressures.

Now, that doesn't mean at all that you're mining the aquifer. All that means is that you're lowering the water pressures, the pressures

in the aquifer, to cause water to flow to these wells. And I do believe that there are certain wells in the Boise Valley that are precariously obtaining water without having its feet wet by very much.

And so I predict that there will -- as we've said in our reports, there will be wells for which the water levels will decline enough to impact their production. That is going to happen.

And we've stated that all the way through, and I think it's a pretty widely known phenomenon. It's the way aquifers work.

MR. ALAN SMITH: No further questions.

THE HEARING OFFICER: Okay. Mr. Edwards?

MR. EDWARDS: No.

THE HEARING OFFICER: Thank you, Mr. Squires.

Next witness, Mr. Fereday?

MR. FEREDAY: Mr. Richard Glanzman, please.

THE HEARING OFFICER: Mr. Glanzman, did I pronounce it correctly?

MR. GLANZMAN: Yes, sir.

///

///

///

RICHARD K. GLANZMAN,
having been called as a witness by M3 Eagle LLC,
was duly sworn and testified as follows:

THE HEARING OFFICER: Thank you. Please be seated.

DIRECT EXAMINATION

BY MR. FEREDAY:

Q. Mr. Glanzman, please state your name and spell it, and also give us your business address.

A. My name is Richard K. Glanzman, G-l-a-n-z-m-a-n. I'm at 2752 South Braun, B-r-a-u-n, Way in Lakewood, one word, Colorado 80228.

Q. And what is your business, sir?

A. I'm a geochemist.

Q. What is your educational background in geochemistry or geohydrology?

A. I've got a bachelor of science degree in geology from the University of Utah, and then a master of science in geochemistry from the Colorado School of Mines.

Q. And how long have you been working in

this field?
A. About 18 years training and experience in water basin studies, basically in geochemistry with the U.S. Geological Survey. Then relevant to this hearing an additional 23 years with CH2M Hill working on water balance of about 50 percent municipal water and well field studies and contaminant hydrology.
Q. Have you conducted geochemical studies around the country? Or where have you done this work?
A. Worldwide.
Q. Worldwide?
A. Yes. Starting in Colorado, western area of the United States, expanding out to worldwide, Great Britain, Saudi Arabia, Indonesia, Taiwan.
Q. Have you any experience working on geochemistry in Ada County, other than in this case?
A. Yes. Several studies, both with CH2M Hill and other studies with Mr. Squires.
Q. I'd like to refer to Exhibit 32, tab I, I believe it is. I believe that's your resumé.

I just wanted to ask you, Mr. Glanzman, whether that is still an accurate resumé?
A. Yes, it looks like my master resumé from CH2M Hill.
Q. So that is an accurate --
A. It is accurate.
Q. -- resumé?
A. Yes.
Q. I'd like you to tell us now what work you've been asked to do and have done for the M3 Eagle project. And I note that you have a PowerPoint here, or at least I understand you do. And if you'd like us to go through that, we can do that on the screen and also you can refer to it in hard copy, if you'd like.
A. I'd like to do that very much. I've been asked to take a look at the aqueous geochemistry, worked with Ed Squires to --
THE COURT REPORTER: I'm having a hard time hearing you. I need you to keep your voice up. Maybe we can move that mic closer or speak up or...
MR. FEREDAY: Can we go off the record just for a second, please?

THE HEARING OFFICER: Yes.
(Recess.)
THE HEARING OFFICER: Now we're recording. Okay.
Q. (BY MR. FEREDAY): Mr. Glanzman, you have provided a PowerPoint here today; is that correct?
A. That is correct.
Q. And I have given copies of this to the protestants and also to the Hearing Officer. And I see we have it projected up here. And I'd like to invite you to speak from this, if that would be convenient for you; is that acceptable?
A. That is acceptable.
Q. With regard to your work for M3, you produced, along with Mr. Squires, I take it, what has been introduced as Exhibit 43, the geochem report?
A. That is correct. And that is the slide that's up at the moment, the cover of that particular document.
Q. Okay. And could you give us just an overview of what it is you did in preparing this report?
A. I assembled the aqueous geochemistry

on the groundwater and other -- any chemistry that was developed for this M3 project with Ed Squires where we worked together. My working on the geochemistry; Ed working on the geohydrology.
As it says on that overview, Ed Squires presented that hydrogeology in the last few days.
As a total we had 84 chemical analyses that were interpreted and part of this interpretation.
Q. Now, Mr. Glanzman, you're a geohydrologist yourself, are you not?
A. I am.
Q. Okay. Continue.
A. As a geochemist I want to know what am I starting with as far as aqueous geochemistry. In this case we have precipitation and Boise River chemistry that we have as end members as potential recharge to the aquifers that we're going to be discussing.
Q. Now, by "end members," is that then referring to, more or less, the extremes of what you might deal with in the possible universe of recharge sources?
A. They are the primary resources being

considered.
Q. Okay.
A. And then we are also considering the potential for mixing between the aquifers that are shown here and the wells -- well areas that are shown. For the groundwater geochemistry, we looked at the Pierce Gulch Sand Aquifer, Terteling Springs formation, Willow Creek Aquifer, Spring Valley Ranch wells, and the Emmett wells as discrete areas.

Next slide, I believe, will show you where those are. Well, it's difficult to see.

Emmett wells are located up here to the north end. Down at the south end we have wells -- depth intervals of wells completed within the Terteling Springs. The green line, which is very difficult to see. It's very difficult to see the green line that Ed was referring to, but there is a green line up here that separates right through there (indicating), Willow Creek Aquifer on the north and Pierce Gulch Aquifer here on most of the south side of that line.
Q. Now, would it be accurate to say that the three Lynn wells and SVR-6 and SVR-10 are within the Willow Creek Aquifer?

A. That is correct.
Q. And you mentioned earlier that some of the wells down to the southeast -- I'm not sure which ones you were pointing to -- perhaps State Street or --
A. I apologize for interrupting.
Q. -- down to the southeast.
A. Yeah, down to the southeast for the Terteling Springs.
Q. Yeah, you mentioned --
A. Yes.
Q. -- that some of those completions are in the Terteling Springs.

Could you explain that, please.
A. The Gary Lane well, there are depth wells of the Swift well. So three in particular. And there are depth intervals in the State and Linder well that are completed in the Terteling Springs.
Q. Do they also have depth intervals completed in the Pierce Gulch Sand Aquifer?
A. They do. The 84 analyses include many depth intervals and discrete wells, as well as one spring.
Q. Now, the Terteling Spring -- to go

back down to the southeast again and the Gary Lane well, for example, the Terteling Springs Aquifer, I take it, is deeper than the Pierce Gulch Sand Aquifer at that location?
A. Yes. Let's go to the next slide.
Q. Okay.
A. And we've got a vertical -- oh.
Q. No.
A. To the cross-section.
Q. The cross-section. Is that page 13?
A. That's page 13. There we go.

This is a cross-section that shows the vertical relationship between the Pierce Gulch Aquifer, which has an upper and lower part, and those will be important when we get into discussion of the groundwater from the Pierce Gulch.

Then you have the Terteling Springs Mudstone that underlies that, that has a central sand aquifer that we've got water analyses for that we were just referring to --
Q. Okay.
A. -- the Gary Lane. There's well completions in the south end of the area that we studied that are completed in that small

sandstone, within those mudstones.

Then across the way we have the -- just a second there. We have the Willow Creek formation on the right-hand side of that graph. Give you the general idea of the vertical distribution of that cross-section.

And if we go back to the last slide, you can see where that cross-section extends across the mapped area.
Q. Okay. Is that back to page 4, I believe it is?
A. That is on page 4. You can see this dotted, dashed line that goes across here. That is where that cross-section is.

We'll be coming back to that cross-section periodically throughout this discussion.
Q. Thank you.

So you mentioned these end members of rainfall and the Boise River.

What can you tell us about your work starting with that -- at that point?
A. The most basic principle that we use is a total dissolved solids. It gives us an idea of how much -- or excuse me, how much solubility

we're dealing with; what minerals we might be dealing with; what is their distribution within each of the aquifers; how do they vary from rainfall from the Boise River; how much are we increasing the total dissolved solids.

And as you can you can see on this slide, the rainfall has only 5.4 milligrams per liter, total dissolved solids from USGS Wood and Low, 1988, references in the report.

Boise River water was 52 milligrams per liter, ten times more. So just exposure to the surface environment itself increases the total dissolved solids an order of magnitude ten times.

And then each of the aquifers, we've taken the averages, and we have the distribution of each of the -- for each of the aquifers and for the well areas. We have the range of total dissolved solids.

As you can see, the lowest average total dissolved solids is in the Willow Creek Aquifer, WCA on that graph. But the Pierce Gulch Sand Aquifer and the Terteling Springs formation, PGSA and TSF, have the next lowest average. But you can see they have a fairly broad distribution.

Getting down to the Spring Valley

Ranch wells, it has the next highest. And finally, the Emmett wells have the highest average total dissolved solids.

Q. What does this slide tell you, or what do these data tell you, Mr. Glanzman, about these various aquifer units?

A. Looking at the various distributions of total dissolved solids, the PGSA, the TSF have minimal solubility product -- or minimal solubility minerals within the aquifer; in other words, there's not very much that's soluble within those aquifers.

As we go up -- and the Willow -- or excuse me. The WCA with a very low level, that, we'd need to think about a little bit. And then the other two, they have -- either there's something else going on that we need to know about or they have minerals that have a higher solubility.

So in order to determine now -- okay? -- whether there is mixing and whether there is -- what the potential source is, we have to look at the major ion chemistry that makes up the total dissolved solids.

There are seven ions that make up 98

or more percent of the total dissolved solids.

Q. And I see where you've moved to slide six now.

What is major ion chemistry?

A. Major ion chemistry is the ions that have the highest concentration, both positively-charged and negatively-charged that are dissolved in the water forming the total dissolved solids. Of those, they are calcium, magnesium, sodium plus potassium. Potassium is -- in this graph is combined because you have similar chemical characteristics. Those are the positive-charged ions.

Negative-charged ions are the bicarbonate, the sulfate, and the chloride.

Q. Now, did you obtain major ion chemistry from these 84 samples that you mentioned earlier?

A. Each of these 84 analyses has a complete analysis of the major ions plus a number of trace elements that we'll be talking about later.

Q. What percentage of groundwater chemistry is comprised of these major ions?

A. All groundwater and surface water

chemistry is dominated by these major ion chemistry.

Q. So what do we see shown here in this trilinear diagram on slide six, sir?

A. Well, as you can see, all the points are plotted for all of the various units there, and it looks pretty complex.

Q. All 84 points are --

A. All 84 points are on there. And you can see that it is quite widespread and seeming to be quite complex. We'll get to -- we'll separate each of those out, and you'll see they simplify very rapidly, in most cases.

Q. Now, when you say you separate them out, are you separating them out according to aquifer location?

A. Yes, that is correct.

Q. Okay.

A. Art Piper designed this diagram. The lower left triangle is the positively-charged ions. The lower right is the negatively-charged ions. What he wanted to know -- and this is precomputer time -- thank goodness we have that now. One point could -- you could plot one point that gives you the percentages of all of the

positive-charged ions, another point -- this is on the lower right -- lower right we talk about the negative ions. One point on that gives you the percentage of each of the three negative ions.

Then if you project those points up into the diagram, you have one point that tells you all about the six ions, how they relate to one another within that water analysis.

Q. Is the Piper diagram an accepted method in your field, sir, for analyzing water chemistry?

A. Has been for more than 40 years, yes.

Q. Who was Mr. Piper, or who is he?

A. Art Piper was a USGS employee in charge of the California division of the state office of the USGS. And at that time there was no computer, so he needed a way of characterizing and visually showing what the major ion chemistry looks like and how it relates from one well to another or from one sample to another of any type of increased geochemistry.

Q. And even since the advent of computers, we still use the Piper diagram?

A. Repeatedly.

So on the next diagram -- or excuse

me, the next slide, what we're showing here is the Pierce Gulch Aquifer analyses. You see up here we -- they all group right around in a cluster here (indicating) that envelopes the Boise River, which is right here (indicating). And it's far away from the precipitation.

What we want to do -- if we want to evaluate mixing, what we do is we draw a line between the end members, Boise River out to precipitation, and wherever that line, the percentage moving along that line gives you some idea of the percentage contribution from both of those sources.

So in this case we're saying that 90 -- 85 to 90 percent of the water in the Pierce Gulch Aquifer is from the Boise River. That's quite unusual.

Q. Why do you say it's unusual?

A. Those deltaic sands -- I have in my 40-plus years' experience have never seen a group of wells along a 12 to 15-mile lateral distance that cluster like that.

Normally what happens is that you see a trend in some direction. And we will see those in the other slides, where you see where the

aqueous geochemistry changes as the groundwater moves through the aquifer.

Q. But here what you're saying, then, is that you see very little change in the fundamental groundwater chemistry, despite 15 miles of difference between sample points?

A. That is correct.

Q. What does this tell you about the makeup, the physical makeup of the aquifer unit itself? Is it full of clay? Is it full of sand? Is it full of fine sand? Is there anything you can tell us about that?

A. It has to be filled with coarse-grained material in which water can move through rapidly, because if it is left to its own devices under any length of time, it will increase and change major ion -- increase total dissolved solids and change major ion chemistry, which is what normally happens in aquifers over that lateral distance.

Q. Okay. Now, I see there are two cross-shaped indicators uptrending toward precipitation out of that Boise River cluster.

What are those and why are they there?

A. As you can see from the index -- or

the index up here, we've separated -- we tried to separate as best we could wells that were completed in the lower Pierce Gulch Sand Aquifer and the upper Pierce Gulch Sand Aquifer.

What we were trying to do was discover if precipitation was favoring the upper part; in other words, was there a surface water infiltration that got into the upper part that would be shown by the major ion chemistry or is there water moving up from the Terteling Springs, for example, into the Pierce Gulch Aquifer. In other words, we're trying to evaluate mixing.

Q. Now --

A. The plus --

Q. Go ahead.

A. In answer to your question on the pluses, the pluses are the lower Pierce Gulch Sand Aquifer. And you'll notice that they are the two that are trending toward precipitation. In other words, here we have the lower part of the Pierce Gulch Sand Aquifer looking like it's got precipitation, an additional component of precipitation mixing with it.

Q. Now, why would that be?

A. Could we go back to the cross-section?

Q. Yes.
A. That's No. 13.
Q. No. 13.
A. There we are. That well is this one right here (indicating). And it's where, as Ed was describing -- or Ed Squires was describing earlier where this lower Pierce Gulch Sand Aquifer comes upgradient and comes near the --
Q. Comes up --
A. -- up near the surface. And that is M3 Eagle test well 2, zone 1. So that's why precipitation is indeed mixing in with the Pierce Gulch Sand Aquifer at that well location.
Q. And I take it from your testimony just a minute ago that that might be to the tune of 10 or 15 percent, something along those lines?
A. There about. I mean as an estimate.
Q. What does this -- to go back to slide 7 where we last were, what does this tell you about the nature of this aquifer? Does it appear to be compartmentalized? Is there interruption in groundwater flow indicated in any way from this geochemistry?
A. No, there is not. And you can see in the positive-charged ions in the lower right

triangle --
Q. The lower left?
A. Yeah, lower left. Excuse me. Lower left triangle, we're looking at -- here is where you would investigate for ion exchange or the potential for ion exchange where calcium and sodium would exchange. And we would see a trend that would go this way along that graph (indicating). And you can see that that cluster does not have that trend.
Q. And what does that mean to us?
A. That means you don't -- you have minimal, if any, ion exchange, which means you don't have any clays. Clays are minimal in that aquifer, which is the same thing as we were saying earlier about rapid transit through a coarse-grained aquifer.
And no, we don't have any partition. We don't have any major changes. We don't have any measurable changes in the major ion chemistry or the total dissolved solids that would indicate compartmentalization.
Q. Okay. What about stagnation of groundwater in any particular area, what do you -- what do these tell us with regard to that

question?
A. Stagnation would have the same effect. If you envision the most stagnant water that we know of is in oil field brines, they become sodium chloride type waters. And there is a regular progression of major ion chemistry that tells you how stagnant that is. In this case, this is calcium-bicarbonate water. There is no stagnant water here.
Q. What does this tell you about transmissivity in this aquifer, if anything?
A. It agrees with Ed Squires' estimate of very high transmissivity aquifer.
Q. I see we have slide No. 8 up there. Could you tell us what this shows.
A. This slide is a synopsis of what's in the report on the Boise Pierce Gulch Sand Aquifer. We just briefly put -- went into several of those aspects.
First of all, it is Boise River recharge in the Pierce Gulch Sand Aquifer. It has very little precipitation. It is a discrete regional aquifer within the Boise aquifer. In other words, we can define what it is within that aquifer.

Q. Now, why do you say it's a discrete regional aquifer based on geochemistry?
A. Because of that cluster we just saw, it is highly characteristic, no other groundwater that we have has those characteristics. As a matter of fact, other groundwaters, as we will see in a moment, have different groundwater chemistries. So it is discrete, identifiable, documented that this -- this segment of the aquifer -- of the Boise aquifer is discrete.
Q. Does this discrete aquifer description you've just given comport with the geologic setting and physical and stratigraphic descriptions that Mr. Squires and Dr. Wood have testified to?
A. Yes, it does.
Q. Continue, please.
A. Again, the average total dissolved solids is a fairly low 191, ranges from 82 to 404. Remember that even -- well, if you remember the total dissolved solids for the Boise River is only 52, that again tells us that 82 -- that's pretty close to the Boise River total dissolved solids.
It has a near notarial pH; in other words, causing the pH either to go alkaline or

acidic. It's highly oxidized. And there's another clue.

The oxidation potential, plus 334. A normal alluvial aquifer has in the region of 200 to 300. Any alluvial aquifer has a plus 200 to 300. This is quite oxidized.

Q. Now, what is 334 mv? What does that mean?

A. Millivolts. And this is the activity of the electrons in the water. It is the redox potential.

Q. What's "redox potential"?

A. It is the activity of the electrons in the water.its analogy would be the pH is the activity of the protium, p-r-o-t-i-u-m, ions in the water. In other words, the hydrogen ion -- positively-charged hydrogen ion.

Q. So what's the significance of it being highly oxidized?

A. That means it cannot be stagnant, it cannot be compartmentalized, and it must be moving. This is a typical of what you would see in surface water.

Q. That is not typical?

A. This value that you see here for that

redox at 334 millivolts is what you would normally see for a surface water. That's very oxidized.

Q. Okay. Continue.

A. It has the same major ion chemistry over the TDS and spatial ranges. In other words, that whole TDS from 82 to 404 total dissolved solids doesn't change major ion chemistry. That's amazing. That has to be a very coherent mineralogy throughout that system with limited clays. A very unusual aquifer.

Q. What does that suggest to you with regard to productivity of the aquifer, if anything?

A. I can only -- that has to do with the volume of water that was able to be transmitted. As transmissive and as oxidized as this water is, it must be moving rapidly through that aquifer.

Q. Okay.

A. So it must have a high productivity, given the thicknesses and other characteristics that Ed Squires has already described. It is quite saying the same thing.

Q. Do you agree with what Mr. Squires has said about his view of the productivity of this aquifer?

A. Yes, I do.

Q. Continue.

A. This would be supportive of that.

Q. Okay.

A. Again, the TOC is very low. 8/10ths of a milligram per liter.

Q. What's "TOC"?

A. Total organic carbon. The nitrate nitrogen, .42, very low. Ammonia nitrate, I think is -- yeah, .08 milligrams per liter. All of those are very low nitrate. Means that it hasn't been exposed to the surface environment, and certainly doesn't include irrigation waters.

Q. Does not?

A. Does not. It has low iron and manganese. You might already have known that from the pH and the redox potential.

Q. Yes, I recognized that immediately. And there is a very low arsenic concentration, well within the drinking water standard of 0.01 milligrams per liter. Low arsenic.

And your question about productivity of this aquifer, we could judge that perhaps by comparing it to the Floating River, Goddard, and HP wells.

THE COURT REPORTER: Say that again.

Q. (BY MR. FEREDAY): Floating Feather?

A. Floating Feather, Goddard, G-o-d-d-a-r-d, and HP. These are names of wells that are on that diagram, if you want to go back to it.

Q. Mr. Glanzman, is there any doubt in your mind that the Floating Feather, Goddard, and HP wells, as well as the wells in the Pierce Gulch Sand Aquifer on the M3 property are all in the same aquifer?

A. I have no doubt.

Q. Okay. What about the quality of this water for drinking and municipal purposes?

A. As you can tell from the chemistry that's been presented, it's an excellent quality.

Q. Did you hear the testimony of Mr. Roger Dittus?

A. Yes, I did.

Q. Did you hear anything in his testimony about his experience with United Water wells that would in any way conflict with your view of this aquifer?

A. No, I did not.

Q. Let's continue, then. You -- I think

you mentioned a minute ago that you were going to show us why the PGSA geochemistry varies from that of other aquifer units in this area.

Does this slide help us do that?

A. This does -- this is an excellent slide to give us that ion exchange characteristic that we were talking about earlier that the Pierce Gulch sand does not have. And you can see this illustrated in the Terteling Springs formation groundwaters where that trend right along the base of the diamond is generated by an exchange of calcium to sodium-dominated groundwater as the groundwater flows down the Terteling Springs sand.

So that isn't an anion exchange. You can see there is no change, zero change in the water chemistry of the negatively-charged ions. It's all positive charged, changed from calcium to sodium.

Q. And does that differ from what we see in the PGSA?

A. PGSA clearly did not show that trend.

Q. What about precipitation in the Terteling Springs formation?

A. The Terteling Springs formation extends down from the Boise River end member away

from precipitation, so that the Boise River is the recharge for the Terteling Springs sand. Zero from precipitation.

Q. And the next slide. Are you ready to move on, or is there something more on this one?

A. No, that's fine. This is exactly -- again, it is a Boise river recharge, even more so than with the Pierce Gulch. This is Boise River.

Major ion chemistries, as we've talked, indicate ion exchange. The linear change in the water chemistry type from calcium-bicarbonate to sodium-bicarbonate. That's what I showed you there. The average TDS is only 206. Very close to that of the Pierce Gulch. So the precipitation will give you a little bit of change in the total dissolved solids.

Range of 148 to 361. Average pH is a little more alkaline, 7.54, becoming a sodium-bicarbonate, water causes that. But nondetect nitrate nitrogen. Nondetect. It is -- the ammonia, however, is quite high, 3.4 milligrams per liter.

Q. Why do you think that would be?

A. That's activity of microbial enzymes in the subsurface under reducing conditions are

creating ammonium ion that is present in the Terteling Springs, so that the -- even though we have low iron and issue manganese, and certainly the sulfate is indicative of low oxidizing to reducing conditions. We don't have measured EH or oxidation reduction potentials for these groundwaters.

The arsenic, however, is similarly low to that of the Pierce Gulch Sand Aquifer.

Q. Okay. What about the Willow Creek Aquifer? I think that's your next one.

A. It is the next one. The Willow Creek Aquifer has a considerable more variability. Again, you'll see that the distribution is -- we do have ion exchange occurring in the Willow -- Willow Creek Aquifer.

But we also have a considerable scatter and a similarity to the Terteling Springs in a couple of the groundwaters. So this is a very interesting water. It has a low total dissolved solids, but it has ion exchange and it also has a wide distribution that's again -- that is out in an area of the water -- major ion chemistry that hasn't been seen before.

Let's take a look at the next slide.

Q. Okay.

A. Again, what we're talking about now in Willow Creek is this little cluster of wells here (indicating) north of that green line that Ed Squires was talking about earlier and that you enumerated the names of those wells.

Q. Uh-huh.

A. If we look at the total dissolved solids of those wells, those five wells that we see here -- and let's talk about these two specific ones here.

Q. That would be SVR-6 and SVR-10?

A. SVR-10. Those are less than 100 milligrams per liter total dissolved solids.

Q. And what does that tell us?

A. Very dilute groundwater. The most dilute groundwaters -- among the most dilute total dissolved solids groundwaters we have. When you step over that green line -- okay? -- over into the Pierce Gulch Sand Aquifer that extends all the way along here (indicating), the total dissolved solids primarily of the Pierce Gulch -- or the Pierce Gulch Aquifer primary range of total dissolved solids is 200 to 250.

So we have more than double by just

stepping across that green line. That's amazing. That means there cannot be movement of water from the Willow Creek into the Pierce Gulch, or vice versa.

And we will see that nitrate and arsenic also tells us the same thing. There cannot be an exchange of water across that green line from the Willow Creek into the Pierce Gulch, nor vice versa.

Q. Have you heard Mr. Squires describe, at least generally, his views about the Willow Creek Aquifer and how it sits in a separate area --

A. Yes.

Q. -- area from -- separate from the PGSA?

A. Yes. And if we go to the cross-section, which is the next one.

Q. Yes.

A. The other thing that's interesting is that the water level in the Willow Creek is considerably lower than that in the Pierce Gulch --

Q. Do you agree -- excuse me.

A. -- the groundwater chemistry.

Q. Do you agree with Mr. Squires' analysis and his description of the Willow Creek Aquifer, generally?

A. Yes, I do.

Q. Okay. Back to the slide 13. I note that you say that you observed the different water levels in the Willow Creek as opposed to the PGSA.

Anything else about this cross-section that you -- that you can tell us that the geochemistry helps to describe, or is there anything more here?

A. The most important thing about it is that the groundwater -- the major ion chemistry is considerably different, as you saw on the trilinear diagram, and the total dissolved solids is double in the Pierce Gulch of that in the Willow Creek.

Q. Mr. Glanzman, have you ever been to the M3 site or looked at various geological outcrops and features in the Boise foothills?

A. Yes.

Q. You have done other work in Ada County as well, you indicated earlier; correct?

A. Yes, I have.

Q. Okay. So the next slide, are you

ready to move there?

A. Yes. This is a summary of the Willow Creek Aquifer, as we've summarized the previous two. It is the upgradient -- as Ed Squires has pointed out, upgradient sand facies of the Terteling Springs formation. You saw that in the water chemistry, reflected in the water chemistry, that it is very similar to the Terteling Springs formation.

Precipitation recharge is dominant in that aquifer. This is not -- we're out of the Boise River recharge now. This is precipitation. That is the most dilute groundwater in total -- average total dissolved solids of 119, range from 70 to only 154 milligrams per liter. I mean that is a very dilute groundwater.

Q. That would be much more similar to rain water, then, than many ground waters you've seen; would that be a fair description?

A. Many, yes.

Q. Okay.

A. The average pH is relatively elevated 7.6. But you'll see what the nitrate did there. Nitrate jumped up to 1.56 milligrams per liter.

Q. And that's NO3N?

A. NO3N. That's nitrate as nitrogen, is what that means.

Ammonia is a reasonably low 0.16 milligrams per liter. This is what you see in normal arid zone nitrate concentrations. So this is surficial. It's just saying the same thing that we said before, precipitation moving nitrate from the surface into the groundwater system.

The arsenic, however, is a very interesting 0.025 milligrams per liter average, average, greatly exceeding the drinking water standard of .010. More than twice that drinking water standard. And it has a range of arsenic concentrations from nondetect to 0.067 milligrams per liter. That's quite elevated. That's quite elevated.

This is a very different water than the Pierce Gulch Sand Aquifer. Again, the nitrate and the arsenic is saying there's no exchange across that green line.

Q. What about the drinking water quality of Willow Creek Aquifer? I take it from what you've just testified that there might be problems with it.

A. With the Willow Creek?
Q. Correct.
A. Yes, exceedance of the drinking water standard is right up there. That is -- the drinking water standard of .010 now is --
Q. For arsenic?
A. For arsenic, means that this water is really -- should not be ingested.
It has an elevated silica of 38 milligrams per liter and an elevated fluoride -- it has the highest fluoride of any of the others. And this is suggesting that there is a volcanic sediment component to this Willow Creek that we have not seen in either the Terteling Springs or the Pierce Gulch Aquifer.
Again, final line, there's no hydraulic connection with the Pierce Gulch Sand Aquifer and the Willow Creek.
Q. Okay. Thank you.
Your next slide is a map. I think we're returning to the same map.
A. This is the same map. But what I wanted to show you here is we're going to be talking about the Spring Valley Ranch wells. Here we have a transit of about a 4-mile transit,

compared to a 12 to 15-mile transit of the Pierce Gulch. And then later we're going to go over and take a look at the Emmett area of wells. So I just wanted to show you where those were again to remind you of where we're going now.
Q. Now, those Emmett area wells, those are not in the Pierce Gulch Sand Aquifer, are they?
A. No, they are not.
Q. And the Spring Valley wells, likewise, not in the Pierce Gulch; correct?
A. Let's go ahead and take a look. No.
Q. Okay.
A. You are absolutely correct, they are not.
Again, take a look at the trilinear diagram. We see the ion exchange signature. This is typical of groundwater. This is what you would anticipate seeing. They have a broad scatter all the way from down here into the sodium-bicarbonate water all the way up into the high sulfate, but it trends up toward precipitation.
Q. Now, these are for that group of Spring Valley Ranch wells up there to the northeast?

A. That little passel of wells that have about a 4-mile linear extent, yes. So you can see that even that small 4-mile extent has a very large range in major ion chemistry and, as we'll see, total dissolved solids as well.
Q. And what does that tell us about those?
A. That tells us a lot about what you asked about earlier in that these wells are laterally discontinuous groundwater systems, very locally recharged. So this is the antipathy of what we see in the Pierce Gulch Sand Aquifer where everything is connected. These things, adjacent wells, do not appear to be connected. They're variable depths as well here, so we have to take that into account.
So the Spring Valley Ranch wells, precipitation recharge, widely different water chemistry types in the groundwater. That's a very small area. That's only a 3-mile area. Highest average total dissolved solids of group that we have right now, range of 116 to 570 milligrams per liter.
I didn't point out the high sulfate concentration. This is not chloride. This is

high. 65 milligrams per liter, ranging 9 to 229 milligrams per liter. That's a --
Q. Now, where would that sulfate come from? From the granitic intrusions there?
A. Okay. The sediments range from volcanic to granitic, and that's one of the reasons why we see such a highly variable groundwater major ion chemistry.
The high iron here corresponding to the high sulfate suggests this is pyrite. And as you can see, the average arsenic here also exceeds the drinking water.
THE HEARING OFFICER: Okay. Just a moment. We need to change tapes again.
Okay. We are recording again.
Q. (BY MR. FEREDAY): I believe, Mr. Glanzman, you were discussing sulfate and pyrite and the high sulfate values we see here in the Spring Valley Ranch wells.
A. We were talking about the elevated percentage of sulfate and the elevated iron concentration, which is not labeled here. I haven't brought it out, but it does have a high iron concentration.
If you look at the average arsenic

concentration of .014 milligrams per liter, that exceeds, again, the drinking water standard. It's not quite as high as the Willow Creek. The highest level there was .038. But there are -- these groundwaters are -- typically exceed the drinking water standard for arsenic.

I think what those are talking to us about is within that mineralogy, the volcanic and granitic mineralogy, we have a sufficiently reducing environment. The pyrite is there, and it is oxidizing, slowly oxidizing and releasing that arsenic. Arsenic is a common contaminant of pyrite.

Q. A contaminant associated with pyrite, did you say?

A. Yes.

Q. What about the permeability of this Spring Valley Ranch well area, does the geochemistry tell us anything about this?

A. Major ion chemistry would suggest -- suggest only -- that you could have quite variable permeability. In some area you might have fairly high and others -- in other words, these -- these groundwaters are spatially and hydraulically isolated, not only from the Pierce Gulch and

Willow Creek, but from themselves.

Q. What about the clay content in these wells, anything to be said about that?

A. The ion exchange clearly indicates that many of these wells are very clay rich.

Q. Now I think it's time to visit Emmett.

A. We go to Emmett. Now we see an even better indication of what does it look like when we have an end member of precipitation going down to a Terteling Springs type of groundwater chemistry. You can see there's a linear line almost between the -- extending from the Terteling Springs indicative nature all the way up to precipitation.

We see the ion exchange characteristic. We also see an increase of the sulfate and chloride a bit. So this is a clear indication that this groundwater is from precipitation. May well be from recharge in the Payette River -- or from the Payette River. That can't know -- we've been trying to find information on the surface water chemistry of the Payette River and have been unsuccessful, at least as far as we've gone in getting that chemistry, or that would have been most interesting here.

Q. Does this Piper diagram tell you anything with regard to whether this Emmett area aquifer is connected to the Pierce Gulch Sand Aquifer?

A. There's nothing in this -- the chemist -- major ion chemistry of these few Emmett wells that would indicate that the Pierce Gulch Sand Aquifer groundwater is present.

Q. Anything about the presence of clay in this aquifer in Emmett?

A. Clearly it has a fairly elevated -- a sufficient amount of clay present that ion exchange is occurring in the environment.

Q. Does it have more clay, based on this, than the Pierce Gulch Sand Aquifer?

A. Considerably more, of course, because the Pierce Gulch did not show an ion exchange, where the Emmett wells clearly do, as well as the Terteling Springs formation.

Q. Just so we're clear about which wells we're talking about in Emmett, it's Emmett No. 9, Emmett No. 10, and a well called Perin, P-e-r-i-n; is that right?

A. That is correct.

Q. Okay.

A. And then if you go into the original report, there is a trilinear diagram labeling all the wells, if you want to know.

Q. Okay. So here is the slide summarizing your findings on the Emmett wells' --

A. It is.

Q. -- geochemistry?

A. It is. We have three wells that we pointed out. Precipitation is certainly the recharge. Average total dissolved solids, however, is a really relatively elevated 303 milligrams per liter. This groundwater has a history.

It isn't well written in the few analyses we have. And since we don't have the surface water, we can't tell about that history. But it's clearly different than what we see in the Boise Basin.

Q. Do you have TDS values from the Payette River to compare here?

A. I do not.

Q. That would be helpful, perhaps.

A. It would be very helpful, yes, to have a lot more chemistry on the Payette area. It apparently has not been studied well.

Q. You mean on the Emmett area?
A. The Emmett area. I'm sorry.
Q. Yes?
A. But the Emmett, in general, is very little known about it, other than it's a very large sandbox.
Q. When you say "it's a very large sandbox," why do you say that?
A. There is a lot of sand present, both in the outcrops and within the base -- the Payette River. I've studied the providence of the sands of the Snake River from Owyhee all the way through Hells Canyon, and when we hit the Payette, there's a lot of sand in that Payette River that discharges out of there. So it -- that's the origin of that. And I apologize for the colloquialism.
Q. That's fine. Have you visited the area around Emmett in connection with the M3 work that you've done?
A. Yes.
Q. And have you observed the oolite bathtub ring that both Dr. Wood and Mr. Squires have described over on the Emmett side?
A. Yes.

Q. And do you find their testimony to be accurate as far as you can discern as a geologist --
A. I do.
Q. -- on that score?
A. I do. As a matter of fact, if anyone here wants to see where these oolites form and how they form, just go down to Bear Lake down there in northern Utah. They're forming there today.
Q. Right there at the lake margin on the shore?
A. Yes, it is.
Q. On the beach?
A. On the beach. There are oolitic sand beaches on Bear Lake.
Q. And oolites, again, are a particle that is coated with some sort of a calcite?
A. It's calcium-carbonate. Yes, it is calcite. Like an onion ring, basically.
Q. So continue with this slide, please.
A. The Emmett wells, again, precipitation dominant, high TDS. Nitrate, nondetect. Ammonia, again, like the Terteling Springs, we have ammonium present, but it's at a very low concentration.

Average arsenic is less than detection, basically. Very low levels of arsenic. So the groundwater trends -- chemistry trends from near precipitation toward the Terteling Springs formation mineralogy.
MR. FEREDAY: Mr. Hearing Officer, I'd like to break here just for a few minutes, if that's okay with everyone.
THE HEARING OFFICER: I've been looking for a time. So let's break for -- what do we need? Ten minutes or fifteen?
MR. FEREDAY: Ten should be fine.
THE HEARING OFFICER: Ten minutes. Okay. Let's come back about ten after 3:00.
(Recess.)
THE HEARING OFFICER: Now we're recording.
Q. (BY MR. FEREDAY): Mr. Glanzman, you've just been describing your conclusions about these Emmett well water quality samples, water chemistry samples. And I'd like to know whether you see anything in the geochemistry in those three Emmett wells which would conflict with the stratigraphy or structural description of the PGSA as provided by Mr. Squires and Dr. Wood?
A. No, I do not. To elaborate a little

bit on that, the scientific curiosity on my part -- well, complaining about the lack of data from the Payette, it would be nice to have had. It would have made no difference.
Q. Okay. And that is because the differences between those -- the geochemistry we do have and the PGSA chemistry is so significant that you see no connection; would that be fair?
A. That's fair.
Q. Your next slide I see has a summary. Could you just quickly take us through that, please, sir.
A. Yeah. On this slide we're just trying to summarize all the information that we had before, some of the most pertinent information. For example, the Pierce Gulch Sand Aquifer groundwater, discrete regional aquifer, and I think we defined that. It's not hydraulically connected to any other designated aquifer or area wells from the major ion chemistry. It is recharged by the Boise River.
The Terteling Springs formation groundwater is also recharged by the Boise River.
Willow Creek Aquifer, the groundwater is recharged by precipitation. Elevated arsenic.

It has elevated arsenic above the drinking water standard, probably originating from volcanic sediments that are incorporated within their mineralogy.

The Spring Valley Ranch well area is recharged by precipitation with highly variable chemistry and also elevated arsenic above the drinking water standard.

And then in the Emmett area, the groundwater is recharged by precipitation and may be -- or it's quite similar to the Terteling Springs formation sediment mineralogy.

Q. Thank you.

Mr. Glanzman, I assume you have heard testimony about the staff's memorandum in this case, their March 2nd memorandum?

A. Yes, I have. And I've read them.

Q. Have you read that staff memorandum?

A. Yes, I did.

Q. That's Exhibit 50, I believe.

Do you recall the staff's comment in that memorandum about the ancestral Boise River and the seeming disconnect between a concept of an ancestral recharge source and the high transmissivity values in the Pierce Gulch Sand

Aquifer? Do you remember something along those lines?

A. I remember reading that, yes.

Q. What do you mean by "ancestral" in your Exhibit 43 geochem report, sir?

A. I think I used the word "ancestral," and there is a "geologically ancestral" also in there. I was trying to get away from the use -- getting -- the Hutchings report clearly indicates that this is not modern. He uses zero. A geochemist uses the word "modern" to mean 1952 and before.

Q. Now, when you say Hutchins and Petrich use zero, what do you mean? Do you mean zero years? Zero to 1,000? Zero to 2,000?

A. Yes, they do.

Q. Okay.

A. Zero to less than 2,000.

Q. Okay. And if you could just refer to slide 22, please, and tell me, if you know, what that is.

A. Slide 22?

Q. Yes. And we'll come back to the previous slide in a moment.

A. This is their table 5. And that's on

page 56 of their report.

Q. Of Exhibit 33G, I believe?

A. Yes, it is.

Q. Okay. And what can you tell us about this table with regard to your comment earlier about zero to 1,000, zero to 2,000, and modern?

A. You'll notice in the upper part of his table here he lists a lot of minimum groundwater residence times as zero. And the maximum, then, is listed, and then a best estimate. And the upper about one-third of the analyses are all less-than values.

Q. Yes.

A. So he has said that in -- if you go to page 55, he clearly indicates and states, "Note that the practical limits of the carbon 14 age dating method are 5,000 to 30,000 years. Therefore, residence time estimates for the basin margin aquifers and some down valley aquifers must be considered accordingly."

Q. Now, that's on page 55 of Exhibit 33G; correct?

A. That's correct.

Q. The Hutchings and Petrich geochem report --

A. Yes.

Q. -- in the Treasure Valley Hydrologic Project; correct?

A. That's right. That is correct.

Q. Tell me about their statement here. Do you agree with that, that the practical limits of the carbon 14 age dating method are 5,000 to 30,000 years? What does that mean?

A. I agree with that. I think John Hutchings has done a very good job of his calculations on carbon 14 radio isotope analysis. His models are what normally would have been used and beyond. He has done a considerable amount of work to try to do and try to give a residence time in the aquifer.

Q. A residence time of what?

A. That's where we need to be more direct. We both needed to be more direct in how we are expressing ourselves.

A geochemist assumes everyone knows what they're modeling. And what they're really modeling when we model carbon 14 is the age of the carbon that is dissolved in that water. That is not the same thing as the age of the groundwater. That's very different.

Q. Okay. Let me see if I understand this. Hutchings in his report and for the Treasure Valley Hydrologic Project warns that ages less than 5,000 have to be considered accordingly, meaning that we don't really know the age if it's less than 5,000? Is that generally accurate?

A. That is accurate. His corrections that he was applying to that did not allow a more accurate date below 5,000 years.

Q. So would it be accurate, then, to say that in a given hypothetical based on carbon dating found in a well sampled in the PGSA that we don't know whether it's 160 years or 1600 years old, that water has been in that aquifer for that period?

A. We're talking about the water, the age of the water. And no, we do not.

Q. Okay.

A. We know what the carbon -- we're trying to calculate what the age of the carbon in the aquifer is, and hoping that that tells us that the carbon has never been separated from the time it recharged all the way through the aquifer. And it's the same carbon all the time, or we can correct back to that carbon.

Q. When on page -- slide 22, the table 5 from the Hutchings report that you've been referring to, when they say groundwater residence time, then, to return to that point, is that a correct statement or is that incorrect, in your view?

A. It's not literally correct. He is ascribing what I have just described, that the carbonate that he's measuring the age of in the groundwater is the age of the groundwater. And that is not the case. They are quite separate issues.

For example, in his -- in his report here, he's using 100 percent modern carbon. 100 percent modern carbon is 1952 groundwater by definition.

Q. Why is that?

A. That's prior to atmospheric testing, nuclear testing.

Q. Nuclear testing that put tritium in the atmosphere in 1952?

A. Not only did it put tritium in the atmosphere, but the carbon 14 to 110 percent volume carbon. So after 1952, we actually had a higher level of carbon 14 than we had prior to

1952.

Q. Let me see if I understand this. If we have something, let's say water, that occurs in nature that's -- that was exposed to the atmosphere in 1952 or that was exposed -- that was exposed to the atmosphere, it will carry tritium and therefore tell us that it's 1952 or younger; is that correct?

A. It should.

Q. Okay.

A. It would be 100 percent modern carbon to begin with.

Q. Okay.

A. Now, that's as a surface water. Now it's going to infiltrate into the subsurface, and it is going to see carbon of different ages as it infiltrates to the groundwater system and then gets transported down into various aquifers.

That carbon age can be as old as 2,000 years. So it could start off actually before it gets to the aquifer at 2,000 years old. We're talking about the carbon age here. That's what we're modeling. We're not modeling the age of the groundwater itself. It is not part of the water. Only by dissolving.

Q. Okay. Let me give you a hypothetical. Let's say that there's a gallon of water that comes out of the Boise River in let's say 1860. 1860. 149 years ago.

THE HEARING OFFICER: That was a very good year.

Q. (BY MR. FEREDAY): Is it possible for that -- and let's say that that water is now present underneath Spring Valley 7 and is now pumped out of Spring Valley 7 well and you sample it, is it possible for that gallon of water to carry a carbon date of 2,000 years?

A. Yes, it is quite a possibility. The current ages that we've established for infiltration of water through modern carbon sediments ranges all the way from 74 percent modern carbon to 100 percent modern carbon.

Q. Mr. Glanzman, have you done age dating studies of groundwater in your career?

A. A lot of it, yes, I have. As a matter of fact, we actually did -- Ed Squires and I did do some age dating on the Goddard 2 well, which John Hutchings also did, and came up with similar results for the age of the carbon.

Q. And that age was --

A. About less than --
Q. -- if you --
A. Less than 2,000 years.
Q. And look back at table 5. If we look at table 5, I see Goddard No. 2 is the third entry there.
Is that the same well?
A. That is the same well.
Q. And while we're here, is TVHP-1 the State and Linder well that we discussed earlier in this hearing, the TVHP-1 well? Excuse me. Not State and Linder. State Street well. Excuse me. The State Street well, the TVHP-1, or do you know?
A. HP is one of the wells.
Q. Okay. And is HP in the Pierce Gulch Sand Aquifer?
A. It is.
Q. And the Goddard 2?
A. Goddard 2.
Q. Do you know whether the two Meridian wells are?
A. I would direct that question to Ed Squires.
Q. Okay. All right. But these -- but let's just take HP, for example.

Best estimate, less than 3,000 years or zero to 3,000, meaning it could be anything prior to 1952 but up to 3,000 years in residence; is that correct?
A. We don't know where it is in there, yes.
Q. Okay.
A. And that's the age of the carbon.
Q. Yes.
A. Where this is not the age of the groundwater. We have to make that distinction, particularly when we're in such a complex basin as we have here in the Boise Valley.
Q. Okay.
A. The other thing that I think that the report could have considered --
Q. Is this the Hutchings/Petrich report?
A. Yes, the Hutchings.
-- was that in thermal springs up in the north there of what we've been considering the area we've been working in, the thermal springs have an age of about 20,000 years. We have about a 10 percent, 15 percent, something else in the Pierce Gulch Aquifer.
Well, it could have been -- I'm not

saying -- I just have not analyzed it. But if you took only 10 percent thermal spring water and added it to the Boise River, you would have had an age starting out at 2,000 years.
So there are a lot of variables when we're trying to describe what the age of the groundwater is. We have a very good definition of the age -- different ways of measuring age less than 50 years. But when we get up to a thousand and certainly 5,000 years, it's -- that range from 50 years to 5,000 is really -- we don't have anything that really is all that good.
Q. With regard to the Hutchings and Petrich report at page 58, this is again Exhibit 33G, in paragraph 5 near the bottom of that page they discuss residence times of Treasure Valley groundwater and note in that paragraph the following: And I'll quote from it. "The youngest waters entered the subsurface a few thousand years ago and are found along the northeastern boundary basin."
Do you believe that based on what you've told us about the statement in Hutchings and Petrich itself on page 55, practical limits of age dating are 5,000 to 30,000 years, and based on

the chart that that statement on page 58 is -- is correct?
A. He's talking about -- actually talking literally about the residence time of the carbon, not the age of the groundwaters. The cold springs, the maximum age we've seen on the cold springs is about a thousand years, less than a thousand years.
So cold springs on the margin of the valley, about a thousand years. But between a thousand and certainly, as he says, between -- between about 50-some years and 5,000 years, we don't know. And it is carbon that we're dating. It isn't the groundwater.
Q. So I take it you disagree, then, with the statement that the youngest waters entered the subsurface a few thousand years ago.
Wouldn't it be more accurate to say that we don't know?
A. We don't know.
Q. Let's go to the next slide. Or maybe back to the first one. You -- I think we started here, and I don't think I let you get quite through that before I started peppering you with questions.

Is there anything else on this slide you'd like to point out?
A. No, I think we've fairly well covered everything that's on that slide.
Q. And on that I see you say carbon 14 dating is indeterminate at less than 5,000 years?
A. Yes, just repeating what is in their report.
Q. Okay. What about your statement at the bottom that residence time of the groundwater from the M3 wells is best estimated by hydraulics, what do you mean by that?
A. Since the groundwater chemistry is not determinate, then we have to use the hydraulics alone to tell us about what that flux looks like and then about the transport time from possible recharge to our location at M3. And that would be far more accurate than anything we've done.
Q. Okay. Continuing here, perhaps to the next slide that you have, did you recall reading in the staff memo their suggestion that additional isotope studies might be appropriate for the Pierce Gulch Sand Aquifer?
A. Yes, I did.
Q. Are you familiar with the various

isotope studies that can be done in groundwater, including those that relate to age dating?
A. I am very familiar with it, and we do generally as a geochemist differentiate isotopes from age dating. If we're talking about age dating, we're involving isotopes, but isotopes were usually referring to stable isotopes.
Q. And what are stable isotopes?
A. They do not decay with time. And particularly when we look at stable isotopes that are important, we want stable isotopes that form water molecules themselves. The deuterium and oxygen-18 isotopes are two of those stable isotopes that we use as -- because they are a part of the water molecule.
Now we're not talking about something that is dissolved in the water-like carbon. We're talking about something that is actually the water molecules themselves.
Q. So can you use deuterium and oxygen-18 to date water?
A. We have for over 40 years. There's a great deal of experience and case studies involving the use of deuterium and oxygen-18 to differentiate sources and mixing of groundwaters,

and I've done both.
Q. Have you done any stable isotope evaluations here in the Treasure Valley?
A. We did -- we initially did not do it because we thought that the young age of the groundwater in the Pierce Gulch and the agreement with the physical settings and particularly the major ion chemistry was definitive enough. It was telling us sufficient amount of information. We didn't need anything else.
But we went ahead and analyzed several of the groundwaters -- the M3 test well No. 1, test well No. 2, test well No. 3 -- and sampled them for both deuterium and oxygen-18 stable isotopes.
Q. And what was the result of that evaluation?
A. Shown on that present slide is deuterium ranges from minus 124 to minus 126 per mil.
Q. And per mil means per thousand?
A. Per thousand. Oxygen-18 -- a standard unit for stable isotopes.
Oxygen-18 ranges from minus 15.9 to minus 16.1. That groundwater hasn't been exposed

to irrigation, or the oxygen-18 isotope range would have been quite broader than that. This is another indication.
Wood and Low, when they looked at the Boise River at Eckert Road, showed that the Boise River has a deuterium stable isotope value of minus 125 per mil, right in the middle of our range.
Again, additional information that indicates that this water in the Pierce Gulch Aquifer came from the Boise River.
Q. But what does it tell us about the -- about when it came from the Boise River?
A. It doesn't tell us anything about that. It just tells us that was its source.
Q. And why doesn't it tell us anything about age?
A. It doesn't decay. It has no age relationship. Deuterium, when it hits the surface and infiltrates, doesn't change. It's a packet of water that has that same deuterium value as it migrates, as far as it migrates, unless it mixes with another groundwater.
In this case, clearly the wells that were sampled up there, it has mixed with no

groundwaters. Not only that, it hasn't been exposed to any irrigation water, which would have altered -- significantly altered the oxygen.

Q. So is it a fact that stable isotope testing can be used to determine source but not age, as the staff has suggested?

A. That's exactly the case.

Q. What would additional isotope studies of the PGSA deliver to the Department or to the public with regard to understanding more about the Pierce Gulch Sand Aquifer, in your opinion?

A. May I reinterpret the question a bit?

Q. Yes.

A. I'm going to use the staff's use of isotopes.

It would further age dating of samples, provide additional information that would be useful for this part of the Boise Basin that we're discussing today, the M3 in particular.

Q. Right.

A. Would it alter anything that we've discussed? No. There would be nothing added by additional work on age dating.

The next slide will answer your question on, I think, the deuterium level.

Q. Okay.

A. We took a look at what the range of the deuterium and oxygen values were for the Boise River, Payette River, and the Snake River at King Hill versus the Snake River at Weiser. That's what we usually do to kind of get a feel for should we do some deuterium or oxygen values, and what information would that provide us.

We look at that range, the deuterium ranges only from minus 133 to minus 125 per mil. That is a very, very small deuterium range to do anything on source or mixing.

The next one on the oxygen was even more surprising. It's only 1.1 per mil difference with the oxygen-18 isotopes, minimal evaporation.

Now, this is not to say that we didn't -- if we went out and picked up groundwater from -- that had been infiltration from irrigation, the oxygen-18 isotope would clearly indicate a difference. Okay?

That's not what we're involved with here at M3, however. So additional stable isotope work applied to anything that we're doing here would have no use. It would apply -- it would give us no additional information that would be of

any use to us.

Q. So would the geochemistry studies recommended by the staff in their Exhibit 50 reduce uncertainty, as they suggest in that memo?

A. I do not see how.

Q. Does any line of geochemical evidence, Mr. Glanzman, contradict what Hydro Logic has explained in their reports and through Mr. Squires' testimony with regard to the -- let's just tick them off -- the transmissivity of the Pierce Gulch Sand Aquifer?

A. No.

Q. What about its extensiveness regionally?

A. No.

Q. What about its productivity --

A. Not --

Q. -- is there anything that you see in geochemistry?

A. No.

Q. What about the question of faulting creating boundaries or compartments in any part of this aquifer?

A. Not in the Pierce Gulch Sand Aquifer.

MR. FEREDAY: Okay. That's all the

questions we have.

THE HEARING OFFICER: Okay. Thank you.

Mr. Thornton?

MR. THORNTON: Okay. Just a minute to formulate.

THE HEARING OFFICER: Sure. Do you want to go off the record?

MR. THORNTON: Yeah, please.

THE HEARING OFFICER: Let's take a rest.

(Recess.)

THE HEARING OFFICER: We are recording again.

Cross-examination, Mr. Thornton.

MR. THORNTON: Okay.

CROSS-EXAMINATION

BY MR. THORNTON:

Q. Mr. Glanzman, if you could refer to Exhibit 32I. I think you've -- if you could refer to that.

A. Yes, sir.

Q. 32I.

A. Uh-huh. Yes, sir. What part?

Q. It would be the last --

A. What page?

Q. Yeah. Actually, I've got a couple questions before that. So sorry. I apologize for that.
A. Okay.
Q. But on 32I, not the last page, do you agree that that reflects accurately your background and your expertise relating to the matter before this hearing?
A. I believe so.
Q. Okay. And then are you licensed to practice geology in the state of Idaho?
A. Not in the state of Idaho. I am in Wisconsin and in Wyoming.
Q. Okay. And then if you could refer to Exhibit 32I, beginning on the last page.
A. Water Budget for the Treasure Valley Aquifer System.
Q. Yeah. This one, 32I, I believe it is -- you just had it in your hands. It is titled "Richard Glanzman, Geochemist."
Do I have that right?
A. Yes, sir. Last page --
Q. And on that -- underneath -- yeah, last page, at the top. And it states, "Pierce Gulch Sand Aquifer."

A. Yes.
Q. And that statement says, "Groundwater chemistry indicates that the Pierce Gulch Sand Aquifer is a discrete aquifer recharged from the Boise River with no apparent hydraulic connection with other aquifers."
And the question I have is, are you implying in that statement that there's no hydraulic connection existing between the Pierce Gulch Sand Aquifer and any other shallower aquifers above it?
A. This is referring to the aquifer study and the wells studied in the M3 area. It does indicate that's what it means.
Q. And so are you stating that there's no other connection with any other aquifers above, shallower aquifers above?
A. That's what I'm saying.
Q. Okay. And then that paragraph states that "The Pierce Gulch Sand Aquifer is recharged from the Boise River," implying no other sources of recharge; is that correct?
A. I believe I said that there was a 10 to 15 percent difference that looked like it could be precipitation. And we don't know what that is

specifically. But 95 -- 85 to 90-plus percent is Boise River.
Q. Okay. And I think I just heard you say now, plus you stated earlier, that precipitation may have a small percentage, 5, 10 percent?
A. Yes.
Q. Okay. And does that imply that that precipitation is infiltrating down through the ground when it hits into the aquifer or through some other mechanism?
A. It's part of the recharge. It couldn't have been exposed to any evaporative process. So it's definitely not part of the irrigation, nor has it been exposed to evaporative processes, evapotranspiration. So it's just part of the recharge right now. It's undefined what that small percentage is. It looks like it could be precipitation. As I also testified, it could be water from the thermal springs, which would give us that carbon date that we were looking at.
Q. Okay. So could you describe to me the method that you think the precipitation which is the Pierce Gulch Sand Aquifer, how would that happen?

A. If -- I don't know what the hydrologic history of the Boise River has been. I've used the average Boise River water chemistry. It could very well have a distribution that is very similar to what we see in the Pierce Gulch Aquifer.
So when I'm saying I have used the point for the average Boise River, I don't know what the whole distribution was over the period of time that that recharge occurred in the past. So I -- I don't really know that that isn't all Boise River water.
Q. So if you could help me understand, the precipitation that you were talking about that is potentially a small portion of the recharge, is that precipitation that we see on an average annual basis, or are you talking hundreds, thousands of years ago?
A. We're not talking about precipitation. I'm talking about component of recharge to the Pierce Gulch that is not defined, but at the very simplistic approach that I have used with the trilinear diagrams, I only have two end members. I could have added the thermal springs groundwater as well, and I could have used all the Boise River water chemistry I could get my hands on to see

what its distribution would be, and if that didn't encompass all the rest of this, so there really wasn't anything other than the Boise River. So at this point, that small percentage did not disturb me.

Q. Okay. Question again, and hopefully it's not too redundant. I believe I heard you say that precipitation may be a small portion of recharge to the Pierce Gulch Sand Aquifer; is that correct?

A. We clearly showed that to the -- for test well 2, that there was a small percentage of recharge where the Pierce Gulch Sand Aquifer comes near the surface, yes.

Q. So in your opinion, is that the only place that precipitation could access the Pierce Gulch Sand Aquifer in that area, that test well?

A. Let me be redundant again. We have a distribution based on two end members, which are averages. I don't know what the difference is. It could be all Boise River. It could be thermal springs water. It could be precipitation. Right now that is undefined, but it's only 10, 15 percent of the difference, and it's consistent.

Q. Okay. And then earlier Mr. Squires

has postulated that in some areas the Pierce Gulch Sand Aquifer may come into direct contact with the gravels of the Boise River.

Would that be considered a hydraulic connection with other aquifers?

A. The actual act that there's a sedimentation feature?

Q. I would say it's based on the exchange of water from the river to the gravels of the Boise River to the Pierce Gulch.

A. Could you rephrase? I --

Q. And I will try to do that.

A. Thank you.

Q. Mr. Squires has postulated that in some areas of Pierce Gulch Sand Aquifer, I believe he's referring to the Capitol Bridge area in general -- I may not have that correct -- that the Pierce Gulch may be recharged from that section of the river commonly, I think, referred to as the gravels of the Boise River.

And then does that not constitute a hydraulic connection with another aquifer?

A. Because it's in contact with the Boise River gravels?

Q. Yeah.

A. I wouldn't consider the Boise River gravels as being separable from the Boise River itself.

Q. Okay. So Mr. Squires has further postulated that the Pierce Gulch Sand Aquifer is reasonably unconfined in the eastern and northern portions.

Would that imply the Pierce Gulch Sand Aquifer does not actually communicate or have some hydraulic connection with those other aquifers?

A. I don't truly understand the connection.

Q. Okay. So if you go back to Exhibit 32I, trying to help clarify my question, on the last page.

A. Yes.

Q. Again, the statement that says, "Groundwater chemistry indicates that the Pierce Gulch Sand Aquifer is a discrete aquifer recharged from the Boise River with no apparent hydraulic connection with other aquifers." Okay.

A. Okay.

Q. And then the question that I have is Mr. Squires is talking about the Pierce Gulch Aquifer in the upper portion, eastern and northern

portion, is reasonably unconfined with a potential for exchange with those other aquifers. But I hear you saying it's not. So I'm confused with regard to that.

MR. FEREDAY: I'll object there, Mr. Hearing Officer. I don't think that the testimony of Mr. Squires was to that effect. But if this is -- if there's a good-faith basis for that question, perhaps we can continue.

MR. THORNTON: I can withdraw that question, if that helps, and try another way.

THE HEARING OFFICER: Let's try.

MR. THORNTON: Okay.

Q. So what area is the Boise River recharged -- is the Pierce Gulch Sand Aquifer recharged? Can you show me on a map?

A. No, I cannot. That was outside the real area of our interest, the M3.

Q. Okay.

A. Part of it was in the M3 area, probably in the Pierce Gulch, down there near the Goddard 2. I mean but obviously there's recharge above that. So the recharge is not a point; it's an area.

Q. And the area for you would be what?

A. Above the M3 area. It's east of the area.
Q. And above the M3 area, is there not shallow aquifers, deep regional aquifer, Pierce Gulch Sand Aquifer going up there, irrigation canals? Is there not the potential for lots of recharge sources to the Pierce Gulch?
A. Those recharge losses are certainly 90-plus percent, probably, Boise River connected, yes.
Q. So you're saying that there's not much recharge? I didn't quite understand your answer. I'm sorry.
A. No. If I'm following your question, I believe, which was the water sources above -- east of the M3 area outside the area that we studied, did those represent a recharge area.
And I answered that it is a recharge area up there, Boise River recharge area.
Q. Okay. If we could go, I believe, to your PowerPoint presentation. I'm not sure what exhibit that number was. If you'll put that in front of you.
A. Yes, I have it.
THE HEARING OFFICER: I don't know that

it's been marked.
MR. THORNTON: Okay.
MR. FEREDAY: And, Mr. Hearing Officer, we'd be happy to mark and offer that if that would help.
Would that fine with you?
MR. THORNTON: For me, I think it's appropriate.
MR. FEREDAY: Why don't we mark this, then. I frankly had intended to do that.
The next number is?
MR. LAWRENCE: 71.
MR. FEREDAY: 71.
(Exhibit 71 marked.)
MR. FEREDAY: We would offer it as Exhibit 71.
THE HEARING OFFICER: Mr. Thornton, any objection?
MR. THORNTON: No.
THE HEARING OFFICER: Mr. Smith?
MR. ALAN SMITH: No objection.
THE HEARING OFFICER: Mr. Edwards?
MR. EDWARDS: No objection.
THE HEARING OFFICER: Before I bring this into the record, I note that there are a number of

sheets on the back end I thought that we did not discuss.
MR. FEREDAY: Correct.
THE HEARING OFFICER: And I'm wondering if those have some additional value, whether they ought to be detached since they were not presented.
THE WITNESS: The entire thing that's presented here, other than the responses to the staff, are a synopsis of what's in the original report. The slides that are in the ending of that are actually figures from that report. The only thing they may do is show the -- you can see down there there are figure numbers for each of them that came from the report. So there are no new information, if that helps. I mean they can be taken off without any loss.
THE HEARING OFFICER: I didn't look carefully at the Piper diagram to see what was represented there. Some of the headings are actually duplicates, I think, of what's contained in the earlier pages. But perhaps what's depicted or drawn or labeled there is different. I don't know.
So what's your preference,

Mr. Fereday?
MR. FEREDAY: Well, my preference would just be to leave them in, with Mr. Glanzman's explanation that they are just simply further information taken directly from the report. They're duplicates of what are in the report.
THE HEARING OFFICER: Okay.
MR. FEREDAY: And I think his intention was to refer to them if questions came up, and perhaps they will, that those would be relevant to answering.
THE WITNESS: What wells are these points on those trilinears, that's why it's in there, for that purpose only.
THE HEARING OFFICER: Okay. The document labeled as Applicant's Exhibit 71 is received into evidence.
(Exhibit 71 admitted.)
MR. OWSLEY: We have not seen the stable isotope data before.
THE WITNESS: That's response to that comment. I said that was --
THE HEARING OFFICER: Okay. Let's go off the record. Let's go off the record.
(Discussion.)

THE HEARING OFFICER: We're recording again.

Mr. Thornton.

Q. (BY MR. THORNTON): If you go to, I guess, slide No. 5 or page 5.

A. Okay. Total dissolved solids.

Q. Yes. And I believe you were stating one of the important parameters you were looking at for differences or similarities in groundwater was the use of total dissolved solids; is that right?

A. It's the most basic measurement that we geochemists look at, yes.

Q. Okay. And then on this page 5 you have a listing of five different aquifers, or at least areas -- I'm not sure if the Emmett area represents an aquifer, a particular one or not; is that correct?

A. It is the Emmett well area, yeah, that's what we're calling it.

Q. Okay. And then you have what appears to be a simple arithmetic average --

A. It is the arithmetic average.

Q. -- and then a range?

Okay. And did you do any assessment

as to why that range is so much in terms of the PGSA, as an example?

A. No, I did not, because the major ion chemistry isn't changing.

Q. Okay. And then when you look at, as an example, the Emmett one, the -- the range 203 to -- and then I should ask, it says 340 there, but if you go to -- probably a typo. But if you go to page 19, it says "385" and not "340." I'm not sure which one that is. It's probably one of the two.

A. I didn't get that corrected. The 385 is correct.

Q. 385 is correct?

A. Yes, it is.

Q. The 385 is the correct one?

A. Yes, it is.

Q. Okay.

A. I'll have to check again, but I believe it is.

Q. Okay. And then the range of data for the Emmett for TDS, 203 to 385, completely falls within the range of the Pierce Gulch Sand Aquifer; is that correct?

A. Yes.

Q. Is that correct?

A. Yes, it appears to.

Q. And then on your trilinear plots on -- maybe just let's just go to page 6, the very next one. And I realize that this is a mixture of all of those areas where you did geochemistry. What I don't notice is any statistics in terms of significance of the spread of data there, and some areas obviously -- well, do you have any statistical information for significance of the spread of that data?

A. What statistical measure would you consider significant?

Q. Well, yeah. And I would be looking at anything that if you could put error bands around in there or some kind of confidence intervals or brackets to find out how different is the Boise River, say, compared to the Pierce Gulch Sand Aquifer? Long question. I apologize. What I'm trying to understand is, I see a mass of data, but that doesn't tell me, the layperson, if that's significant or not.

That -- is that so close that they're all the same, or is there anything that says, "Whoa" -- if you were to say "Whoa, there's quite

a bit of difference here"?

A. Are you talking about the cluster of the Pierce Gulch Sand Aquifer?

Q. Well -- and I apologize for walking on your -- in the case of page -- on page 6, on the top diamond, you have -- center to that is the Boise River, and then you have a number of other plots where I can look at a scattering of data, some appears to be very tight, and some is -- looks like outliers. What I'm not understanding is how significant is that cluster.

Is that telling me that within a 95 percent confidence interval they are all the same, or -- you have such a large range. I don't know if this is good data, bad data, or not.

A. No, it's excellent data. Okay? The data quality is very good.

Q. Okay.

A. It's clearly within a 5 percent error margin of mass balance.

Q. Okay.

A. So the data is good. The distribution here is what I referred to earlier as a complex distribution.

Q. Right.

A. It's spread all over. Okay? It appears very complex. We -- it would be difficult to -- I don't know what statistical measure that you would like, other than perhaps the average value for each of these components, plus or minus a standard deviation. I have those.
Q. Okay. And do you have those so that I could look at --
A. I could get them.
Q. -- whether it's one or two standard deviation?
A. I would.
Q. Yeah, maybe --
THE HEARING OFFICER: Okay.
MR. THORNTON: I'm sorry.
THE HEARING OFFICER: Gents, you're stepping on each other.
MR. THORNTON: I apologize.
THE HEARING OFFICER: It's becoming a conversation.
MR. THORNTON: Okay.
THE WITNESS: I apologize.
MR. THORNTON: And I do too.
THE HEARING OFFICER: Go ahead.
Q. (BY MR. THORNTON): Yeah, I would be

interested to see what that data is at one standard deviation or two, especially when we're looking at Pierce Gulch sand data.
A. Is there any parameter that you have of interest?
Q. Let's just go with total dissolved solids.
A. Well, total dissolved solids range has a standard deviation 191, plus or minus 63, coefficient of variance, .329.
Q. Okay.
A. Pretty respectable.
Q. And the coefficient of variance was what, point --
A. .329.
Q. .329. And you're considering that good?
A. It's not bad.
MR. THORNTON: And I guess, Mr. Hearing Officer, a question to you, if I may. I just wondered, is that something we can view other than just hearing, to look at, or not? I mean I hear that, but I don't see it.
THE HEARING OFFICER: You can ask for the details of that information.

MR. THORNTON: Okay.
Q. Is it possible to get the details of that information for your statistical analysis?
A. I got it right here.
MR. FEREDAY: Yeah.
Q. (BY MR. FEREDAY): Not to review this second, because it would take time, but potentially could refer to it later. I mean I don't want to take the time to review it this second, but I would like to review it over this evening.
THE HEARING OFFICER: All right. Let's go off the record a minute.
(Recess.)
THE HEARING OFFICER: We're recording again after a recess where we discussed possible statistical analyses of the geochemical information and testimony that Mr. -- or Mr. Glanzman has presented.
And after listening, the Hearing Officer would invite Mr. Glanzman to provide to the protestants any existing statistical analysis that he's done related to the geochemical data information that he has that's existing that you have in your possession. And if you can provide

that to the protestants after we finish here, and if there's a need for the Department to copy some of that, we can do that. So I'd invite that exchange and submittal.
And then, Mr. Thornton, you'll have tonight to look at that information and ask any questions you may wish of Mr. Glanzman tomorrow morning when we convene.
MR. THORNTON: Yes.
THE HEARING OFFICER: Fair enough? Is that fair, Mr. Fereday?
MR. FEREDAY: That's acceptable.
THE HEARING OFFICER: Okay. All right. And as a result of that, then, we'll defer any questioning on statistics until tomorrow morning.
MR. THORNTON: Yes, that's fine.
THE HEARING OFFICER: Okay. Thank you. You may ask further questions.
MR. THORNTON: Okay.
Q. On page 22 of the Exhibit 71, your slide presentation.
A. Yes, sir.
Q. And this was a table, I believe, extracted from the Treasure Valley Hydrologic Project; is that correct?

A. Yes.
THE HEARING OFFICER: Which sheet is it? I'm sorry, Mr. Thornton.
MR. THORNTON: I was on page 22, Exhibit 71.
THE HEARING OFFICER: Okay. Thank you.
Q. (BY MR. THORNTON): And what in the -- currently or in the recent past, what are the standard methods for dating water?
A. Netpath has six, N-e-t-p-a-t-h. It is free software from the USGS. It is what the USGS uses regarding 14 dating purposes. And most everyone who does any dating uses that method.
In addition to that, however, Mr. Hutchings -- or Jan Hutchings, also he had -- he used -- he used six methods, of which he indicates three of those methods are the same methods that are in Netpath from the 1970s and 1980s. Others are excerpts and additions that he has to those dating methods.
So overall there are six well-known to everyone as far as Netpath is concerned that you can enter your data in there, and they ask a bunch of questions. But there are also default values, but that's what most people use.

Q. And then what data do you have to determine the age of the water in the Pierce Gulch Sand Aquifer? What did you use?
A. I used some carbon 14 and carbon 13 data that was generated by another study.
Q. And where was that study?
A. It included Goddard 2 in the Boise Basin.
Q. And is Goddard 2, could you -- I just want to -- I'm trying to -- I see a Goddard 1 here. I'm trying to find out if Goddard 2 is in the Pierce Gulch Sand Aquifer.
A. Oh, yes, it is.
Q. It what?
A. Yes, it is. Goddard 2 is completed in the Pierce Gulch.
Q. And what do you know about the construction of the well for Goddard 2?
A. You're asking the wrong person. I'm a geochemist.
Q. Okay. So you're saying you don't have an idea if that well was constructed to either State standards or to other --
A. You'd have to direct that question to Ed Squires.

Q. Okay. And then so you have -- and where, in general, is Goddard 2 located at in terms of --
A. You can see it on the map --
Q. Yeah, that would be great.
A. -- if you wanted to.
THE HEARING OFFICER: Okay. Again, Mr. Glanzman, you need to wait until Mr. Thornton finishes his question.
And, Mr. Thornton, you need to wait until he finishes his answer.
MR. THORNTON: Yes. Thank you.
THE HEARING OFFICER: Thank you.
MR. THORNTON: We do good in a pub.
THE WITNESS: Yeah, we would. Where is the beer?
Q. (BY MR. THORNTON): Yeah. On page 12 -- and I don't know if this helps -- I see -- page 12, the bottom right-hand corner, I see a United Water Idaho Goddard --
A. Yes.
Q. -- but I don't know if that's the one you're referring to.
A. Goddard 1 and 2 are close enough together that I think that would suffice.

Q. Okay. And that area there is the one area you have for dating water that would be in the Pierce Gulch Sand Aquifer; is that correct?
A. That's right.
Q. Okay. And what was the age or range of age that you had for that water out of the Goddard well?
MR. FEREDAY: Objection. Asked and answered.
THE HEARING OFFICER: Overruled.
THE WITNESS: The age that I generated off of Goddard 2 is almost exactly the same as what Jan Hutchings estimated for Goddard 2. In other words, he said zero. What he really means is when you add ages that were calculated that are in the future, they're negative numbers. I had the same problem with Goddard 2 groundwater. The carbon date for that age is indiscriminate.
Q. (BY MR. THORNTON): So when you say "indiscriminate," does that mean that you can't put a bracket around it? Is it 50 years, a hundred years, or --
A. Jan Hutchings put a bracket around the carbon 14 date of less than 2,000 years. Zero as a minimum and 2,000 as his estimate of maximum.

Q. And do you have any better data than that, than what is portrayed in that report?
A. No.
Q. Okay. Earlier in your testimony you had talked about, I guess, the length of time that water chemistry would change when it's in an aquifer; is that correct?
A. I don't believe I talked about the length of time that it was in the aquifer. I think it --
Q. I -- I'm sorry. I believe you stated that any length of time of water in an aquifer, the water chemistry changes. That's what I wrote down.
A. Normally as the groundwater trans- -- is transporting through the aquifer, moving through the aquifer, it is exposed to more of the mineralogy for a longer period of time, it can change. But the time, however, is not the issue per se. It's the mineralogy of that aquifer.
Q. Uh-huh. And does the mineralogy of that aquifer require time to change?
A. The mineralogy of the aquifer does not change.
Q. Over time does the mineralogy of an

aquifer change?
A. Over millions of years.
Q. Millions of years. And I believe you also testified that the aquifer -- Pierce Gulch Sand Aquifer movement was -- I have written down here, was rapid.
Do you remember testifying to that, using the term "rapid"?
A. Rapid in the context of groundwater velocity, I believe that, yes.
Q. What information do you have to describe what "rapid" is?
A. I think Ed Squires was talking about a flux and a time of transport between -- a potential time of groundwater flux from its recharge source to the M3 area of about 100 years. To me, that's very rapid.
Q. Okay. So long enough that we wouldn't be able to pick up any tritium in there; is that correct?
A. A hundred years, yes.
Q. Okay. In terms of geochemistry for the Pierce Gulch Sand Aquifer, I believe you were connecting that to the Boise River recharge in that; is that correct?

A. Yes.
Q. Do you have any information in terms of the difference that might occur, or is there any difference in the geochemistry to the Boise River versus what may come off of the Boise front, some of the drainages coming off the Boise front?
A. We've looked at the cold springs and the thermal springs. There is some differences in the Boise River water. I have no other data on the tributary streams.
Q. Such as like Dry Creek coming off the of the Boise front?
A. There is no -- I don't have any data for that.
Q. Okay. Do you know if there would be much of a difference in groundwater chemistry in the Pierce Gulch Sand Aquifer, whether it was in the Eagle area versus if there was Pierce Gulch Sands Aquifer in the Emmett area? Do you have data on Pierce Gulch Sand Aquifer -- I'll ask the question differently. I apologize.
Do you have information on the Pierce Gulch Sand Aquifer in the Payette Valley?
A. No, we do not.
Q. Do you have any information that would

tell you that there would definitely be a difference in groundwater chemistry at the same elevations as, say, Pierce Gulch Sand Aquifer if it was recharged by the Boise River versus the Payette River?
A. As I indicated, I don't have water -- surface water chemistry for the Payette River, so I would have to say I don't know.
Q. And is surface water chemistry typically indicative of the type of landscape geology, lithology that it's flowing through?
A. Typically, yes.
THE HEARING OFFICER: Your answer?
THE WITNESS: Typically, yes.
Q. (BY MR. THORNTON): Okay. And are you familiar with the geology and lithology of the Payette River versus -- watershed sub-basin versus the Boise River sub-basin?
A. Not if and when and where to answer any questions.
Q. Okay. So do you have any way to differentiate between recharge from the Boise River to the Pierce Gulch Sand Aquifer versus recharge from irrigation using Boise River water?
A. Yes.

Q. And how do you do that?
A. I testified the oxygen-18 values clearly indicate no irrigation input. Nitrate values clearly indicate no irrigation input. Both those I testified to.
Q. And yet the recharge area, I believe you said, is an area from the Boise River.
Would that not have to go through the topsoil, the upper organic layer of gravels and cobbles to get down to the Pierce Gulch Sand Aquifer?
A. We were talking about irrigation.
Q. Right.
A. Surface water flowing down the Boise River is not irrigated.
Q. So can you describe to me how the water chemistry would change coming out of an irrigated field or out of an irrigation ditch versus coming out of the Boise River still going through that organic-rich top layer of valley fill.
A. The Spring Valley Ranch is clearly indicative of what near-surface changes from irrigation can show in major ion chemistry.
Q. Okay. On your -- looking at

geochemistry and looking at the whatever six or eight wells or whatever that you did -- I mean the sample for the geochemistry located northwest of the M3 site, I think there's about six or seven northwest of the M3 site. I'm referring, I think, to one of -- your figure 1 on your Glanzman/Squires 2009. Maybe we can go to that document. Let me find that.
THE HEARING OFFICER: Do we need to go to an exhibit, Mr. Thornton?
Q. (BY MR. THORNTON): And actually, I think we could probably go to your --
MR. FEREDAY: Exhibit 71, page 12.
MR. THORNTON: Yeah, Exhibit 71 -- thank you -- page 5 -- or what was that page, Jeff?
MR. FEREDAY: 12.
MR. THORNTON: 12.
Q. So on that exhibit --
THE HEARING OFFICER: Just a minute.
Q. (BY MR. THORNTON): This is on your slide show presentation.
THE HEARING OFFICER: This is 71, then, not --
MR. FEREDAY: 71.
MR. THORNTON: I have 71.

THE HEARING OFFICER: Okay. I thought somebody had referred to 75. Or did I miss -- okay.
MR. THORNTON: I potentially may have misspoke.
THE HEARING OFFICER: So we're looking at 71?
MR. THORNTON: Yes, 71, and page 12.
Q. And that describes the location of your geochemistry studies, location of the wells; correct?
A. It does.
Q. And how many wells were northwest of the M3 property?
A. There appears to be about nine.
Q. Okay. And out of that, I believe some of those, would you agree, were in the so-called Willow Creek Aquifer?
A. One is.
Q. Okay. And how many of those northwest of the M3 property are in the Pierce Gulch Sand Aquifer?
MR. FEREDAY: I believe this question's been asked and answered. He testified that the Lynn wells and the SVR-6 and 10 wells are in

Willow Creek, but the others are in the Payette.
Q. (BY MR. THORNTON): And are they in the Pierce Gulch Sand Aquifer?
THE HEARING OFFICER: Now, just a minute.
MR. THORNTON: I'm sorry.
THE HEARING OFFICER: Just a minute. We had an objection. And I need to rule on that --
MR. THORNTON: Okay.
THE HEARING OFFICER: -- and then we go on. So I --
Mr. Fereday, I understood his question to be different than what you were objecting to. I understood him to be asking -- Mr. Thornton to be asking about wells to the west of the M3 property within the Pierce Gulch Sand Aquifer.
Wasn't that the nature of your question?
MR. THORNTON: Correct. That's what I tried to ask.
THE HEARING OFFICER: So as a result of that, I'll overrule the objection.
And ask the question again, would you please, Mr. Thornton.
MR. THORNTON: Okay.
Q. In areas northwest of the M3 area, is

there any geochemistry data collected in the Pierce Gulch Sand Aquifer?
A. No.
Q. And then the geochemistry work and analysis that you did, did that add any additional information, in your opinion, to the hypothesis that the Pierce Gulch Sand Aquifer continues from the M3 Eagle area to the Payette River Valley?
A. There is no information that we have that would suggest that the groundwater in the Pierce Gulch Aquifer stops at the northwest boundary of M3 area. It is still moving.
Q. Okay. Do you have any information to show that it is connected to the Payette Valley?
A. We have no documentation that it is connected to the Payette Valley.
Q. And then has the geochemical analysis added any additional information to support the presumption of groundwater flow system from the Boise River drainage to the Payette River drainage, in general?
A. Yes. And I think we covered that in numerous cases.
Q. Could you describe to me, because I think I missed it, how it connects to the Payette

River drainage --
A. No. How it --
Q. -- based on geochemistry? Excuse me.
THE HEARING OFFICER: Okay. Where are we?
MR. THORNTON: Yeah. Good point. And I apologize.
THE HEARING OFFICER: Okay.
Q. (BY MR. THORNTON): Has the geochemical analysis added any additional information to substantiate flow from the Boise River Basin to the Payette River Basin?
A. Yes, in the -- from the standpoint of total dissolved solids and major ion chemistry, clearly indicating that there is no stagnant water here. There's no compartmentalization. There's no fault that would impede flow to at least the boundary of M3.
So the -- from a science standpoint, since it doesn't stop there, you would say that it moves on to wherever it's going to the north-northwest.
Q. And what evidence do you have to show that it goes to the north-northwest, based on geochemical analysis that you're testifying as an expert in?

MR. FEREDAY: Objection. Asked and answered.
THE HEARING OFFICER: Overruled.
THE WITNESS: I believe Ed Squires answered that by the gradients that he has shown.
Q. (BY MR. THORNTON): And I'm asking you in terms of geochemical analysis, do you have that data?
A. There's no chemistry beyond the boundary of M3.
THE HEARING OFFICER: Okay. Now, I think we've covered that subject sufficiently.
MR. THORNTON: Okay.
THE HEARING OFFICER: I don't want to go through it again.
MR. THORNTON: Last question.
THE HEARING OFFICER: Okay.
Q. (BY MR. THORNTON): And has the geochemical analysis that you have undertaken provided any additional information to support an analysis of impacts of water-level declines from full project development?
A. No.
MR. THORNTON: Okay. That's my last question.

THE HEARING OFFICER: Okay. It's ten minutes to 5:00. Do we want to start Mr. Smith's examination?
MR. FEREDAY: If there's any chance he can get it done, even if we have to go late, I think it would help, and just leave whatever we have with regard to the statistical issues in the morning.
THE HEARING OFFICER: How much do you have, Mr. Smith?
MR. ALAN SMITH: Probably about ten minutes.
THE HEARING OFFICER: Okay. Let's forge ahead.
MR. ALAN SMITH: Thank you.

CROSS-EXAMINATION

BY MR. ALAN SMITH:
Q. Mr. Glanzman, let's go to Exhibit 43, page 4. And the last paragraph, first sentence.
A. Yes.
Q. Do you have that?
A. Yes, I do.
Q. All right. Would you look at that first sentence in the last paragraph. And I think

it says in that sentence, "The average Boise River water chemistry indicates that the PGSA groundwater originated almost exclusively from ancestral Boise River surface water."

THE HEARING OFFICER: Okay. I'm in the wrong place, Mr. Smith.

Q. (BY MR. ALAN SMITH): Are you drawing a distinction between --

THE HEARING OFFICER: Mr. Smith. I'm in the wrong place again. I'm in 43 --

MR. ALAN SMITH: Okay. Exhibit 43.

THE HEARING OFFICER: Page 4.

MR. ALAN SMITH: Page 4. And it's the first sentence. I only quoted about the last half of it.

THE HEARING OFFICER: It's which sentence in which paragraph?

MR. ALAN SMITH: Third paragraph, starts out "The type clustering."

THE HEARING OFFICER: I see. Okay.

Q. (BY MR. ALAN SMITH): I just quoted the part here about "The average Boise River water chemistry indicates that the PGSA groundwater originated almost exclusively from ancestral Boise River surface water."

Are you drawing a distinction between "ancestral" and "geologically ancestral"?

A. No, it's between ancestral and modern.

Q. Ancestral and what?

A. Modern.

Q. Modern. All right. If it's ancestral Boise River surface water that originates almost exclusively, doesn't that indicate that the recharge is occurring over a long period of time ago?

A. No. It has no time inclination, other than it's not modern.

Q. Okay. Let's go to page 5 of that same exhibit, 43.

A. Yes, sir.

Q. And the third paragraph, the first sentence there says, "In summary, the aqueous geochemistry analytical results indicate that the PGSA is a distinct regional aquifer containing groundwater originating from the geologically ancestral Boise River."

Does "geologically ancestral" mean something different than "ancestral," is what I'm trying to find out?

A. It is a good question. And it could

be -- it is a fair question. That was -- geologically, I usually use, when I'm trying to say it has been suggested to be more than a thousand years old.

Q. Okay. Let's go to the -- on that same page, the last sentence in the last paragraph also mentions "geologically ancestral Boise River water in the Terteling Springs formation."

So does that indicate that you're talking about water that's thousands of years old?

A. No. I was indicating that I don't have a specific age, but it has been suggested elsewhere that it's maybe as much as a thousand years old.

Q. But you draw a distinction between carbon dating that I believe Petrich did and water dating, they're not the same?

A. No, they are not the same.

Q. So when Petrich is talking about -- I believe he -- I believe he said "contemporary seepage from river and irrigation diversions is not the primary source of recharge for most of the deeper regional aquifers" -- that's Petrich 2002 at page 58, I have.

But when he's talking about

"contemporary water," what does that mean? Modern water?

MR. FEREDAY: Objection. I don't think that the witness has been directed to an exhibit where that language appears.

THE HEARING OFFICER: I agree. I don't know where to look either, Mr. Smith.

MR. ALAN SMITH: I don't believe I have the exhibit. I have the quote, and I think it may -- it may be from the staff memo.

THE WITNESS: No. It's in the Petrich report page 58, it's item 6, "Temporary seepage from rivers and/or irrigation diversions is not the primary source of recharge for most regional aquifers." You'd have to ask Joan Hutchings what I means by "contemporary."

Q. (BY MR. ALAN SMITH): But that would clearly not be ancestral?

A. I have no idea.

Q. You mentioned that seepage from the Boise River and precipitation was the primary source of recharge. I didn't hear you mention anything about the irrigation canals that Mr. Squires talked about.

A. To me, they're an extension of the

Boise River, since that's what the water is in them.
Q. So you're including irrigation runoff or --
A. No. Hang on. May I interrupt him?
THE HEARING OFFICER: Okay.
Q. (BY MR. ALAN SMITH): Go ahead.
A. Irrigation runoff, I didn't include that. Okay? Irrigation runoff means irrigation. And I said that there is no indication of irrigation water entering the PGSA.
Q. Okay. So you think that the recharge comes from the Boise River and precipitation, but not irrigation seepage from the canals, like the New York Canal?
A. I have no evidence that there's irrigation returned water as a recharge source.
Q. All right. Did I understand you to say that you had not been successful in finding any evidence of water from the PGSA in the Payette Valley?
A. Well, we have no documentation in the Payette Valley.
Q. Could you -- would you define "geologically ancestral" for me, because I have

trouble with the two.
A. I believe I did a little earlier. But to me, that means it's somewhat suggestive that the water could be as old as a thousand years.
Q. Okay. Could thousands of years of being submerged in a large lake reduce the amount of solids available for the PGS water to pick up?
A. A hypothetical case where you have a lake --
Q. I'm asking --
A. -- that is ponded, and is that water infiltrating to the PGSA? Is that what your question is?
Q. Well, what I'm trying to find out is if the solids have washed away or having been submerged and dissolved, if that affects your finding of the solids in the PGSA?
A. The change in the total dissolved solids in the PGSA indicated no new change in major ion chemistry.
Q. What about the evidence of the solids in the water itself?
A. That is a range of total dissolved solids in the water.
Q. Would that explain the low total

dissolved solids instead of it being from a relatively high -- or I think you said rapid aquifer movement?
A. The total dissolved solids that's moving through the bulk of the water in the Pierce Gulch Sand Aquifer has a range of 200 to 250, 260 milligrams per liter.
The total range is reflecting perhaps finer-grained sediments in the lower part of the Pierce Gulch Aquifer, not the whole part. So the shallow -- well, the 80 milligrams per liter, indicating that you're near a recharge source, perhaps. That's my interpretation.
Q. And are you drawing a distinction between a stable isotope and an unstable isotope, and what's the difference?
A. A stable isotope is an isotope that does not change in time. An unstable, we usually call radiogenic or radionuclides, and those do change with time. And carbon 14 is one of those.
Q. Would an unstable isotopic study better reveal the age of the PGSA water?
A. We have no method of radiogenic, other than the carbon 14, that would be of any interest for this time interval.

Q. And so that would not give us a better understanding of the recharge of the PGSA?
A. None that I can think of.
Q. Do you know what the IDWR staff hydrologists were suggesting when they talked about an isotopic study?
A. My original understanding -- or thought I understood was that they were talking about doing additional stable isotopes. But with the rest of the task clearly indicating that they were thinking about age dating, which is carbon 14.
And from that standpoint, it was the same kind of information that would have been generated and has been generated by John Hutchings in his report. It would have no effect, as far as the M3 area is concerned.
Q. All right. I believe -- would the PGSA sands be washed and the solids reduced over thousands of years of being submerged in water?
A. They have -- they appear to have very limited solubility, so I would guess not. I would think it's going to take considerable more time than that. We have no clays, for example. And if it had been degrading or being weathered, as we

call it, it would be -- would have been forming clays.

So since it has been deposited, we don't see any measurable or significant weathering of the minerals within the PGSA.

MR. ALAN SMITH: Okay. I think that's all I have.

THE HEARING OFFICER: Okay. Mr. Edwards?

MR. EDWARDS: I have no questions.

THE HEARING OFFICER: At this point should we adjourn and come back tomorrow morning and let Mr. Thornton ask his additional questions, and then you can ask redirect questions of Mr. Glanzman, Mr. Fereday?

MR. FEREDAY: That sounds reasonable. Thank you.

THE HEARING OFFICER: Okay.

MR. ALAN SMITH: Can we suggest 9:00? I didn't think we gained much by 8:30. That's up to you, sir.

MR. FEREDAY: I would prefer 8:30. I thought we did gain some. And obviously we had some trouble waiting for the court reporter. That won't happen tomorrow, I'm sure. So I think we can get going and save ourselves at least half an

hour.

THE HEARING OFFICER: Let's try 8:30 again.

MR. ALAN SMITH: Very well.

THE HEARING OFFICER: We'll go off the record.

(Proceedings concluded at 5:09 p.m.)

-oOo-

REPORTER'S CERTIFICATE

I, JEFF LaMAR, CSR No. 640, Certified Shorthand Reporter, certify:

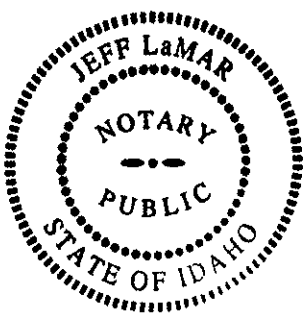
That the foregoing proceedings were taken before me at the time and place therein set forth, at which time the witness was put under oath by me.

That the testimony and all objections made were recorded stenographically by me and transcribed by me or under my direction.

That the foregoing is a true and correct record of all testimony given, to the best of my ability.

I further certify that I am not a relative or employee of any attorney or party, nor am I financially interested in the action.

IN WITNESS WHEREOF, I set my hand and seal this 12Th day of May, 2009.



JEFF LaMAR, CSR NO. 640
Notary Public
Eagle, Idaho 83616

My commission expires December 30, 2011

S